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The Biobased Delta

Where agro meets chemistry

A GLOBALLY COMPETITIVE REGION FOR DEVELOPING BIOBASED BUSINESS









Preface

The chemical industry in Europe is within reach of a golden opportunity for sustainable growth. Ongoing innovation and further investments in the production of biobased materials and chemical building blocks form the core of a strategy to regain its competitive edge. The chemical industry has a key role to play in this transition towards the biobased economy. The greening of global brand owners and consumers buying their products is one of the megatrends driving this. Stimulated by new solutions and functional properties, the shift towards the biobased economy will accelerate. Think for example of the suitability of PLA for additive manufacturing. The growth rate for biobased materials is already well above GDP and traditional fossil-based alternatives. Innovation will also come from the start of the green chemical value chain, which includes crops such as the EnergyBeet of KWS combined with direct processing technologies, to create an alternative starting point for fermentation.

The Netherlands, and the Biobased Delta* in particular, have a strong position to capitalize on these developments and this opportunity. This document will describe a number of reasons for this. The concept of the bio-refinery is well-understood and increasingly coming into operation in this region. This encompasses process intensification and integration, the valorization of side-streams, the flexibility to use multiple feedstocks and a product offering with a higher added-value. Secondly, the ecosystem, the knowledge intensity, and the core capabilities are in place for "agriculture to meet chemistry" and to develop new ways of working together, i.e. implement new business models. Furthermore, the attractiveness of this location is strengthened by the link to the existing ARRRA network and chemical value chain. The Biobased Delta also benefits from a strong logistics infrastructure. Last but not least, the sugar beet provides the region with an attractive local feedstock offering security of supply and growing market volumes.

The Biobased Delta plays at the heart of these developments. Its participants and stakeholders are well-positioned to capture the "early-mover advantage" in the coming years.



Dr. Willem Vaessen Director Chemical Value Chain, Deloitte Consulting

*The Biobased Delta refers to both the Delta Region (see also www.deltaregion.eu) as well as the Biobased Delta Cluster (see also www.biobaseddelta.nl) throughout this report.

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Unique characteristics of the Biobased Delta

- An **available & demanding market**: part of the biggest chemical cluster in the world (ARRRA) which is searching for green building blocks and biobased chemical products.
- A strong feedstock position to accelerate biobased business: the availability of local, cost-competitive sugar beets and the possibility to connect to international markets for feedstock is ensured by the presence of the world ports of Rotterdam and Antwerp.
- A successful Triple Helix structure in which industry, knowledge institutions and governments all work together to accelerate biobased business.
- A dynamic ecosystem that provides easy access to knowledge and science. The universities of Delft, Ghent, Wageningen and Eindhoven are in close proximity of the Biobased Delta and; three Universities of Applied Sciences increasingly provide young talent.
- Professional teams to **support** investment decisions.



SUSTAINABLE SUPPLY POSITION

Cost-competitive and available

LARGE ESTABLISHED MARKET Powered by the industry's leaders in sustainability

1. Summary of qualifications of the Biobased Delta



The biobased economy is inevitable. Within the biobased economy, few locations in the world have the same advantageous location and connections as the Biobased Delta. This document starts with the worldwide competitiveness comparison and subsequently zooms in on a European, regional and local level.

1. The Antwerp Rotterdam Rhine Ruhr Area (ARRRA) is the world's biggest chemical cluster and a frontrunner in the field of sustainability, offering market demand

