



## Biobased Backbone

Integraal systeem voor energie, biomassa, CO2 en grondstoffen



## Biobased Backbone

### Zeeland

Towards a sustainable, economically resilient and more beautiful Dutch-Belgian

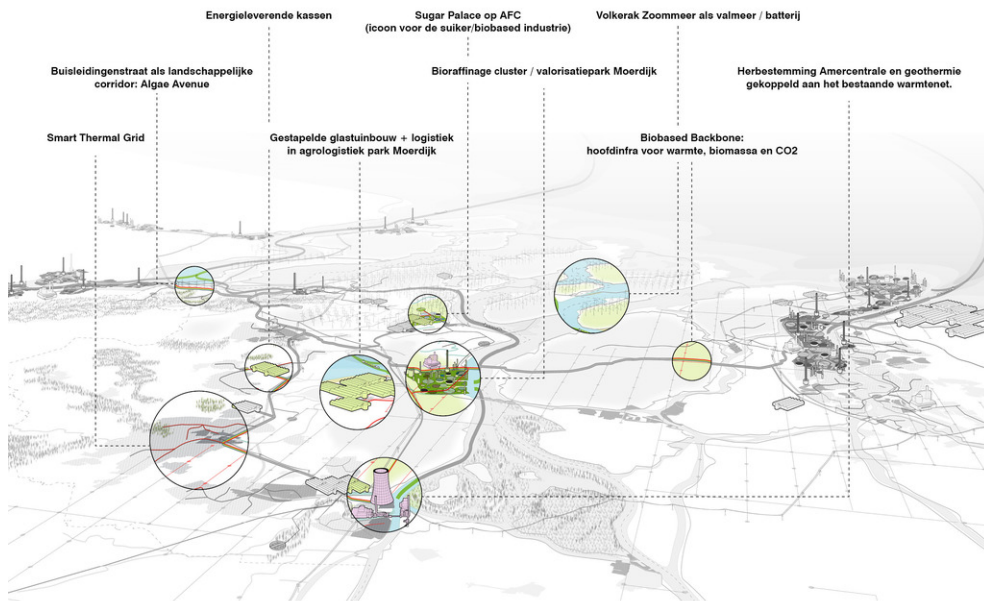
delta region.

Delta Development until the 21st century

## West-Brabant in het hart van de Biobased Delta



## Sleutelprojecten West-Brabant



In North-West Europe, at the confluence of the rivers Rhine, Meuse and Scheldt, a vast delta emerged on the coast of the North sea. Behind elongated sand ridges, an archipelago emerged between rivers and sea arms. The frequent flooding of the land made the soil fertile and good for agriculture. Cities thrived through trading, fishery and ship building.

Like most delta regions in the world the economic potential came with the risks and challenges of high water. So the land was secured by dikes and reclaimed to protect the growing economy, the cities, ports, agriculture and industry. Economy of scale shaped

the agricultural landscape. Sugar beets and potatoes became the dominant food crops. Napoleon designated the delta in the 1800's as European centre of the sugar agro-industry. This eventually developed into an agro-chemical cluster and, towards the end of the 20th century it had transformed into one of the largest petrochemical areas in the world.

With deep seaports in Rotterdam, Antwerp and Ghent and highly navigable rivers the delta became even more important as a transit area for oil and goods. It is the undisputed logistic gateway to a large part of Europe, with good water connections, an extensive network of roads, highways railways, offering many different ways of transport in all directions. An underground system of pipelines for fluids and gas completes the multimodal network.

Dynamic networks in the delta

As oil became a major driver in the world economy, Rotterdam developed into a major oil hub for transport and processing. Slightly less than half of all crude oil that enters the Dutch delta is passed on to the petrochemical industry in Belgium and Germany. The rest is processed in oil refineries in the Rotterdam port area. The major part of this oil is refined into derivatives used for transport fuels. A much smaller part is refined into chemicals and materials such as solvents and plastics - which are then distributed again to factories in Europe and all over the world.

Natural gas is also a major economic driver and the abundance of this resource in the Netherlands made it possible to grow fruits and vegetables all year round. This has resulted in the biggest concentration of greenhouses in the world just north of the port area.

Thanks to the fossil-based economy, the region is among the most prosperous in the world. Good news so far.

A large part of our daily goods such as toys, paint and packaging material is still being produced here, but businesses are struggling to stay competitive against upcoming markets in Asia and South America. As employment declines, once strong communities falter. Meanwhile ecosystems have suffered and are not as dynamic and productive as they used to be. Once beautiful landscapes have lost much of their natural appeal and diversity.

And what about the future? How resilient is the current economy, when fossil resources become increasingly scarce?

By processing and burning fossil fuels, the oil processing industry is responsible for releasing huge quantities of ancient carbon. Together with coal power plants in the area the CO<sub>2</sub>, contaminants and particles this emission causes air-pollution in one of the most densely populated areas of the world. Long distance transportation of raw materials and products also contribute to CO<sub>2</sub> emissions and air pollution. The increasing CO<sub>2</sub> concentration in the atmosphere leads to climate change, resulting in temperature increases, rising sea levels and an increased drainage of rivers. Ironically, climate-change hits the delta region the hardest.

A massive structure called the Delta Works has been put in place to protect the area against rising sea levels, but this system of dams, dikes and levees has complicated the free flow of river water to the sea. Industrial plants that have sprung up along the

waterfronts cause thermal pollution in the rivers and emit particulates into the air. As a result fish migrations have been disrupted and the health and biodiversity of local ecosystems has significantly decreased.

