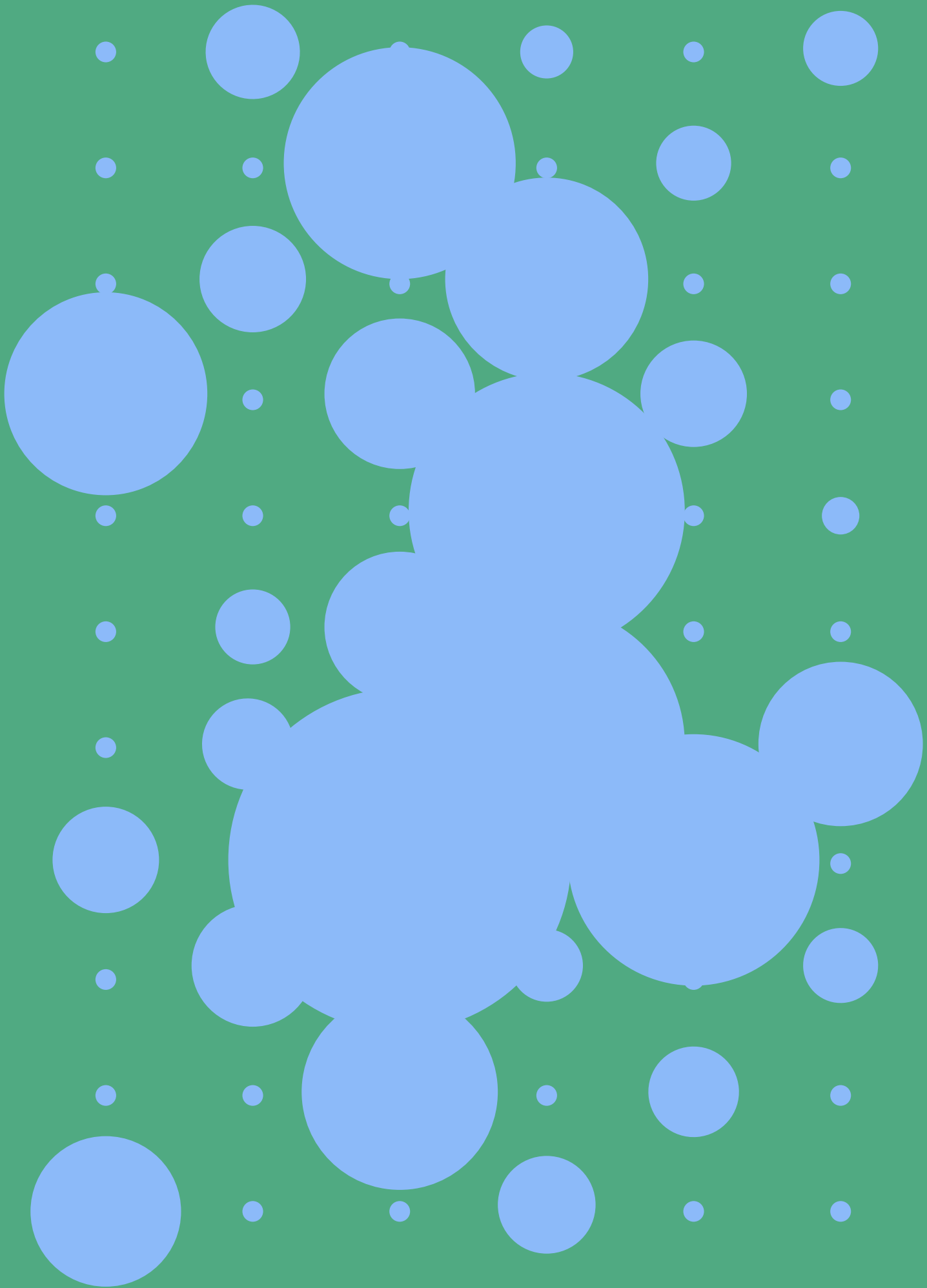
Workbook 3
Exploring the Port Region

Architecture Workroom Brussels
Ministry of the Interior and Kingdom Relations of the Netherlands

Delta Atelier



Initiator
Delta Atelier

Commissioner
Ministry of the Interior and Kingdom Relations of the Netherlands

Authors
Architecture Workroom Brussels (AWB)

Graphic design
Vrints-Kolsteren



Ministerie van Binnenlandse Zaken en Koninkrijksrelaties

Delta Atelier

ARCHITECTURE WORKROOM BRUSSELS

Delta Atelier

The Delta Atelier positions itself as an autonomous P2P knowledge and action platform among more than 50 actors who work in innovative ways to make the urban landscapes of our joint Delta, composed by: Netherlands, Flanders, Brussels and, by extension, the regions of North Rhine-Westphalia and Nord-Pas-de-Calais. The platform bundles scattered knowledge and practical experience about the spatial impact of different transitions (mobility, energy, water, biodiversity, circular economy, agriculture, care) and organizes interaction between peers - both designers and policy makers and organizations as experts - so that they learn from each other and jointly formulate and realize new breakthroughs. The Delta Atelier sets out a program of debates, workshops, project initiations, design research, a physical workplace, exhibitions, virtual exchange (documentaries, podcast) and a community-driven online exchange platform.

Program 'Circular Ports in the Delta'

The 'Delta Atelier Circular Port Program (2018-2020)' has been the framework in which the knowledge and insights between different scales were exchanged and cross-border cooperation was strengthened.

- The study 'Circular Mainframe', conducted by the Studio Marco Vermeulen on behalf of the Ministry of the Interior and Kingdom Relations, focuses on the required infrastructure, spatial development and new value chains at the scale of the Delta.
- At the corridor level, a regional test around the North Sea Port - 'North Sea Port District" ' - has been set up, based on a collaboration between the provinces of East-Flanders and Zeeland, and the municipalities of Ghent, Evergem, Zelzate, Terneuzen, Borsele and Vlissingen, with support of North Sea Port.
- In 2018, the Circular (City) Ports research was set up by Flanders Circular/OVAM in collaboration with 1010au, VUB and AWB, around city port environments as catalysts for the circular economy transition. In the course of the project, however, the scope was broadened to include the port environment in relation to the city and the hinterland.

An open discussion with port authorities (North Sea Port, Brussels, Amsterdam, Rotterdam, Antwerp, Ostend, ...), reflections with international organizations (EFIP, ESPO, AIVP, ...) and governmental parties (OVAM, BZK, RVO, ...) activated a process of mobilization and mutual exchange, with the aim of outlining a strategy for the further development of an action-driven common Circular Agenda on a Delta scale.

This workbook dives into the port region and presents the region as an interesting scale to investigate further in light of the circular transition. While it is clear that the circular transition will change the working of our economic system, with port environments as crucial players, this document wants to show the potential of looking beyond the port borders. Therefore, this exploration aims to be a conversation starter, rather than a complete research on the port region.

In order to explore the potentiality of the port region for the circular transition, eight Circular Buildings Blocks (1010au & AWB, 2020) are presented as possible circular projects, based on recurring initiatives defined during a benchmarking (AWB & 1010au, 2018-2019). Next to that, these Building Blocks are connected to three strategic pillars of port strategies, destilled from existing strategies for Belgian Ports (Haezendonck, Van den Berghe, 2020). Further, the three port regions around North Sea Port, Rotterdam and Amsterdam, now defined in the Netherlands as NOVI-areas, are explored for their potentiality for Building Blocks. Next to that, we zoom out and look at the Circular Mainframe (Studio Marco Vermeulen, 2018 and 2021), as a larger infrastructural network that will have an impact on the port region, which should also be considered when implementing new circular projects.

The different insights mentioned above result in an ending chapter, where five different conversation starters are defined for further investigation and exploration of the port region.

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01 Circular projects

In our Delta, there are many ongoing circular initiatives. These have proven to be important new projects in order to go a step forward in the circular transition. During the first phase of the research ‘Circular (City) Ports’, a benchmarking of 11 ports in the Delta led to an analysis of these initiatives and a bundling into eight Building Blocks. These Building Blocks are based on the similarities that were possible to identify between the initiatives across the different ports, according to their recurring circular project and its specific spatial context. Each Building Block, as a type of strategic project, has the potentiality to be replicated elsewhere.

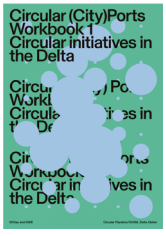
The Building Blocks represent different links in the total circular chain, and their interaction seems essential to steer the circular system. Although not all these Building Blocks are necessarily found in every analyzed port, they do capture the vibrancy of answers that ports and waterbound (industrial) areas provide to their explicit circular goals.

This chapter looks at the eight Building Blocks as recurring types of circular projects. For each Building Block, a summary is provided of its spatial context, side conditions and relations to other elements in the circular chain. An illustration by 1010au shows a generalized situation in which the Building Block could be found. Next to that, two exemplary cases are mentioned per Building Block.

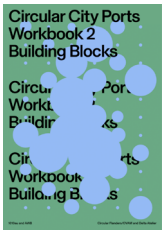
The Building Blocks are the following:

01 Capacity Fields
02 island of Urbanity
03 Canal Cluster
04 Incubator
05 Local Job Generator
06 Urban Trieur
07 Hinterland Hub
08 Knowledge District

Source material:



Workbook 1 - Circular initiatives in the Delta
Architecture Workroom Brussels (AWB) and 1010 architecture urbanism (1010au), 2019, Circular (City) Ports: Workbook 1 - Circular initiatives in the Delta, commissioned by Circular Flanders / OVAM.



Workbook 2 - Building Blocks
1010 architecture urbanism (1010au) and Architecture Workroom Brussels (AWB), 2020, Circular (City) Ports: Workbook 2 - Building Blocks, commissioned by Circular Flanders / OVAM.

1 Capacity Field

Definition

The Capacity Field functions as a hub for containerized cargo and the transhipment of goods (e.g. liquid and dry bulk), not only for the regional economy but mostly declinating its use to international connections. It is a spot where bigger industries are located and where there is the infrastructural capacity to promote the growth of emerging circular industries.

Spatial context

The Capacity Field is a large area, located next to the sea and the network of waterways. It consists of bigger plots, close to berths, facilities and operational techniques typical of sea ports. It is a part of the port which is more isolated: there is a physical distance to living areas for safety standards also because the activities located there usually generate noise and odours.

Relation to the port and region

The Capacity Field takes up wide surfaces. It is in strong connection to other activities - and building blocks - in the port, as it enhances the interactive development of the coastal and shipping industries. It is connected to the other parts of the port by water, road or railway.



Illustration 'Capacity Field' © 1010au



Exemplary case: Maasvlakte, Port of Rotterdam, the Netherlands



Exemplary case: Port of Le Havre, France

2 Island of urbanity

Definition

The Island of Urbanity usually creates a regional community in the port, by having a network of firms and institutions to support linkages between flows and locally available expertise. Nowadays, there is often a gap between the flows of goods and materials and the high-value-added activities related to these goods, such as advanced services, innovation and knowledge-intensive employment. It should increase the proximity and collaboration among firms to build up capabilities, collective learning and to ensure competitiveness. It is a hub where infrastructure and facilities are grouped and made accessible to companies in order to facilitate research and development.

Spatial context

The Island of Urbanity is positioned close to other companies, which can provide it with (secondary) materials and with innovation hubs. It is rather a small to medium scale Building Block and is positioned in the port, but is strongly connected by public transport to other environments, such as the city and the whole region.

Relation to the port and region

The Island of Urbanity is well connected to the residual flows and issues of the companies of the port. It works in close relation with the port authorities, universities, private and public instances and specific private actors.