- The ARRRA is home to the most competitive, fully integrated and technologically advanced chemical cluster in the world. Major sub-clusters include the ports of Rotterdam and Antwerp and the inland regions of North Rhine-Westphalia and Ludwigshafen-Mannheim-Karlsruhe. This local clustering allows for shared utilities, which implies cost and energy efficiency. The ARRRA is well-connected through pipelines, inland waterways, railways and roads. This ensures efficient transport and supply chain management.
- In the highly global competitive landscape, chemical production facilities in the ARRRA are looking ahead by differentiating through sustainability. New value chains are being designed based on sugars and lignin and industrial streams such as CO₂, CH₄ and syngas. This is strongly driven by affluent and green-minded customers and supported by ambitious governments.
- Sugar beets provide the ARRRA, and the Netherlands in particular¹, with a proven cost competitive feedstock position for the biobased chemical industry. Sugar beets are a rotation-crop a guarantee for soil fertility. This is why they are more sustainable than crops like sugar cane from Brazil.
- 2. The Biobased Delta encompasses the Southwest Netherlands and a part of Belgian Flanders, ensuring a cost competitive feedstock and an optimal business fit for biobased companies
- Various reports endorse the Biobased Delta as a European frontrunner in the biobased economy². It is best positioned to capitalize on its favorable and regionally available sugar feedstock position due to the presence of the worlds' most efficient¹ and large-scale sugar beet producing industry. Alternative feedstock (a.o. agricultural waste streams, woody biomass) can be regionally sourced or imported via the (deep) sea ports of Rotterdam, Antwerp, Moerdijk, Terneuzen, Vlissingen and Ghent. As such, supply of feedstock can be ensured.
- Large industry players in agro and chemistry such as SABIC, Royal Cosun, Suiker Unie, DSM, Dow Chemicals, Cargill and Corbion are committed to the Biobased Delta. In addition to a concentration of multinationals, the region has many highly innovative small and medium-sized enterprises (SMEs).
- 1) Deloitte (2014), Opportunities for the fermentation-based chemical industry: An analysis of the market potential and competitiveness of Northwest Europe.
- ECRN, 2014, Clusters and Initiatives on Bioeconomy and Green Chemical; Vanelslander et al (2011), The Flemish-Dutch delta from a European perspective.



- The authorities in the Biobased Delta actively support business development. Aside from an attractive tax regime and various incentives (especially to facilitate research), co-financing is possible too, provided a solid business case is presented. Well-known academic institutions such as Wageningen UR, Delft University, Eindhoven University and Ghent University are within a one-hour drive from the center of the Biobased Delta. The Delta also houses three Universities of Applied Sciences. They all collaborate on cutting-edge technological advancements and ensure talented human capital.
- The Biobased Delta is a frontrunner in the field of sustainability and it is well aware
 of the sensitivities involving the "food for chemicals" dilemma. The Biobased Delta
 has a clear position on this: the cascading of biomass, and thus securing food
 supply and fertility of land, is the only way forward.
- 3. The various top locations in the Biobased Delta are well interconnected, accelerating the development of the biobased chemical industry. A prime example is the development corridor Green Chemistry Campus -Nieuw Prinsenland Business Park - Port of Moerdijk
- The Green Chemistry Campus, located on the premises of the site of SABIC in Bergen op Zoom, accelerates biobased enterprises on the interface between agro and chemistry by offering state-of-the-art lab and office facilities and business development programs. Nieuw Prinsenland Business Park, where the Cosun Food Technology Center is being built, offers ample space for modern enterprises operating in, or linked to, the biobased chemical industry. The (deep sea) port of Moerdijk (and nearby power plant) is examining the possibilities to become a regional hub for wood refinery and pyrolysis. The functional profiles of Nieuw Prinsenland, Green Chemistry Campus and Moerdijk are complementary; this makes the development corridor Nieuw Prinsenland – Green Chemistry Campus – Moerdijk the place where agro meets chemistry - the go-to place for biobased business.



White dots are the top locations within the Biobased Delta which mark the presence of green innovations and pioneering entrepreneurs. The number of top locations is expanding. For more information on the top locations, see www.biobaseddelta.nl



- There is extensive knowledge on sugar beet harvesting, biomass treatment and conversion, chemical building blocks and chemical markets within the development corridor. A clear example is the Biorizon program (technology development for production of functionalized aromatics from sugars and lignin).
- The development corridor is connected via the A4 highway and the Schelde-Rijn canal. The corridor offers readily available, competitively-priced locations. It is surrounded by the worlds' most efficient agriculture (existing for over 400 years) and world-class chemical players.