It's clear that the delta region is facing some big challenges related to climate change, water safety and ecology. But even when fossil resources are phased out, how will the region transition to a biobased economy? A large part of the current economy still depends heavily on oil and its derivatives? Is the region resilient enough for such a major and fundamental change?

The delta region has a lot of potential to make a successful transition from fossil to biobased and renewable resources. But clear choices and investments have to be made in the short term.

To start with the energy supply. The delta is blessed with several locally available renewable resources. The wind close to the sea is strong and a significant part of the electricity demand can be harvested with windmills on both land and water. Especially the harbour and greenhouse areas would be suitable for wind parks, without compromising the landscape.

The estuaries in the delta are perfect for harvesting so called 'blue energy': Energy released in the process of osmosis. The amount of sun hours is highest close to the open water. Covering rooftops in cities and industrial parks with photovoltaic cells provides another source of renewable energy.

By connecting urban heating networks to the existing petrochemical industry and power plants, waste heat can be used to heat cities and greenhouses. Geothermal wells can be added to what will become a smart thermal grid, replacing the need to use fossil-based resources.

But what about the production of plastics, clothes, detergents and medicines we use in daily life? They are now practically all produced from oil derivatives. Can we substitute oil for other, more sustainable resources? The answer is yes and, fortunately, these resources are abundantly available in the delta area.

The sugar beet for instance, introduced to the delta region by Napoleon, is a good example of a crop that can be used for much more than raw sugar alone.

At harvest the beet is defoliated and headed. During the annual beet campaign all the beets are transported to the sugar factory while the leaves stay behind and are used to fertilize the land.

The sugar beet is going through a process of washing and centrifugation to obtain sugar crystals. Residual products of this process, like heat and carbon dioxide, are being used in adjacent greenhouses to grow crops.

Beet pulp is used as food for animals but also digested into biogas. Even the tare ground that is washed from the beets can be used. To construct water retention basins for irrigation, for instance. The next step, is to extract valuable resources from these organic residues before they get fermented in the biogas plant.

But this is not just the story of the sugar beet. All kinds of organic waste from local agricultural fields, orchards and greenhouses can be refined. This also applies to the maintenance-waste of the nature reserves in the region. Even filtering manure (produced by the livestock in Brabant) for phosphates and other valuable minerals can be an option with new technology.

If you look at it this way the region turns out to be a vast mining area full of valuable resources. And the good thing is; this mine renews itself every season!

The demands for biomass will probably also trigger the cultivation of new types of crops that are more effective for the production of biomass, like elephant grass, flax, willow and algae. Maybe even salt-tolerant crops like spelt, samphire and sea lavender. Or large underwater seaweed forests that supply protein and also serve as a shelter for fish and as a paradise for divers. Maybe a growing demand for cellulose will change the current monotonous agricultural landscape into a scenic landscape with beautiful alder avenues? The bio-based delta could become a picking garden for the bio-based economy with a growing recreational potential.

Technology is being developed to unravel biomass into fibres and green building blocks that serve as raw material for the producing industry. This process only releases carbon dioxide from recently captured carbon. This means that in the long run also the balance in the atmosphere could be restored.

Some companies in the delta region already feel the urgency to phase out fossil fuels and are investigating the possibilities of using organic waste of food production as biomass for green refinery. In this way growing biomass doesn't compete with food production and has a better chance of becoming economically feasible.

This potential of organic waste could trigger farmers to rethink their current position as supplier of crops for the food industry. They could be suppliers of biomass as well. With a local, small-scale, bio refinery they could even become direct suppliers of green building blocks for the surrounding industry. The shift of the production from the central plant to the local farmer would create alternative business models for a new generation of farmers. This process of valorisation of organic waste into green building blocks is the essence of a bio-based economy where agriculture meets chemistry.

Cities generate enormous amounts of biomass on a daily basis, produced by millions of people. This biomass is conceived as waste and finds its way as 'black water' to wastewater treatments.

Some of these wastewater treatments have found ways to turn the sludge into biogas and electricity for their own use. Other experiments in urban mining extract valuable components before digesting the residue into biogas.

It gets even more interesting when all households in the delta would shred their food and garden waste. This pulp can then be transported through the sewage system to the wastewater treatment plants during the night, when the system is underused. Here, the green residue can also be refined into green building blocks.

In this way all sewage treatment plants gradually become small-scale bio refineries of urban green waste.

So what will the bio-based landscape look like?

Farmer or citizen, everybody in the Bio-based Delta is going to be a supplier of biomass. This means that a bio-based economy will necessarily also be a circular economy. The cooperation and interaction between sectors and stakeholders in society will create an interdependent or "smart" grid for all resources and flows. The result will be a cleaner environment, more efficiency, with shorter production chains, less transportation of resources and no more waste.

Existing oil- and gas pipelines will be converted for transportation of green components. Slowly but surely a bio-based backbone emerges where biomass and other resources are being exchanged, growing into a robust, efficient and sustainable metabolic system on a regional scale. This new dynamic creates competitive conditions and business opportunities for new innovative companies.

The available expertise in intensive agriculture combined with the knowledge of chemical cracking offers the delta a leading position in the transition towards a bio-based economy. By reinventing its own system the delta will become the centre of knowledge and expertise regarding the bio-based economy, exporting innovative technology to places all over the world.

The landscape itself will also transform, with an agricultural and chemical industry that is better integrated with the environment, a sustainable balance between technology and nature, and a better living quality for the people living in the cities and towns of the delta area.

#### Call to Action

Right now we are at the crossroads. Will the delta region be leading the transition towards a future without oil? Are we capable of investing seriously in an inevitable greener future? For the well-being of future generations, we have to join forces, use our knowledge, our infrastructure, and all the resources at our disposal to make this happen.

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