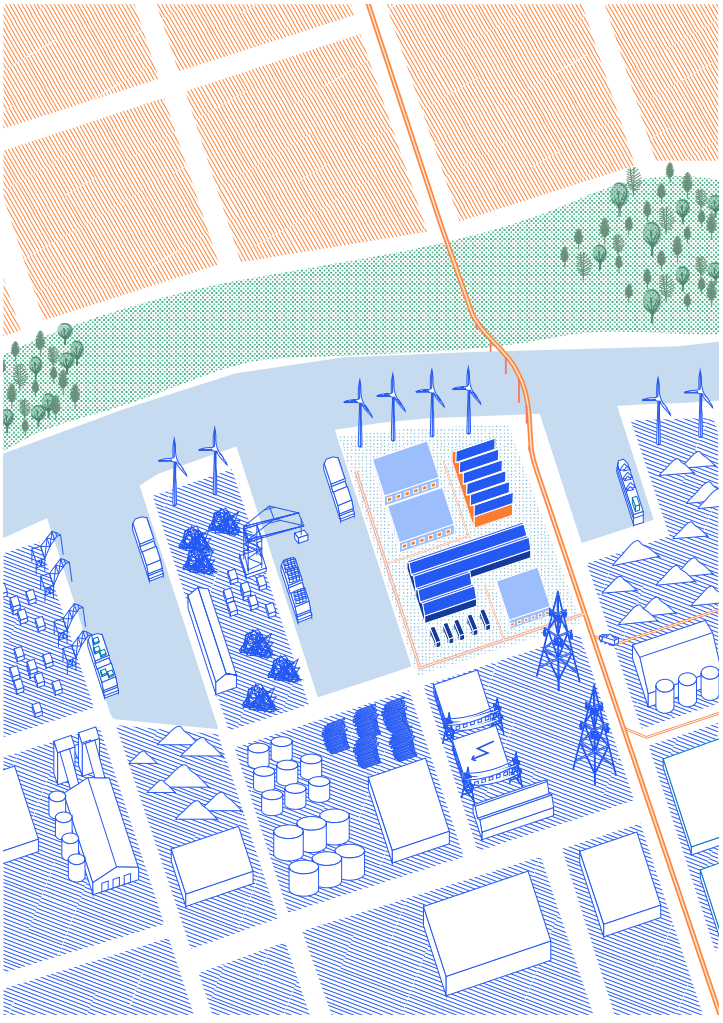


Illustration 'Island of Urbanity' © 1010au



Exemplary case: Prodock, Amsterdam, Netherland



Exemplary case: Plant One, Rotterdam, Netherland

3 Canal cluster

Definition

The Canal Cluster is a specific type of economic agglomeration that can include firms in the maritime sector (from bunkering and shipping agencies, to ship or container repair and maintenance, or dredging) or any other industry - typically in the construction, recycling and food processing industries. The clustering can facilitate the symbiosis and collaboration between the different industries in order to enhance circularity inside the cluster, and in connection with other economic hotspots.

Spatial context

The Canal Cluster is situated close to the city center, along a waterway and with good access to logistical infrastructure. It consists of large available surfaces, plugged into a well-connected road network, and brings together activities that are grafted around the existing core. The Cluster consists of activities that should be near the canal, mostly linked to transhipment platforms (e.g. recycling centres, concrete mixing plants, building materials, food manufacturers, pharmaceutical products, chemical industries). The Canal Cluster could both be inside or outside the port area and can thus be managed by the port authority or by a 'park manager'. In both cases, the development of synergies among those industries should be assured, in terms of industrial symbiosis.

Relation to the port and region

The Canal Cluster should be very accessible and well connected with other major (urban) economic centres. If it is in close proximity to residential areas, there could be an opportunity to develop certain activities and symbiosis. The Cluster should be located to a Canal where there is a good connection to the different flows needed, ideally it should be the passage

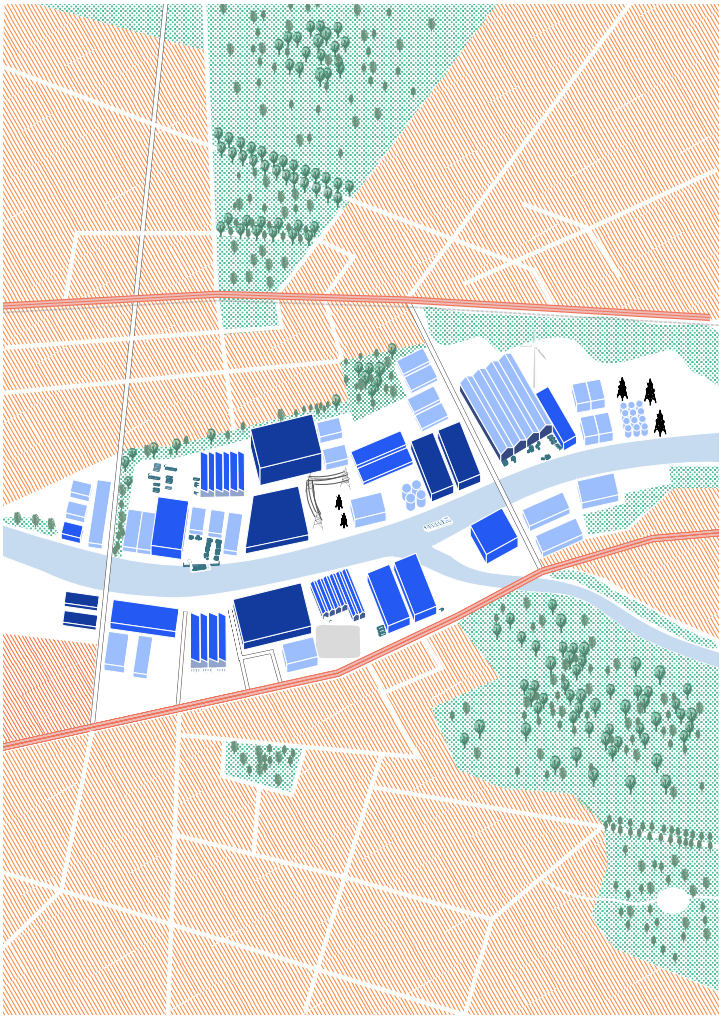


Illustration 'Canal Cluster' © 1010au



Exemplary case: Area manager Kanaalkant, Albert Kanaal, Antwerpen



Exemplary case: Laeken Port, Brussels

4 Incubator

Definition

The Incubator plays the role of supporting environment for the port ecosystem in transition. In fact, it refers to those innovative enterprises which can fill the gap between innovative small companies (niches) and the bigscale industrial and logistics setting characteristic of ports. It offers financial and organization support to early-stage start-ups and early grown-ups to help them to upscale and adapt to the global concurrence that partly governs the port ecosystem and provide adapted infrastructure to them (e.g. testing centres and labs).

Spatial context

The Incubar can be located in diverse city port areas, mostly not in close proximity with housing development. It uses various vacant spaces of a medium small size (1ha - 8 ha) in order to set test sites, and experimentation areas to support local start up to innovate and test circular business models and new circular functioning. Moreover, it often accommodates space to store specific flows, and the needed infrastructure to support the specific activities.

Even if, the location of the Incubator can be different within specific environment, import is the proximity with other companies operating with the same industry, in order to build fruitful and circular synergies between the growing initiative and the existing one

Relation to the port and region

The Incubator is linked primarily with the urban environment. It plays a key role in linking the urban dynamic with the port one, in order to find synergies and possible new circular chains. In this sense, innovatives practices engaged in linking the city- port dynamics can be found here.

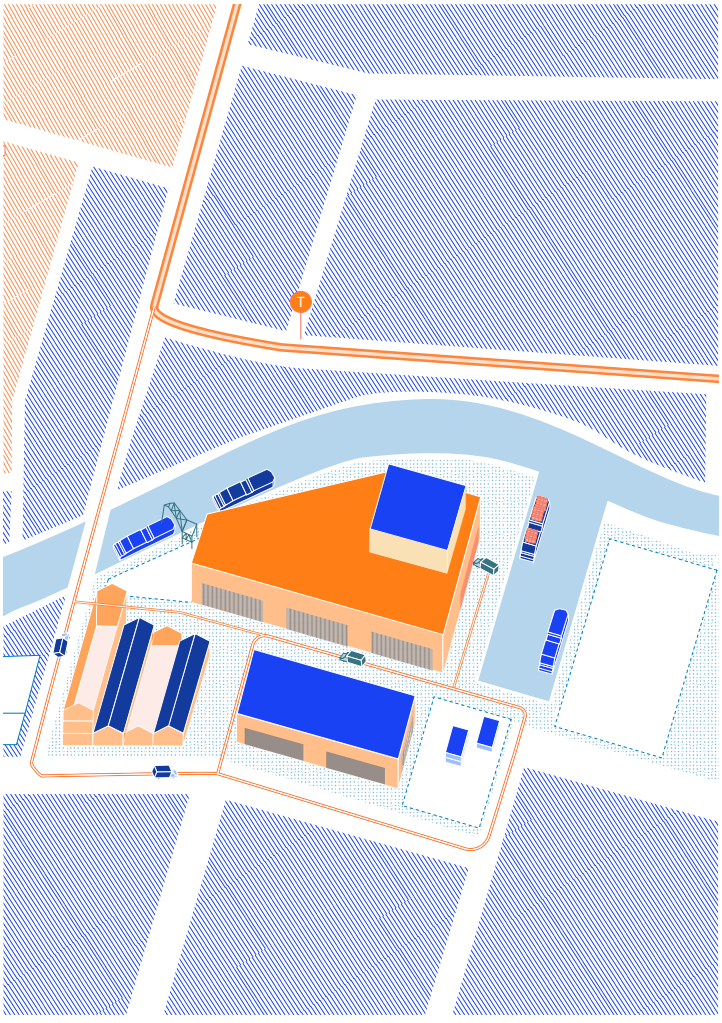


Illustration 'Incubator' © 1010au



Exemplary case: Greenbizz, Brussels © Denia Zerouali



Exemplary case: Bluebridge Science Park, Ostend

5 Local Job Generator

Definition

The Local Job Generator links the specific activities of the port environment, mostly related to new types of manufactures, upscaling of materials, etc, with local task forces. Synergies with the nearby neighborhood are most likely to happen, in terms of training and job placement (e.g. food processing, furniture making) as well as in the type of products that can be handled locally, like repurposed textiles or electronics. Sometimes they also operate as autonomous zones, entertaining relationships with areas well beyond the close-by neighbourhoods. Therefore it most of the time hosts labor intensive activities that do not require vast spaces or sophisticated infrastructure.

Spatial context

The local Job Generator often occupied structures that were left behind by the continuous up-scaling of the logistical activities in the port. It is positioned close to the source of the material stream, and in proximity to living areas. Also the presence of waterways represent a crucial element for the Local Job Generator, in order to build synergies with other activities in the port and in the region.

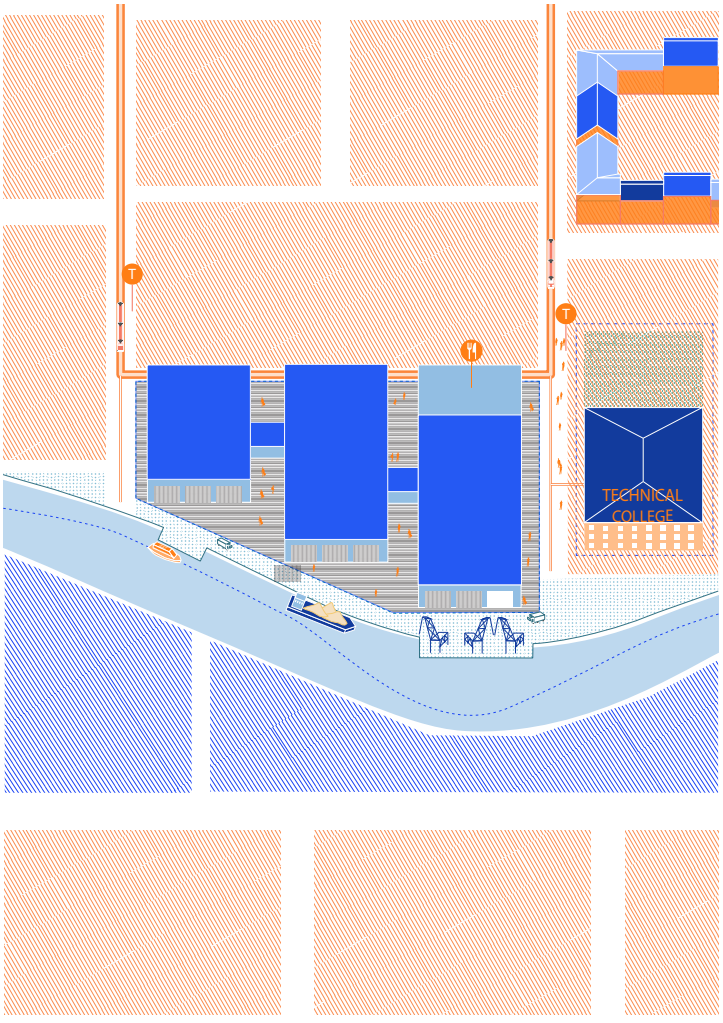


Illustration 'Local Job Generator' © 1010au

Relation to the port and region

This building block represents a key element in the interface between the city and the port, especially in light human capital needed for the circular transition. Building new technical skills in close relation with the local existing activities and the local inhabitants or task forces does represent a crucial step toward local specialization of port activities.