2. A globally competitive region

The location analysis shows the USA and Northwest Europe (NW-E) have the best international business fit compared with competing "sugar regions." On a national level, the scores for countries within Northwest Europe (Netherlands, France, Belgium and Germany) are somewhat comparable. The Netherlands has the highest overall score, mainly due to the dimensions Infrastructure, Business Climate and Regulations. On a regional level, the Biobased Delta clearly scores highest when compared with neighboring regions in France and Germany

Deloitte has applied its Location Study Methodology to perform this location comparison. The overall score, based on 96 indicators for the international and national level, is determined by expressing the importance of six dimensions in a weighting. The importance is based on research by knowledge institute TNO³ combined with Deloitte analysis and experience for companies in the biobased economy in their search for an optimal location.

Globally, NW-E and USA are the favorable business regions

- Based on the six dimensions both USA and NW-E score above average on the overall business fit.
- NW-E also scores high on Regulations (ease of doing business/cooperative government) and Knowledge Infrastructure. It has the highest score when it comes to Infrastructure.
- Thailand and especially Brazil score substantially lower on the dimensions included in this location study. The lack of adequate infrastructure, a relatively unstable political climate, and the absence of world-class universities make Brazil and Thailand less favorable business locations. Especially where it regards performance and specialty chemicals these unfavorable dimensions come into play. As such Brazil and Thailand have not been taken into account in the remainder of this location analysis.

Zooming in on the national level, differences between countries in NW-E and USA are small; the Netherlands, however, stands out

- The Dutch business climate is experienced as stable doing business is very easy. This is the result of minimized risks (for example in terms of security, tax, political interference and finance).
- The Dutch labor market has an international orientation, enabled by Dutch employee's proficiency in multiple languages (English, German and French). The reliance on professional managers and their international experience is considered to be higher than in the other countries.
- The quality of infrastructure in the Netherlands is considered to be extremely high, especially its extensive road network, the waterway network (in particular from the port of Rotterdam) and the quality and reliability of telecommunications.
- 3) Netherlands Organisation for Applied Scientific Research



Score (0-100) 100 873 83.7 84.1 6,7 Ø 80 10.9 71.8 72.0 12,9 8,0 60 40 20 0 Netherlands Germany Belgium France USA Business climate Regulations Labour Market Knowledge infrastructure Infrastructure Utilities

- The Dutch government is characterized by its transparency and custom procedures are highly efficient. The Dutch tax climate is known to be "tax friendly," with great freedom for investments and a low tax rate on profit.
- The quality of the scientific research institutions in Belgium, Germany and the Netherlands is comparable to that in the USA. The number of patent applications (in relation to the population) in Germany and the Netherlands is even higher.
- The Netherlands scores highest on utilities, the energy infrastructure in particular is considered adequate and efficient. Access to water is ensured and well managed.

The regional level of this location study focuses on innovation and education specifics, which are more regionally embedded. The Biobased Delta encompasses both the Dutch region of Southwest Netherlands and a part of Belgian Flanders. Although the entire ARRRA is characterized by its excellent chemistry and biotechnology knowledge base, the Biobased Delta is the best positioned region from the perspective of innovation and education

- Many characteristics of the European regions within the sugar belt are somewhat comparable. But none of these regions has the advantages of world-class ports stretching from central Flanders to Southwest Netherlands - except the Biobased Delta.
- The Biobased Delta scores higher on four out of five factors than the other two regions. The only exception is the total of patent applications, which is higher in North Rhine-Westphalia.
- The Biobased Delta, and to a lesser extent North Rhine Westphalia, scores significantly higher than Northern France. It should be noted that the agricultural region of Northern France does have a relatively high standard for specifically biobased R&D. The Biobased Delta stands out for its high number of people with a tertiary education and the many people working in science and technology.