Exemplary case: M4H Makers district, Rotterdam



Exemplary case: Heyvaert district, Brussels

6 Urban Trieur

Definition

The Urban Trieur hosts activities ranging from the distribution of products directed to the urban economy (from construction materials to consumer items) to the handling of wastes (collection, storage and sorting), and even their treatment on site (involving repair and recycling). Moreover, flows of goods and materials are bundled here, via sustainable transport, and are distributed at the local scale. Dynamics of reverse logistics are also initiated where outgoing flows and incoming goods can be put together on the same means of transport.

Spatial context

The fast-growing activities included within the Urban Trieur claim their strategic position next to the urban markets and residual streams, therefore located close to urban cores. Its size is modest, implying that it can only handle relatively small volumes at once while relying on other locations along the port corridor for consolidating and eventually treating them further. Moreover it is mostly linked with big transport infrastructure such as waterways or railways, and organises the last mile logistics of goods within the urban environment. Therefore, it also functions as a key location for movement of materials needed in the port.

Relation to the port and region

The Urban Trieur is connected with waste flows from the city and other urban activities. It represents a key location for upcycling and producing secondary raw materials to be used by other activities in the port and beyond. Its relevance can be found mostly at the scale of the port, since the transport of waste is highly restricted by regulation. It also connects the activities and products with the final users. For example, the building material produced by port organisations can be linked with new construction sites in the city (e.g. Material Village Brussels), and transported by waterways from one location to another. At the same time the Urban Trieur plays a central role also as a logistic platform collecting goods coming from elsewhere, such as other ports or industrial areas, and it organises the distribution and management of those flows locally (port-city level) and at the regional scale.

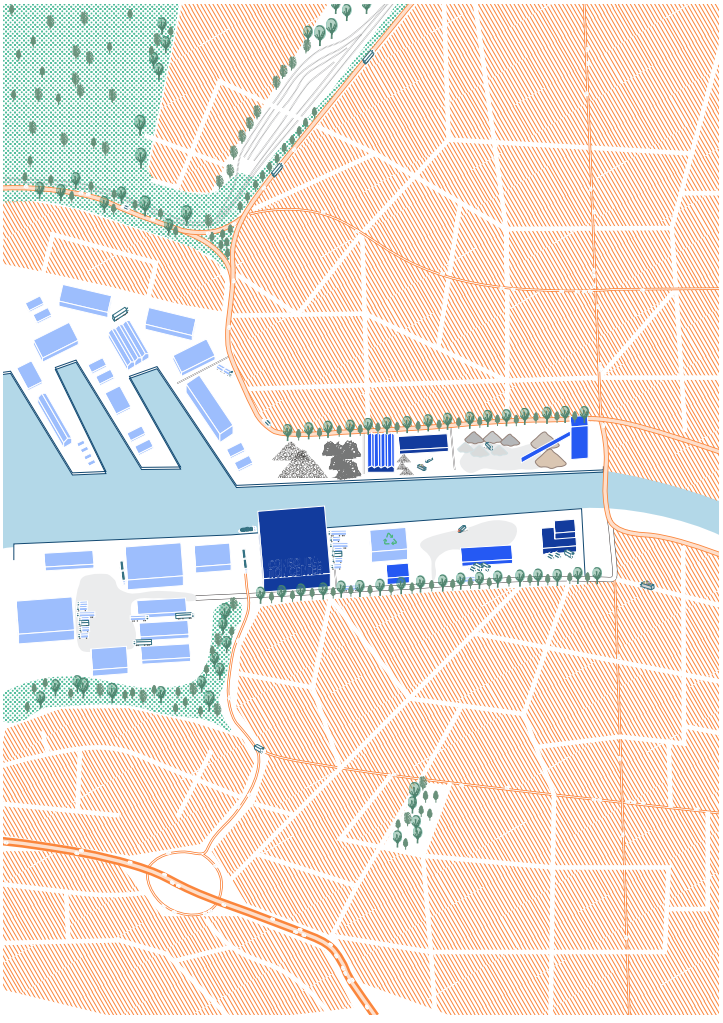


Illustration 'Urban Trieur' © 1010au



Exemplary case: Building Material Village, Brussels © Filip Dujardin



Exemplary case: Multimodal Center of Urban Distribution, Lille

7 Hinterland Hub

Definition

The Hinterland Hub exemplifies best the numerous possibilities that the redesign of global value chains holds for ports, by combining traditional maritime activities like the handling of commodities with activities in other economic sectors, e.g. in energy or agriculture. On one hand, this Hub can operate as a transhipment point for goods and raw materials coming from the port and being further distributed across its hinterland, and perhaps further processed or customized in order to capture some of their added value. On the other, it can operate as a specialized location in the agri-food sector, capable of revaluing organic waste flows and feedstock coming from the nearby agricultural areas for the generation of energy (e.g. green biorefinery) and the production of new biobased materials (e.g. bioplastic from cellulose, bio-construction materials, etc.).

Spatial context

The Hinterland Hub is linked with differentiated kinds of infrastructure to facilitate mobility of materials and goods. In fact the presence of railway or waterways is key to enhance the connection between the port activities and the one taking place in the hinterland. In this sense, its location is mostly in relation to other sectoral activities or urbanised areas, functioning as a connector between this specific environment and activities located elsewhere.

Relation to the port and region

The activities that take place in the Hinterlahub can be very different depending on its location. In this sense, this building block tries to reinforce the dynamics of flow exchange between the port and the broader regional scale, especially between sea ports and hinterland ports.

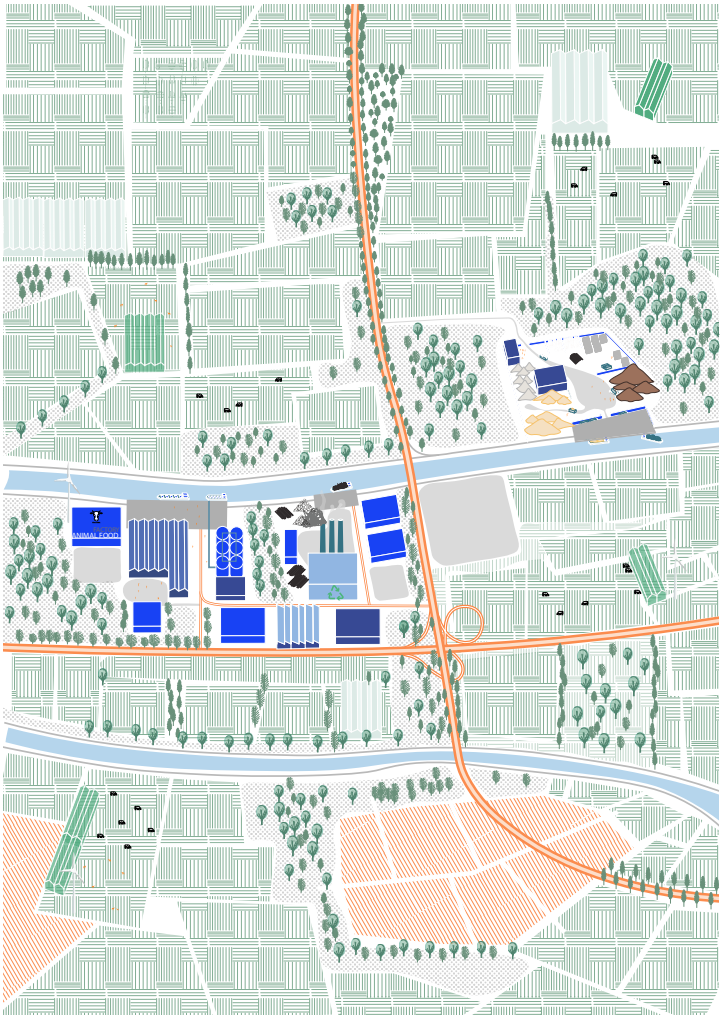


Illustration 'Hinterland Hub' © 1010au



Exemplary case: Brick factory,the North Sea Port, along the Escaut



Exemplary case: Aggregates quarry of Cemex along the Seine, between Le Havre and Rouen

8 Knowledge District

Definition

The Knowledge Districts are the breeding ground for start-ups busy with breakthroughs in fields such as the life-cycle environmental impact (also of vessels), autonomous shipping, Internet of Things, biochemicals and energy diversification (incl. in transport). They are characterized by the involvement of University research institutes and typically support new ventures originated within them. They depend on funds that are necessary for linking public and private stakeholders in a cooperative network integrating cross-sector activities, as well as to support local applied tests and pilot projects.

Spatial context

Usually the Knowledge Districts are well connected areas located within the city port environment, in close relation with the city. Mostly linked with research organisations and universities already present, they enhance cross pollination and collaboration within differentiated local actors in order to implement circular innovation locally.

Experimentation is mostly carried out in vacant areas of the port where, in connection with the surrounding indies and organisation, new technologies are tested.

Relation to the port and region

Regional economic benefits could be stimulated by innovation and high-value-added activities carried out in the Knowledge district. Therefore the connection of local university, research centers and specialized educational environment steer the shift in light of the circular transition, based on the specific need and activities taking place in the port and the region.

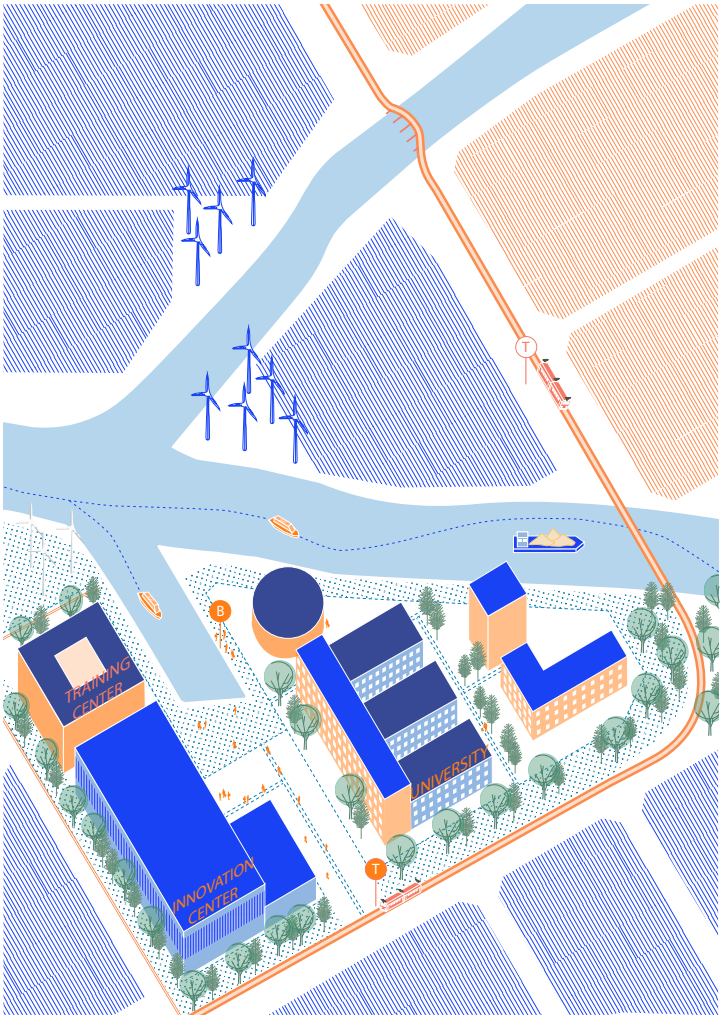
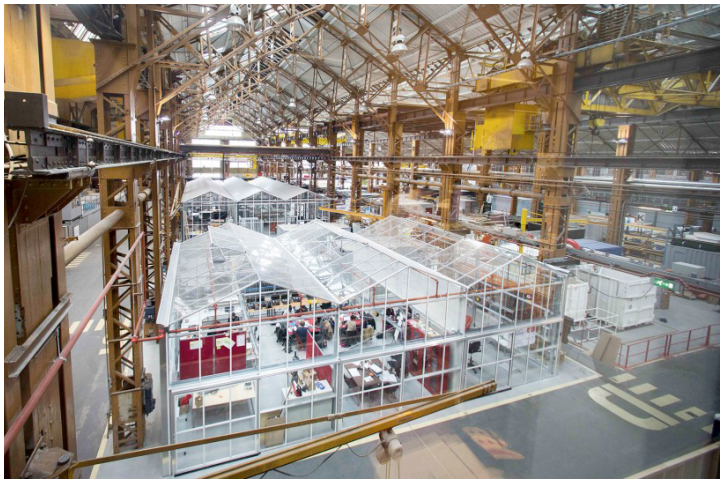