Innovation & Education



3. Market demand in the ARRRA

The industry's commitment to increasing sustainability

A selection of quotes from leading multinationals – they currently have a fossilbased product range - confirms the market potential:

"To meet market demands for consumer goods based on renewable raw materials" (BASF)

"Achieve 15% biobased products by 2016" (Arkema)

"Accelerating the pace of sustainability commitment" (AkzoNobel)

"Demonstrate the commercial viability of sustainable, renewable technologies" (DSM)

"Aggressively pursuing innovations that enable customers to operate in a more sustainable manner and investing in large projects that produce both economic value and sustainability improvements across several dimensions" (SABIC) The Biobased Delta's presence in the ARRRA offers many market opportunities. Chemical companies such as SABIC, DSM and AkzoNobel, and "brand owners" like Unilever, Coca Cola, KLM and P&G are all located in the ARRRA and are searching for "greenification" and flexibility in feedstock. They are all well aware of green-minded consumers pushing for biobased products and governmental regulations.

- Europe houses 25% of the chemical production in the world⁴, which is centered in the ARRRA. With world chemical players such as BASF, Bayer, SABIC, Dow Chemicals, the chemical industry in the ARRRA constitutes a fourth of all industrial activities in the ARRRA. The chemical industry is thus vital to the regional economy of the ARRRA. It has strong links to other industries and related value chains.
- In the highly global competitive landscape, companies in the ARRRA region are now looking ahead by differentiating through long-term sustainability. This development is partly driven by governmental regulations but also by consumers aspiring a greener future.
- Conversion of biomass into biobased building blocks (through fermentation, chemical conversion and/or chemical catalysis) provides the industry with tools to realize a stable and more sustainable (chemical) industry, enabling the creation of bio plastics, fibers, advanced biofuels, superabsorbents and medical materials from biomass.
- The biobased chemical industry in the ARRRA has developed gradually. It started out with the use of biomass as an energy source, subsequently producing chemical building blocks such as ethanol, furfural, furanics, isosorbides, sorbitol from sugars, or corn. This has allowed the industry to evolve towards the sustainable use of biomass for chemicals, materials, coatings and personal care. The biobased chemical industry is also connected to the production of advanced biofuels for aviation and shipping.
- Growth projections for the global biobased chemical industry vary between 3 to 4 percent annually⁵. The biobased chemical industry is expected to represent 30% of the total chemical industry globally in 2030; >50% for specialty chemicals, less than 10% of bulk commodity chemicals⁶.

- Blaauw, R., H. Bos, et al. (2013) De biomassabehoefte van de chemsiche industrie in een biobased economy. Inschattingen gebaseerd op drie extreme technologische scenario's, rapport 1376, Wageningen UR.
- US Department of Agriculture, 2008, US Biobased Products Market Potential and Projections Through 2025, OCE-2008-01.
- Harmsen, P., Hackmann, M. et al., 2014, Green building blocks for biobased plastics.
- 6) Star-COLIBRI, 2011, Joint European Biorefinery Vision for 2030.





• Clearly depicted in the figure below, the ARRRA houses most of the European chemical industry. The ARRRA chemical cluster competes and interacts with other leading chemical clusters in the United States, China, India, the Middle East, Singapore and Brazil. Connections within the ARRRA are well-organized and reliable. Transport from the ports of Rotterdam and Antwerp to the major chemical sub-clusters (and vice versa for global export) is ensured by an extensive network of roads, railways, pipelines and inland waterways; readily available to the biobased chemical industry. The real strength of the ARRRA is the strong local clustering and integration.



Source: Amadeus Database; Deloitte Analysis



"The Biobased Delta offers a very attractive combination of technology development at the Green Chemistry Campus, most competitive biobased feedstock, industry, infrastructure and talent. Committed cooperation of government, science- and education-institutes, agriculture and industry will enable world leading positions in biobased chemistry"

Mark Williams Vicepresident SABIC Europe

4. A competitive feedstock position



"The Biobased Delta is a unique concept of networking and collaborating enterprises, both big and small, both agribusiness and chemistry, both government and research and educations institutions. They all discerned the opportunities to create products and applications from biomass and waste streams. Win-win situations are possible. The knowledge and infrastructure present in the Biobased Delta is perfect; if the parties find each other, the potential is enormous."

Albert Markusse General Manager Suiker Unie

Want to know more about...

...an exhaustive overview of biomass availability (including sugars beets) in the Biobased Delta?