Illustration 'Knowledge District' © 1010au



Exemplary case: RDM Campus, Rotterdam, The Netherlands



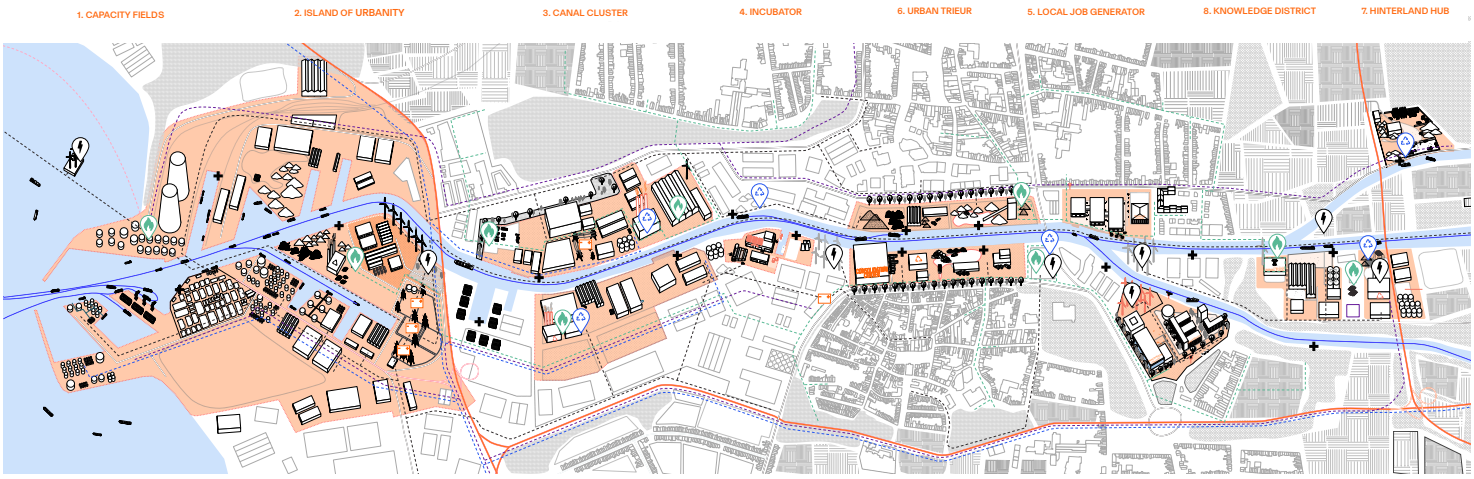
Exemplary case: Duurzaamheidsfabriekm, Dordrecht © RAU Architects

Interrelation between the Building Blocks

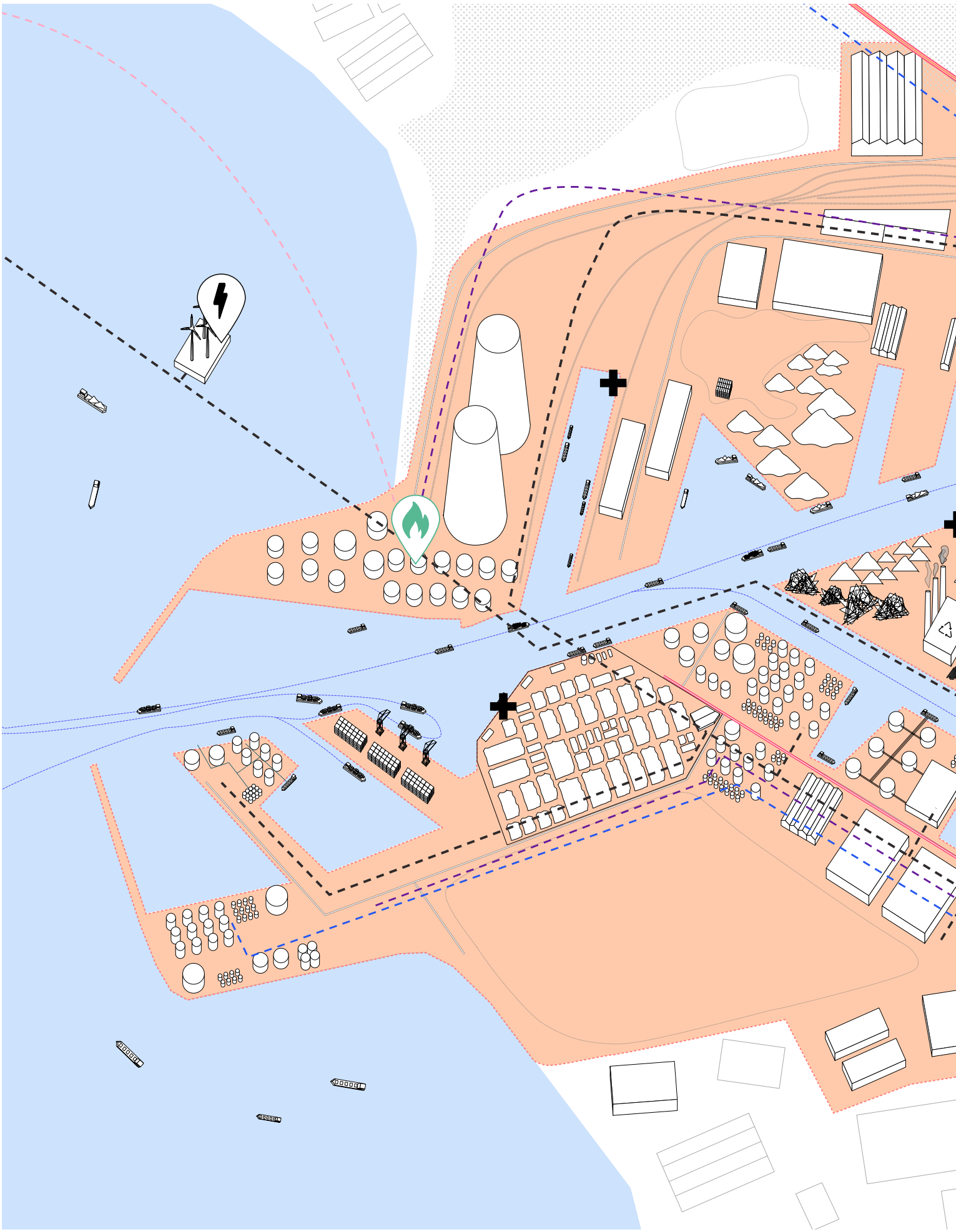
The Building Blocks or Circular Projects illustrated before cannot be seen in isolation. In fact, they represent an innovative piece in the circular value chain. The envisioning and establishment of circular ecosystems reaching beyond geographic borders - from the single company to the port area - is important in order to create and capture differentiated values. Therefore, the shift to a circular system consists of various connections between these potential circular projects. These connections can happen not only in the port environment but also beyond.

If moving toward a circular system starts to be the priority in the agenda at many levels, it is important to understand that this transition cannot be seen only in port environments. The relevance that the ports have in the global chain put them in the spotlight as central drivers for this change, but it is crucial to understand the overall system of which the port is part of. The physical interconnections and the spatial developments around this transition at a broader scale represent a real opportunity for the creation of functional synergies and industrial symbiosis. Assemblages of Building Blocks, where a collection of Circular Projects are put into place in an ecosystem, can start to facilitate the circular transition and see change happening on the ground. The regional scale of ports can represent strategic importance for this transition, and needs further investigation in order to accelerate it.

The interrelation between the different Building Blocks, and the need for a certain functioning assemblages of Circular Projects, seeks for new governance models, organization and coordination strategies that can offer opportunities for those circular ecosystems to bloom and develop. When we dive further into the three port NOVI-areas, it is important to note that there is an opportunity to experiment and further develop the circular system.

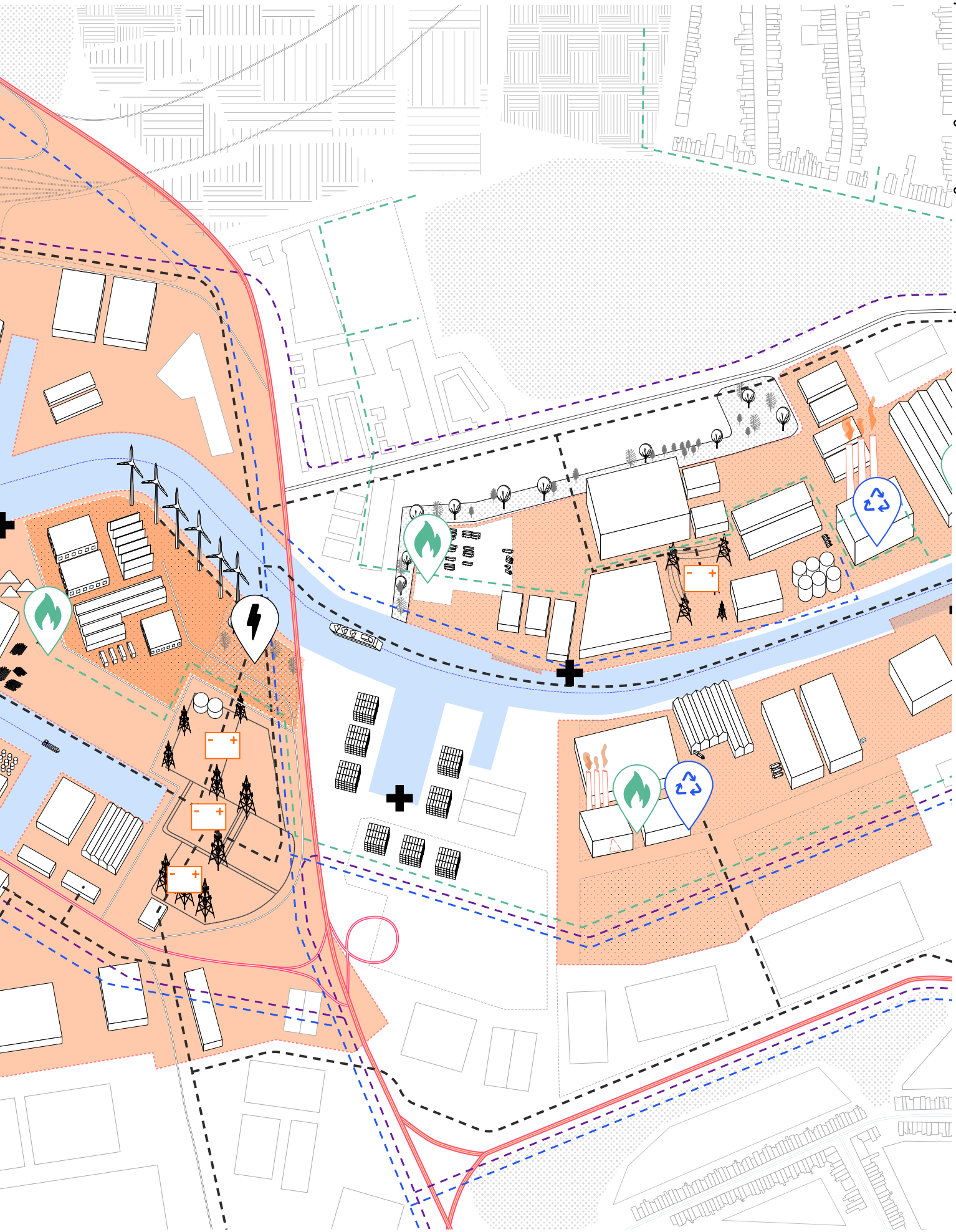


Panorama of the eight Building Blocks in a fictive port corridor © 1010au
> see next pages for a zoomed-in version