See page 18 to get in touch The Biobased Delta is the starting point for companies focusing on the use of green building blocks from biomass feedstock. It is one of the two dominant regions in the Netherlands that produces sugar beets and is home to the most efficient sugar-refining factory in Europe. Due to its close proximity to the ports of Rotterdam, Moerdijk, Vlissingen, Antwerp and Ghent, a sufficient supply of lignocellulosic material can be secured

The regionally harvested sugar beets provide the biobased chemical industry with cost-competitive feedstock

- The sugar from Northwest Europe, especially based on sugar beets from the Netherlands, is globally competitive. This creates a unique feedstock position for Northwest Europe. Due to further intensification in the agricultural industry and improvements of crop seeds and yields⁷, cost-competitiveness of the Dutch sugar beets is likely to continue to improve.
- A repeal of the EU sugar quota in 2017 will increase the availability of sugar beets. Additional production after the release of the sugar quota is expected to be 14% in the Netherlands, ahead of the European average of 10%⁸.
- The Biobased Delta houses one of the largest, most modern and most efficient sugar refining factories of Europe⁹, located in Dinteloord and belonging to Suiker Unie (a subsidiary firm of Royal Cosun).

Partly due to its proximity to the world ports of Rotterdam and Antwerp and various other regional ports, the Biobased Delta also has access to large volumes of lignocellulosic material

• To ensure feedstock flexibility and secure sufficient volumes, the Biobased Delta also focuses on the potential of (ligno)cellulosic (2nd generation) biomass (agricultural side streams or from plants). Research shows the Netherlands to be able to supply a substantial amount of lignocellulosic material¹⁰. Lignocellulosic material could also be sourced internationally, mainly in the form of wood pellets or wood chips, which is stimulated by the demand for green energy.

- Deloitte, Opportunities for the fermentation-based chemical industry: An analysis of the market potential and competitiveness of Northwest Europe.
- Wageningen UR, 2014, Suiker als grondstof voor de Nederlandse chemische industrie. (sugars als feedstock for the Dutch chemical industry)
- 9) SugarindustryInfo (2015), Campaign data of sugar factories in 2014/15.
- 10) Including straw, prunings, side streams from the paper industry, waste from the greenhouses and agricultural waste streams, based on Expert interviews.



Aquatic feedstock

AlgaeBiotech and CSM are aiming to use CSM waste water to create micro-algae biomass. This algae is then used to extract high quality omega-3 oil. Next to this the byproduct is used for aquafeed. International enterprises are already considering moving to the region, underlying the favorable location of the Biobased Delta regarding both the aquatic and sugar feedstocks.

- The Biobased Delta houses a number of ports (Rotterdam, Antwerp, Moerdijk, Ghent, Vlissingen and Terneuzen), via which international sourcing can be secured. With a current throughput of 10 million tons of agricultural bulk and a growing number of direct lignocellulosic streams, the Port of Rotterdam strategically aims to attract these cargo streams to become Europe's leading bioport. Ongoing successful research, for example in Vlissingen, makes the Biobased Delta the place for the valorization of these wood pellets and wood chips for the use of the chemical industry.
- Next to cellulosics, the lignocellulosic material also provides for lignin. Lignin can currently be used for co-firing but is also promising for the production of aromatics (as currently researched by TNO and VITO¹¹ in the shared research center Biorizon on the Green Chemistry Campus). Lignin based functionalized aromatics are expected to be sufficient for full commercialization before 2020.

The Biobased Delta also looks into third generation feedstock such as algae and waste (municipal and industrial)

• Algae, frequently referred to as the "new gold," will be the most likely so-called 3rd generation feedstock. In the province of Zeeland, located right on the North Sea, several projects involving algae production in aquaculture are already running.

The food versus chemicals dilemma

- The relationship between the biobased economy and food and feed security is complex and multifaceted¹².
- It is essential to consider what type of biomass feedstock is to be used for which application. This guarantees that any undesired competition with the food and feed supply chain can be avoided. All stakeholders in the Biobased Delta fully understand that the first priority of biomass allocation is food and feed security. The long term focus should therefore be on utilizing non-edible biomass (such as agricultural and forestry waste streams) as feedstock.
- Repeal of the sugar quota by the EU in 2017 and continuous enhancement of agricultural practices through technology will increase the availability of sugar, efficiency of feedstock (i.e. increasing crop yield per surface area) in the Biobased Delta and thus supply security for food and feed. Soil fertility is secured by the crop-rotation practices developed through more than 400 years of highly efficient agriculture in the region, driven by precision and innovation.
- A 100% turn from petrochemicals to biobased chemicals would require only 5% of agricultural biomass production and global arable land. The Biobased Delta is involved in an ongoing effort to use crops from non-arable land such as industrial zones and to use crops that require less fertile land.

¹¹⁾ Flemish Institute for Technological Research.

¹²⁾ FAO Statistical Yearbook 2013, World food and agriculture.

5. A thriving cluster of biobased businesses



Building on a Triple Helix, the Biobased Delta has set a comprehensive structure that supports the acceleration of innovation, development and further growth of the biobased economy in the region

- Research confirms that Triple Helix collaboration (industry, knowledge institutions and governments) supports the regional potential for innovation and economic development¹³. SMEs¹⁴ act as a catalyst for interaction between the involved actors. The Triple Helix structure in the Biobased Delta accelerates innovation and business opportunities.
- The governing board of the Biobased Delta consists for the greater part of business people, supplemented by people representing research, educational, advocacy and governmental parties. Together they have set and are executing an ambitious agenda for the next decades.

SMEs in the biobased economy

A vibrant network of SMEs is crucial for the development of the biobased economy for a number of reasons: First, SMEs tend to focus on innovations with a short time to market. Secondly, SMEs can more easily implement new (regional) feedstock and / or processes as their scale of operation is often less complex compared to full-scale chemical industries. Finally, SMEs tend to be more technologydriven and function as the 'translators' between the different worlds of agriculture and chemical industries. SMEs are thus pushing the boundaries of the biobased economy and paving the road for the envisioned large scale transitions.

The ecosystem of the Biobased Delta will allow for successful integration and new value chains to arise, implying an acceleration of biobased business

- The industry has vastly developed in the past few years. The Biobased Delta
 has seen € 400-600 million investments in over 120 projects. The investment
 program will have expanded by an additional € 600 million by 2020. Governments
 (European, national and provincial) support these developments and, if possible,
 they are willing to consider co-investment or provide grant schemes.
- In order to realize the potential from the biobased economy, the Biobased Delta focuses on 6 main pillars:
 - Pillar 1 Business development: By stimulating shared R&D via the principle of Open Innovation the Biobased Delta advocates the development of large scale transition programs based on sugars and lignin. Next to the transition programs the Biobased Delta encourages innovative SMEs via its valorization programs. Currently 100 SMEs are supported via 10 different valorization themes.
 - Pillar 2 Human Capital and Education: Via the Centre of Expertise (CoE) Biobased Economy, the universities of applied science and vocational educational partners are educating talented people. The CoE also performs applied research and is part of the national Biobased Economy center (chaired by the University of Wageningen).

13) Klofsten et al. 1999; 2010; Inzelt, 2004; Geuna and Nesta, 2006; Lawton Smith and Bagchi-Sen, 2010; Geuna and Rossi, 2011; Svensson et al. 2012.
14) SME refers to small and medium enterprises.

Opportunities from clustering

Cluster development is key to the success of the biobased chemical industry in the Biobased Delta, potential benefits are numerous. Aside from an increased exchange of knowledge and the creation of a highly qualified labor pool, physical proximity also facilitates the integration of production processes (i.e. industrial symbiosis) and allows for shared utilities. This implies that side streams such as agricultural waste, waste energy, waste heat and CO₂ from one production process could be used in other production processes. An example: CO₂ is released during the fermentation process of bio-ethanol. This could be used for the production of citric acid or, in case of pure CO₂, even in sodas. SMEs play a crucial, enabling role in the development of the cluster. Clustering will also enable more innovative connections of new industrial biotechnology and current chemical processes.