1. CAPACITY FIELDS
2. ISLAND

OF URBANITY

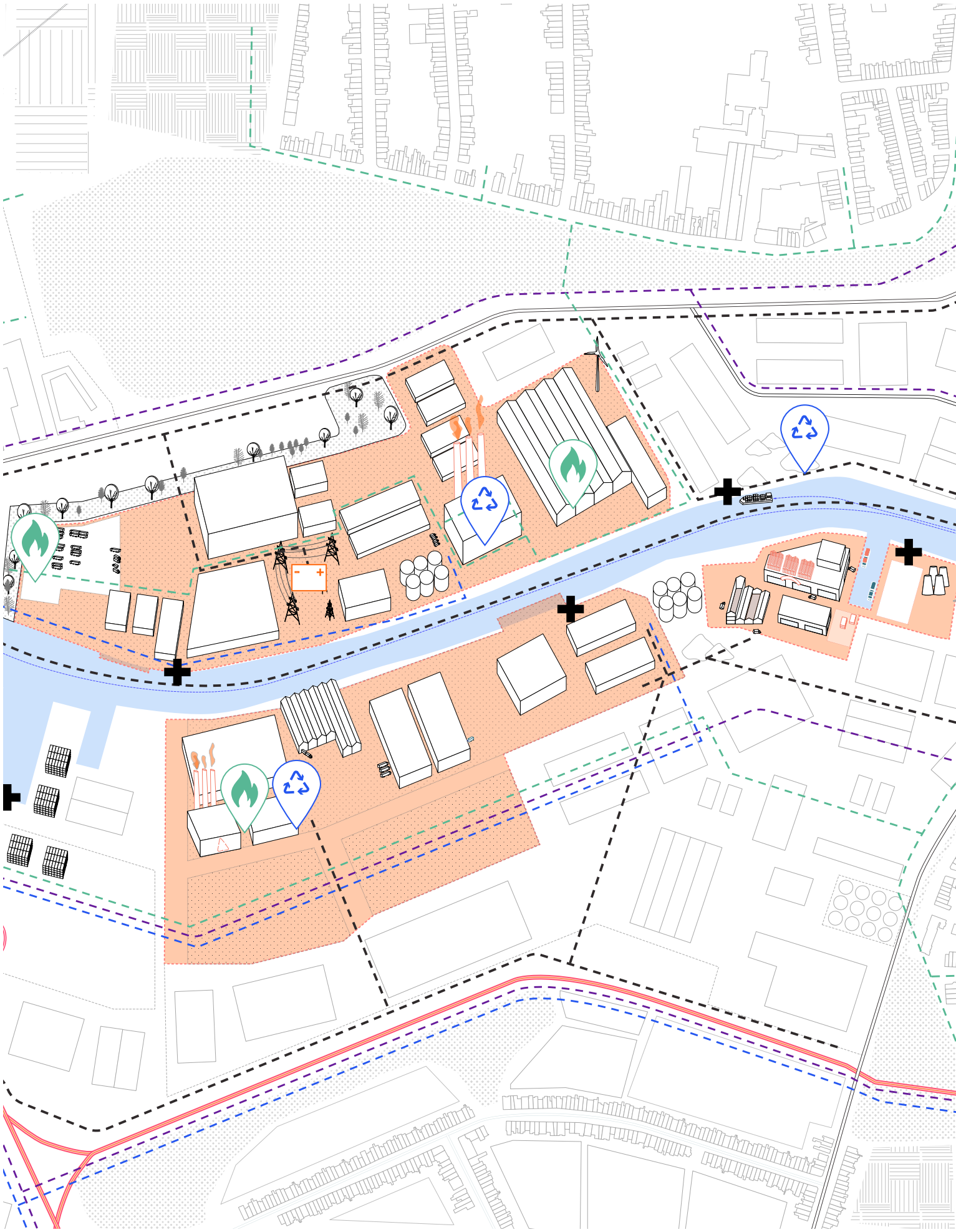
3. CANAL CLUSTER



Zoom-in: panorama of the eight Building Blocks in a fictive port corridor © 1010au

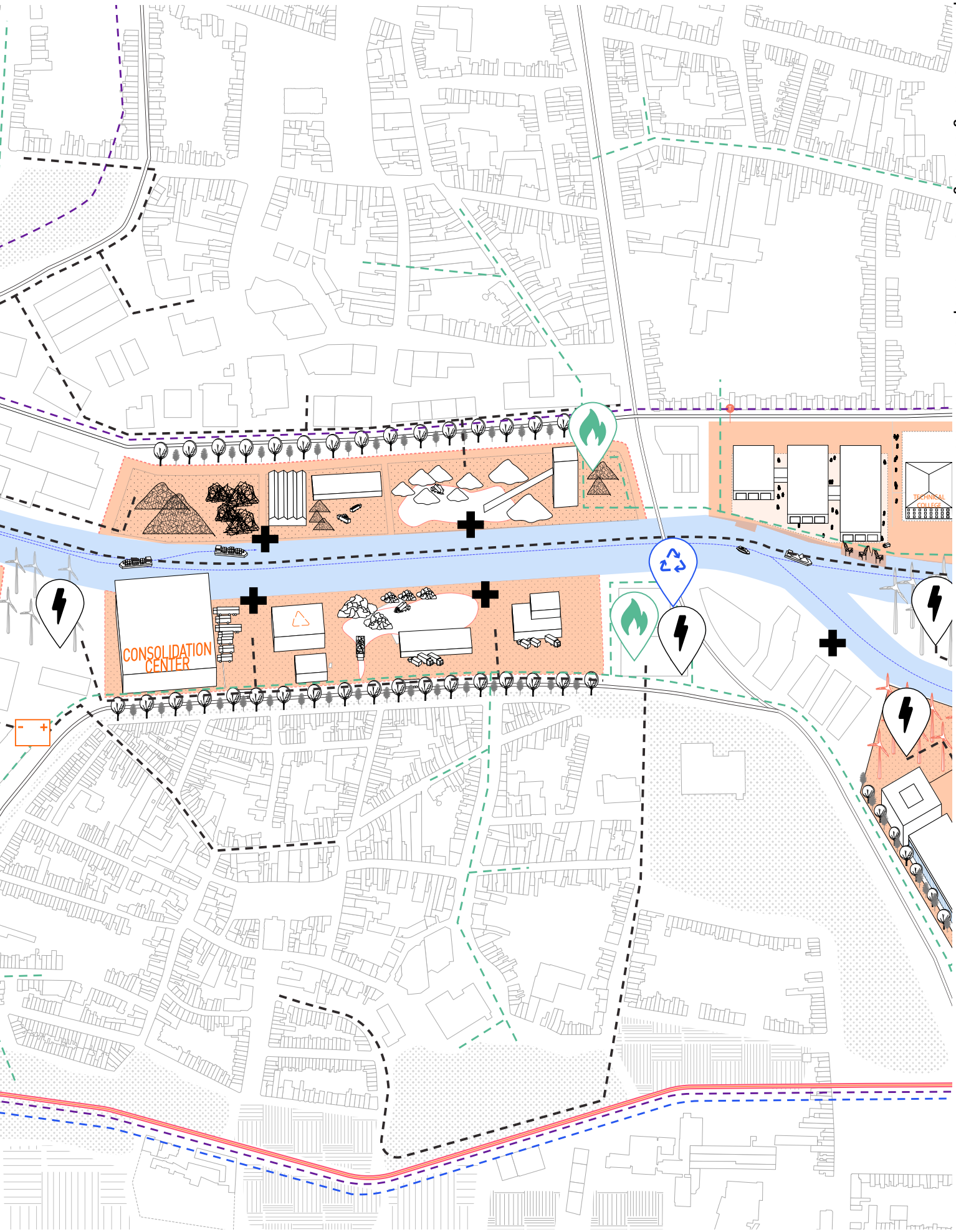
3. CANAL CLUSTER

4. INCUBATOR



6. URBAN TRIEUR

5. LOCAL JOB GENERATOR



Zoom-in: panorama of the eight Building Blocks in a fictive port corridor © 1010au