- Pillar 3 Infrastructure: By offering geographical focal points the Biobased Delta offers R&D, experimental and production locations. The focal points range from the Bio Innovation Garden (experimental farm), Application Centers (small scale test production) to the Green Chemistry Campus and Nieuw Prinsenland (R&D, demo and full scale operations) and the Bioprocess Pilot Facility (large scale pilot facility).
- Pillar 4 Policy & Promotion: The Biobased Delta is lobbying for a strong biobased ecosystem with national and European governments. The Biobased Delta works with and advises policy makers and advocacy parties (like farmers associations). Moreover, the Biobased Delta is promoting the development of the biobased economy on national and international levels.
- Pillar 5 Funding: The Biobased Delta has access to the financial support structures of the governments involved and offers direct contact with financial institutions.
- Pillar 6 International partnerships: To accelerate the transition towards the biobased economy, the Biobased Delta has set up partnerships (e.g. exchange programs) with other regions where industry, knowledge institutions and governments also work together closely. Current partnerships include North Rhine Westphalia, northern France, Brazil and Canada. These partnerships will be intensified the upcoming years.

Agro and chemistry meet within a radius of 60 km in the Biobased Delta. Collaboration between and integration of technologically advanced farmers, the presence of agrofood companies, large chemical players, the presence of brand owners, a large number of innovative SMEs, renowned knowledge institutions, educational institutions, pilot and demonstration plants, and supporting governments: together they form the innovation ecosystem of the Biobased Delta





"The wide delta crossing the border of the Netherlands and Belgium is a prime example of agro meeting chemistry. The landscape varies with large agricultural firms and several chemical sites, connected to the rest of the world by the various ports. This gives the chemical industry the opportunity for smart specialization, based on renewable chemicals with new functionalities and a higher added value. Together with the hinterland, the value chain will be completed and innovative chemicals can be produced."

Ludo Diels

Professor of University of Antwerp and (co-) founder of BIG-C and Biorizon

Aside from a vibrant cluster within, the Biobased Delta also connects to other regions that are frontrunners in the biobased chemical industry. This international knowledge network enables further developments, technological and otherwise

- The biobased chemical profile of the Biobased Delta is complementary to the biobased chemical profile of Brightlands Chemelot, located in the southeast of the Netherlands. Brightlands Chemelot focuses on materials and final market-applications.
- Cross-border cooperation with Flanders and North Rhine Westphalia has been institutionalized in the Bio Innovation Growth mega Cluster (BIG-C). BIG-C improves the capacity for action of the three participating regions while also having access to the substantial innovation funds from the European Union.
- The Biobased Delta has signed a Memorandum of Understanding with the Industries & Agro-Resources (IAR) in the north of France and the Canadian Bio-industrial Innovation; focusing on information and student exchange, joint development (2nd generation sugars, lignin, pyrolysis) and business network.
- Relations with other European clusters such as BioVale (York, UK) and Bio Economy (Leuna, Germany) and participation in European projects provides the Biobased Delta with a Europe-wide network of industries and knowledge institutions.

Strategic alliances characterize the Biobased Delta, examples include:

BE-Basic

The BE-Basic (Biotechnology based Ecologically Balanced Sustainable Industrial Consortium) Foundation was founded early 2010. Originally coordinated by the Delft University of Technology, it builds on the recognized breakthroughs of the B-Basic and the Ecogenomics consortia. The BE-Basic program started with an R&D budget of €120 million, half of which is funded by the Ministry of Economic Affairs, Agriculture and Innovation as part of the Economic Structure Enhancement Fund (FES).

Smart Delta Resources

Many industry leaders (i.e. Arkema, Cargill, Dow Benelux, ArcelorMittal, Lamb Weston-Meijer, SABIC and Suiker Unie) have united in the Smart Delta Resources platform to look into possibilities for the exchange of their waste streams and waste. The platform connects to sustainability initiatives in the field of energy and metals. This crossover enables an integral switch to more sustainable processing.