6. URBAN TRIEUR

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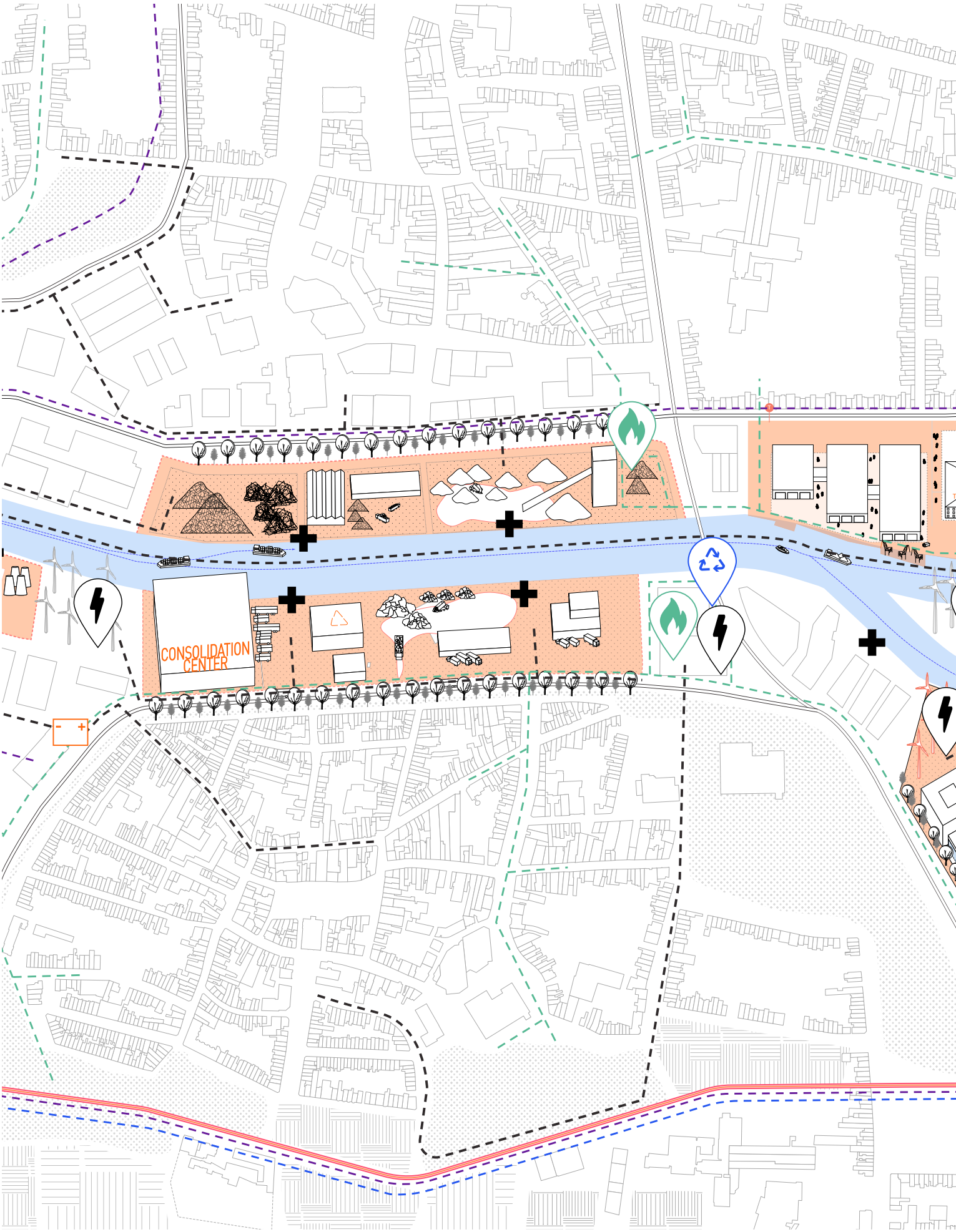
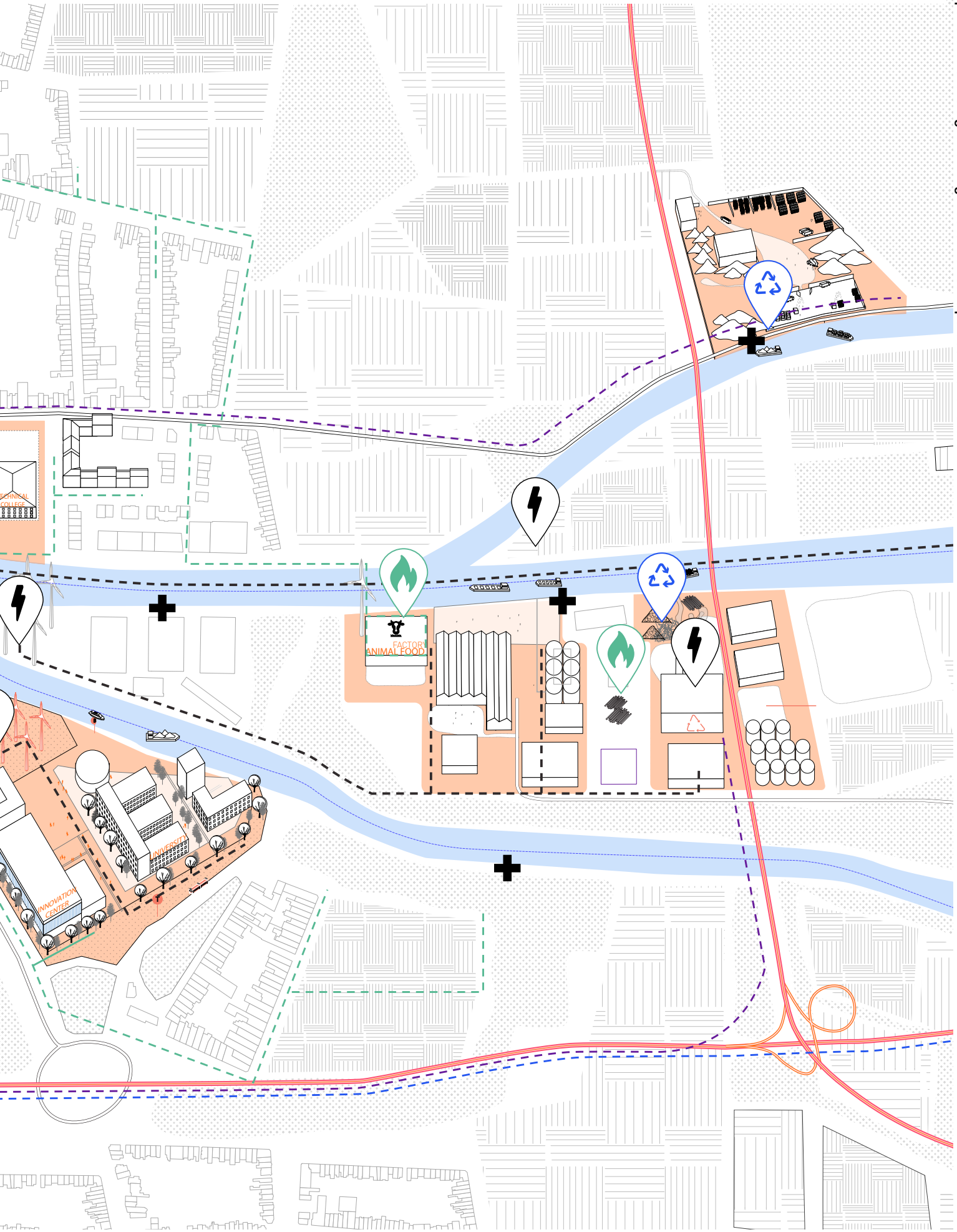


OR 8. KNOWLEDGE DISTRICT 7. HINTERLAND HUB



Zoom-in: panorama of the eight Building Blocks in a fictive port corridor © 1010au

02 Port strategies

There is no single way of being circular, and circularity has an impact on all players in the field, from cities to ports. Every port has to face different challenges, look for various opportunities and define multiple ambitions. This means that every port is confronted with a diversity of choices or pathways to reach the circularity goals. Each port environment is looking at and focusing on different aspects of the transition, and in each environment, various experimentations, projects and knowledge has been developed. The different port strategies that port authorities are developing, show a variety of goals and pathways towards these goals. However, in this variety of strategies, recurring circular thematics or strategic pillars can be recognized.

This chapter is based on the insights of the paper ‘Patterns of Circular transition: What Is the Circular Economy Maturity of Belgian Ports?’ by dr. Elvira Haezendonck (VUB, UA) and dr. Karel Van den Berghe (TUDelft). By investigating the port strategies of the Belgian ports, this paper presents three pillars on which ports are working on for the circular transition: energy recovery, recycling of materials and orchestrating new streams. This theoretical framework of the three pillars is also recognized in other ports in the Delta and can be used to structure the mosaic of circular goals and initiatives. The three pillars cannot be seen in isolation, and certainly they need to be integrated and initiated in the same environment, to envision a comprehensive and ambitious circular transition.

These strategic lines of interventions in each port environment look at different scales and spaces that can play a key role in accelerating this process of change. In fact, it is relevant to understand the spatial realities in which those new dynamics will take place, and how to accommodate them in new sites. Next to that, it is clear that ports are crucial to provide spaces for exchange and symbiosis, two main activities to further circularity. Linking these observations of the three strategic pillars with the spatial dimensions and interrelations seems crucial.

In this chapter, each strategic circular pillar is connected to the Building Blocks mentioned in the previous chapter. Since each Building Block is based on existing activities, and at the same time suggests possible new circular activities, it is possible to show the potentiality of each Building Block to house a piece of the strategic puzzle. With this, a speculative strategic framework can be built and used to understand and analyse port environments on how they are contributing to the circular transition and where new potentialities lie.

Source material:



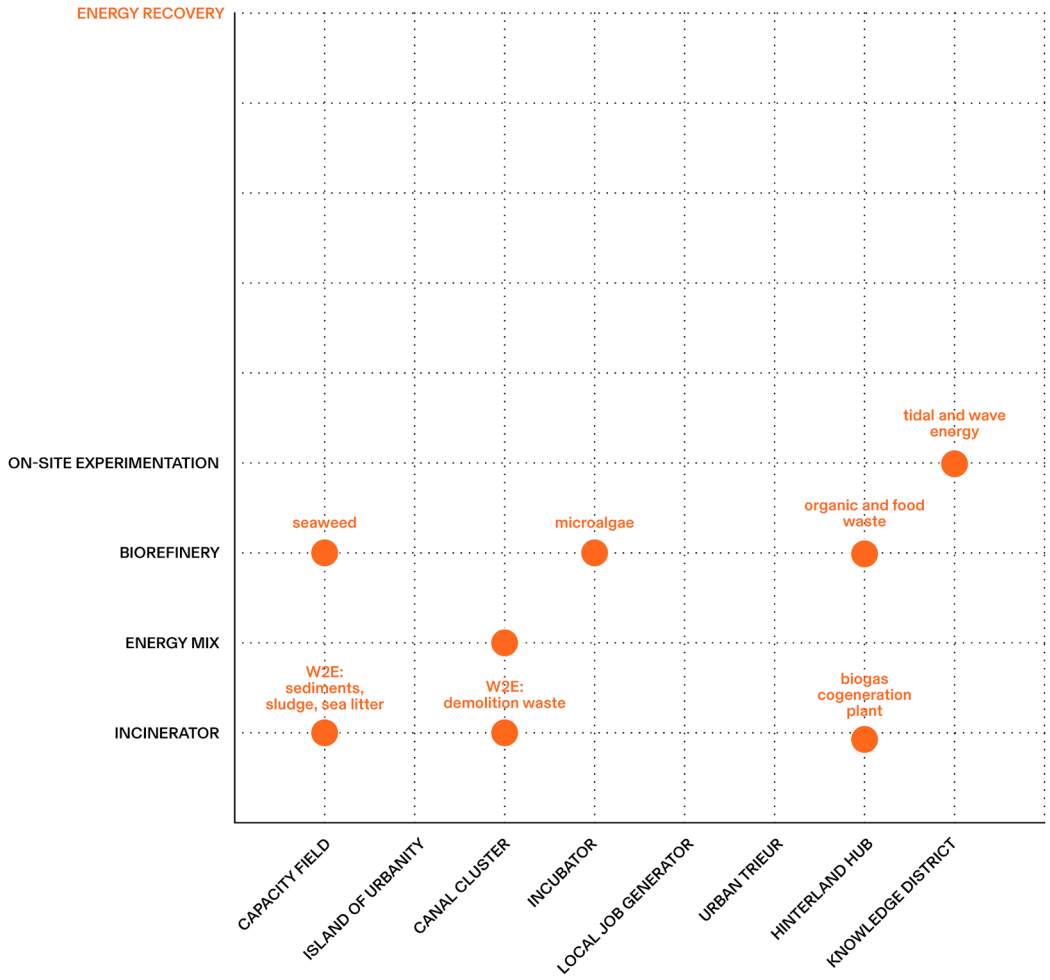
Patterns of Circular Transition: What Is the Circular Economy Maturity of Belgian Ports?
Haezendonck, E.; Van den Berghe, K. Patterns of Circular Transition: What Is the Circular Economy Maturity of Belgian Ports? Sustainability 2020, 12, 9269.

1 Strategic pillar: energy recovery

As big consumers of energy, ports have to find new ways to energize their industrial and logistical activities. Therefore, ports start to look for means to use renewable energy, which can partly come from circularity inside and outside the port borders. An important aspect is the setting up of industrial symbiosis: the reuse of steam, the capturing and reuse of CO2, the exchange of hydrogen as residual flow, the transport and use of residual heat from different industrial processes etcetera. The residue of one entity can be used by another, which means that the receiver doesn't have to use other, often fossil-based, means to generate heat, hydrogen, steam, etc. This strategic direction is mostly labeled by ports as the Energy Hub: the port can function as a key cluster, working towards the production and use of renewable energy and residue streams for energy production.

If we look back at the different strategic building blocks mentioned before, some of them can be recognized as essential in facilitating and/or activating this strategic pathway. At all scales and in all locations, solutions are sought for diversifying the energy mix in favour of renewables and low-carbon conversion technologies for electricity, heating and cooling. This is not only true for the Canal Cluster environment, where the overview of possible symbiosis in this sense can be seen, but also for other locations in the port region.

At the same time, experimentation in the field is still needed. The Knowledge district seems the right location in which tests on different sources of energy can be done. For example the water movements inside the dock and the potential wave tank next to can be used to try out prototypes to exploit tidal and wave energy. Moreover, Seaweed biorefinery which converts native seaweeds to CO2 neutral chemicals and bioenergy can be identified in the Capacity Field environment as an exemplary activity to further look into sustainable and renewable energy sources.



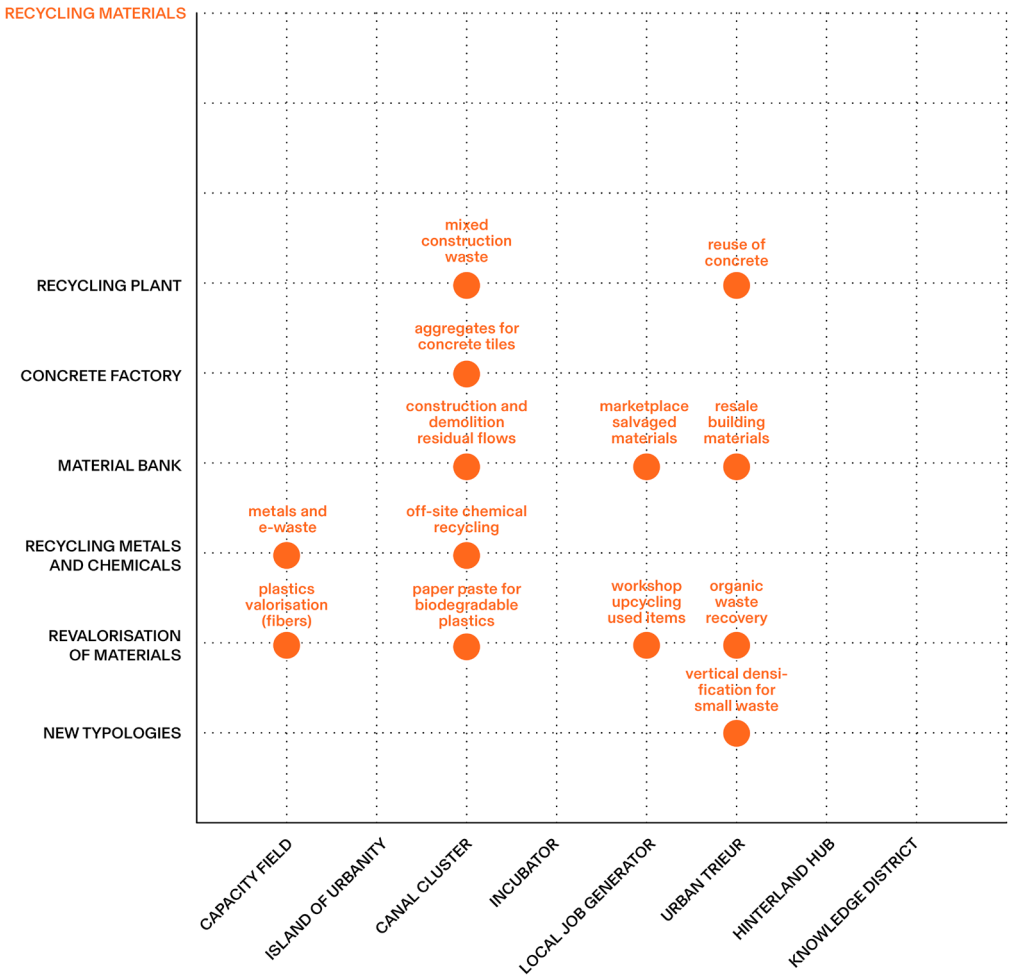
2 Strategic pillar: recycling materials

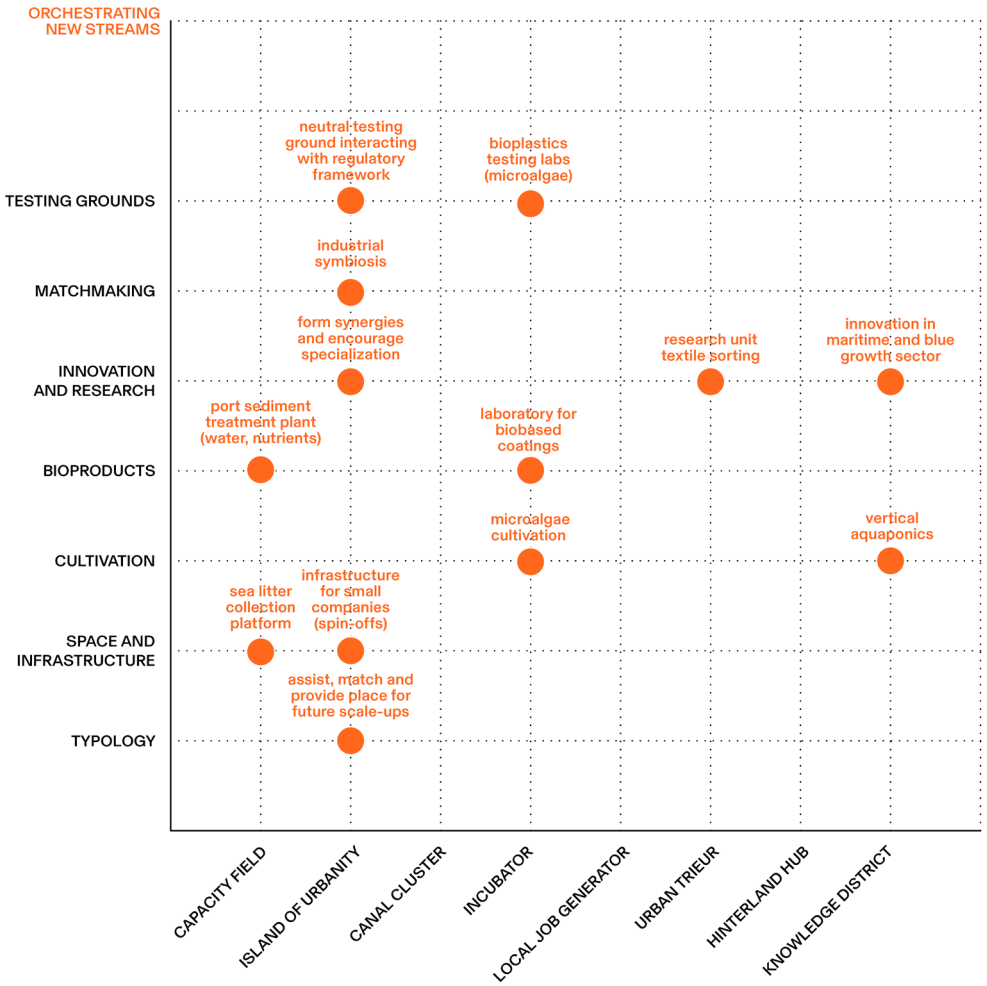
The recycling, reuse and upgrade of material flows are recognisable at different scales, inside various projects with the port environments. This strategic direction doesn't only look at the dynamics happening within the port cluster, but it enlarges its influence and importance towards the cities and region beyond the port borders. Recycling and reusing waste flows means to also involve and activate other fields of operation: food production, building materials, demolition… Resources can be collected, stored and treated within the port, but in symbiosis with its surroundings - city, region and hinterland. This means that this strategy is mostly considered as the creation of recycling hubs, in which different flows come together, storage is organized, treatment takes place and the dispersion of treated flows can happen. Often this strategic direction considers left-over spaces inside port environments as potential places to host these activities of recycling materials.

Therefore, some of the building blocks illustrated in the previous chapter can be considered key projects in order to initiate this local strategy. The Urban trieur reinforce the material collection and exchange between the city environment and the port. It allows collection of different streams and activates diversified dynamics of urban 'mining'. Biomaterials Labs, where organic waste from the living areas are collected and transformed to make new products and process biomass-derived intermediaries, is an interesting exemplary activity that can be developed in the urban trieur environment. At the same time, other resources from the city as concrete resulting from demolition sites in the city, can be stored in this key location and, by processing it, re-introduce it into the manufacturing process of new concrete.

As mentioned also before, the strategies or pathway toward circularity that each port is undertaking do not stop at the port border. In fact, the influence and the impact that this transition has with the broader region is crucial. Therefore differentiated kinds of symbiosis can be envisioned, and different facilities in order to facilitate the recycling, up-cycling and reuse of material can be implemented. A material bank that can serve the whole region where high-value separation and repurposing of construction and demolition residuals can take place. The same goes for Chemical recycling plants, where recycling processes that cannot happen on site, can take place here, and where testing for differentiated and more sustainable processes can be done. These activities can be seen as part of the Canal cluster functioning, where the coordination of the different activities in a specific environment are also managed by setting up various facilities to enhance innovation and exchange and serve the companies in transition.

Moreover, if we think about further developing recycling, upcycling and reuse of differentiate materials, it is important, on the one hand, to create new human capital around those activities. On the other, is to build dynamica of sensibilizations of citizens, but also different involved groups. Therefore activities carried out in the Local Job Generator can be pivotal in constructing this mind shift. Organisation of Workshop for upcycling used consumer items (garments, furniture...) or repairing and repurposing a fraction of e-waste (domestic appliances and other discarded electronics, from computers to phones), can be considered extremely important to envision a broader system of actors strategising upon the circular transition.


RECYCLING MATERIALS
RECYCLING PLANT
CONCRETE FACTORY
MATERIAL BANK
RECYCLING METALS AND CHEMICALS
REVALORISATION OF MATERIALS
NEW TYPOLOGIES
mixed construction waste
reuse of concrete
aggregates for concrete tiles
construction and demolition residual flows
marketplace salvaged materials
resale building materials
metals and e-waste
off-site chemical recycling
plastics valorisation (fibers)
paper paste for biodegradable plastics
workshop upcycling used items
organic waste recovery
vertical densification for small waste
CAPACITY FIELD
ISLAND OF URBANITY
CANAL CLUSTER
INCUBATOR
LOCAL JOB GENERATOR
URBAN TRIEUR
HINTERLAND HUB
KNOWLEDGE DISTRICT


ORCHESTRATING NEW STREAMS
TESTING GROUNDS
MATCHMAKING
INNOVATION AND RESEARCH
BIOPRODUCTS
CULTIVATION
SPACE AND INFRASTRUCTURE
TYPOLOGY
neutral testing ground interacting with regulatory framework
bioplastics testing labs (microalgae)
industrial symbiosis
form synergies and encourage specialization
research unit textile sorting
innovation in maritime and blue growth sector
port sediment treatment plant (water, nutrients)
laboratory for biobased coatings
microalgae cultivation
vertical aquaponics
sea litter collection platform
infrastructure for small companies (spin-offs)
assist, match and provide place for future scale-ups
CAPACITY FIELD
ISLAND OF URBANITY
CANAL CLUSTER
INCUBATOR
LOCAL JOB GENERATOR
URBAN TRIEUR
HINTERLAND HUB
KNOWLEDGE DISTRICT

3 Strategic pillar: orchestrating new streams

The transition towards circularity seeks for the identification of new business opportunities, derived from local and regional supply chains. This strategic direction is complex: it requires a proactive search for local and regional possibilities in order to start up new specialization(s). This means that the port looks beyond its borders and searches for exchange and interrelations with its corridor and hinterland. These new specializations go hand in hand with the development of new logistics and the development of new supply chains. The modal shift and the regional freight flows are key aspects that have to be investigated in order to go forward in this strategic direction.

Looking at how ports are strategizing around this local specialization, interesting activities can be identified in the building blocks. In fact, the Island of Urbanity has the purpose to facilitate the building of local industrial symbiosis and incentives the settling of new circular activities by assisting, matching and providing place for future scale-ups. This goes hand in hand with the organisation a neutral ground to test and interact with the regulatory framework.

Clear, therefore, is that further developing local specialisation needs testing and further looking at undiscovered fields. For these reasons, crucial are the activities carried out within the incubar environment as the testing of different innovative practices, such as biorefinery test labs, or experimentation on material recovery. This goes hand in hand with the activities related to the local job generator, where businesses incubator experiments on how to scale up those innovative activities to make them structurally part of the port environment.

Moreover, the collection, storage and distributions of all those differentiated materials is recognized as pivotal. In fact, the specialization of those port environments would be based on the specific local opportunity, shift the economical model of the port from a global trade oriented to a local trade oriented. Therefore facilities, such as distribution hubs, and the use of waterways and more sustainable means of transportation are fundamental to facilitate this process.

03 Port region as experimentarium

The circular transition is worked upon at different scales. Firstly, the circular transition takes most clearly shape in the circular projects, where new experiments take place or where certain initiatives position themselves as a missing part in the circular chain (Chapter 1). Secondly, circularity is strategized upon in the different ports, where the three strategic pillars of the circular transition could be recognized (Chapter 2). Thirdly, the importance of the connection between ports and the hinterland, cities and other (industrial) activities is clear.