6. Accelerating biobased business: zooming in on the Green Chemistry Campus

"Progression Industry is just one of the 12 new entreprises that has chosen the Green Chemistry Campus as their optimal location for further growth. With its businesses WEDACS, PFAMEN and CyclOx, Progression Industry is a globally operating entrepreneurial company, which aims to excel in researching and developing innovative green technologies, products and services for the automotive industry and automotive aftermarket. " Right in the heart of the Biobased Delta, the Green Chemistry Campus is located on the premises of SABIC in the municipality of Bergen op Zoom (with its industrial Theodorus port complex). It is a business accelerator for biobased innovations on the cutting edge of agro and chemistry. B2B entrepreneurs - both large companies and SMEs - knowledge institutions, educational partners and the government: they all closely collaborate in an open innovation environment. Jointly they develop biobased building blocks for the chemical industry from (agricultural) waste streams containing sugars and lignin. The aim of the Green Chemistry Campus is to increase the chances of biobased business success

- The Green Chemistry Campus is part of the COCI network (Center for Chemical Open Innovation), established by the Dutch Chemical Association. The long-term vision is to become a leading European center for open biobased innovation.
- The Green Chemistry Campus offers entrepreneurs office infrastructure, state-ofthe-art process technology laboratories and an analytical technology center of excellence. Pilot plant and demo plant capability will be part of the future model.
- The Green Chemistry Campus taps into an extensive biobased business network and provides a link to a broad range of services, all with the aim to support and speed up business development (including patent counseling, funding guidance, product positioning).
- The Green Chemistry Campus can facilitate the evaluation of co-siting opportunities at SABIC.





The Green Chemistry Campus is home to the Biorizon Shared Research Center, initiated by knowledge institutions TNO and VITO and the Green Chemistry Campus. It is a cluster of innovation and entrepreneurship for the development of bio-aromatics

- Biorizon Shared Research Center focuses on technology development for the production of functionalized aromatics from sugars and lignin.
- The innovation roadmap of Biorizon is based on four horizons ranging from short-term transformation of biomass into green cracker feed and long(er) term transformation of sugars and lignin into functionalized aromatics. The horizons have been set in consultation with industrial partners.
- Biorizon's goal is to produce functionalized biobased aromatics on a commercial scale for industrial partners in 2020.



Source: Biorizon

The Green Chemistry Campus forms a development corridor with the Nieuw Prinsenland Business Park and the port of Moerdijk. The corridor is where agro and chemistry meet within only a 20 kilometers radius

- Nieuw Prinsenland Business Park is located next to Suiker Unie's sugar refining factory in Dinteloord, one of Europe's largest and most productive and energy effective sugar factories. Nieuw Prinsenland offers strategic and operational partnerships with the sugar refining factory related to the use of sugar as feedstock, by-products and other (biomass) streams. Nieuw Prinsenland Business Park is also the home of Cosun's research center: the Cosun Food Technology Center. This is connected to an open network of companies with research and development activities in agricultural production and biomass processing, including the Institute of Beet Cultivation.
- The (deep sea) port of Moerdijk has embraced the development of the biobased economy, with a particular on sugars from lignocellulosics (wood chips, wood pellets). As such it adds direct access to second generation feedstock supply to the development corridor.
- The development corridor connects to the extensive pipeline route between Rotterdam and Antwerp, transporting naphtha, ethylene, CO or syngas.



7. Window of opportunity

The market pull is there and recent technology developments are ready to be leveraged: allowing the creation of a proprietary know-how position in an expanding market. First-mover advantages such as the accumulation of market share apply but also governmental support, financial and otherwise



Contact details

If you have any generic questions regarding the Biobased Delta and its feedstock position, please contact the Biobased Delta:

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If you have any questions regarding possible investments in the Biobased Delta and location advice, please contact one of the following organizations:

- Regional development agency N.V. REWIN West Brabant
- Regional development agency N.V. Economische Impuls Zeeland
- Netherlands Foreign Investment Agency (NFIA)
- Brabant Development Authority (BOM)
- InnovationQuarter



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