If we then look at the broader region, we begin to recognise the interconnection of these different projects, ports, hinterland and infrastructure. It is crucial that we extend the boundaries of the study area beyond the ports themselves. The region should be seen as an experimental area to drive the concept of circularity even further. On the scale of the region, new initiatives and coalitions should and can be set up in order to bridge gaps in the circular chain and form new kinds of symbiosis between different activities.

The definition of eight focus areas for the Dutch National Strategy on Spatial Planning and the Environment ('Nationale Omgevingsvisie' or NOVI in short) can be seen as a momentum. By looking at a specific region, the government aims to break through a sectoral approach and organize the different ministries, departments and organizations around specific spatial questions. Three port areas are currently indicated as NOVI regions to dive deeper into the transitions and their spatial implications: the Port of Rotterdam, the Port of Amsterdam and North Sea Port (the Zeeuws-Vlaamse Kanaalzone or now called 'North Sea Port District'). The regional scale offers a tool for both the most practical level (the initiatives) and the highest level (the government) to work together.

In this chapter, these three port regions are investigated in terms of their potential to host circular initiatives. For each region, its main characteristics are examined and strategies and ambitions are clustered according to three pillars for a circular port strategy (as described in Chapter 2). Illustrative maps show the current status of these strategic levels and the potentialities for advanced circularity. Consequently, this mapping forms a base to position the Building Blocks (as described in Chapter 1). The Building Blocks are put into relation with the local dynamics and characteristics of each region to reveal possible future scenarios and local potentials to further develop the circular transition.


Port of Amsterdam
Port of Rotterdam
North Sea Port District



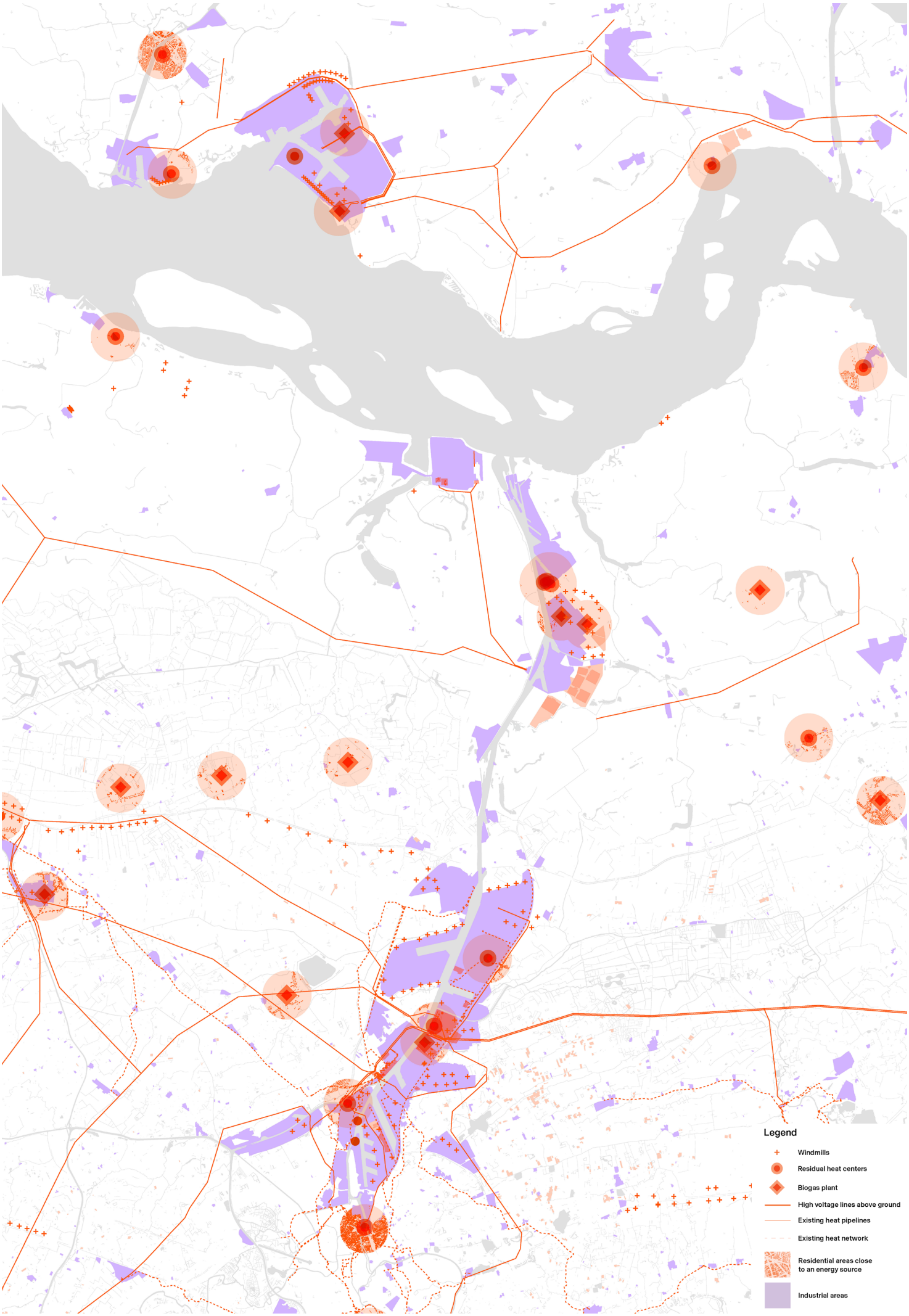
A North Sea Port District

The region of North Sea Port District is unique compared to the other NOVI port regions: the region exceeds the Dutch border and includes three municipalities of East-Flanders (Belgium). Since the fusion of Port of Ghent and Zeeland Seaports into North Sea Port in 2018, the port has claimed a more sustainable image. This new cross-border collaboration is a leverage to accomplish a circular and energy transition: next to existing innovative projects, many new projects are launched to accelerate the transition, where the knowledge and specific expertises of the different port areas can be combined. Moreover, North Sea Port is currently writing its new strategic vision for the whole port area, where sustainability in all its aspects is one of the most important goals. Spatially, this port involves entirely different environments. The southern part of the port is positioned along the Canal between Terneuzen and Ghent, touching upon different cities and smaller towns. The northern part of the port consists of the bigger plot of land of Vlissingen and Borsele, next to the older and smaller port of Vlissingen. This spatially diverse setting offers possibilities, but can also be challenging: the diversity makes different forms of exchange possible, but working cross-border still creates issues and could slow down the process of planning and financing.

1 Energy recovery

North Sea Port District is an important area in light of the energy transition. Firstly, the wind energy produced offshore is connected to the mainland in the port area of Borsele and Vlissingen, giving this area the nickname of ‘the plug of the Netherlands’. Next to that, on the mainland there have been big investments in solar parks (eg. Zonneberg Terranova) and windmills on concentration locations in the Netherlands and in a more scattered way on the Belgian side. Thirdly, since North Sea Port is a port with many industrial activities, there is a vast amount of existing companies with residual heat (eg. ArcelorMittal, Stora Enso Langerbrugge, Yara…) which could be a potential for exchange with other industries, housing, offices or greenhouses.

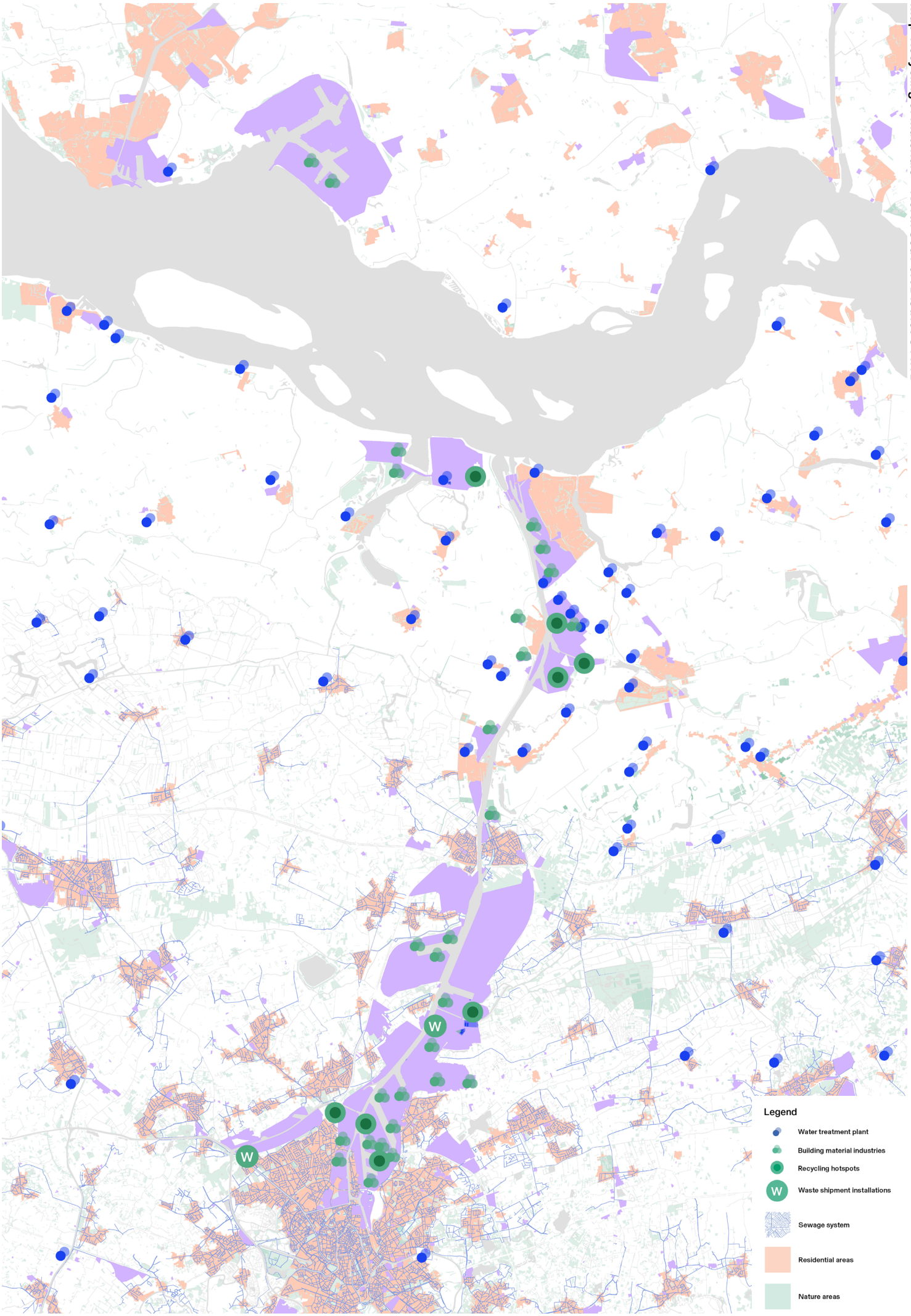
A challenge for this area is the construction of a good circular mainframe that allows to exchange waste streams and facilitate industrial symbiosis. On a local level, there exist already successful initiatives where steam (eg. Stora Enso Langerbrugge with Volvo Cars) and hydrogen (eg. Dow Chemicals with Yara Sluiskil) are exchanged between different companies inside the port, or heat with glasshouses (eg. WarmCO2, Terneuzen). Next steps are being planned to provide a first heat network in the residential area of Zelzate with the heat of Arcelor Mittal. However, there is still a need for more cross-border infrastructure. In addition, legislation to transport to and use certain materials on the other side of the border is still limiting new uses (eg. transporting CO2 or waste).



Map 'Energy Recovery' - North Sea Port District © AWB

2 Recycling materials

There are already different recycling companies present in North Sea Port. These range from dismantling businesses for old cars, boats and wagons (eg. Galloo Ghent), in order to use the materials again in the metal industry abroad, to a big paper recycling company (eg. Stora Enso Langerbrugge). Even advanced forms of urban mining are present: the ashes from burning household waste are collected and sorted to take out specific materials, like ferro and non-ferro metals (eg. Heros Sluiskil). The sorted ashes are then used in construction works. However, there is still more potential. The vicinity of different residential areas along the port borders presents possibilities to work with other streams: household waste, e-waste, demolition materials, ... As mentioned before, also for the recycling of materials, the country border still presents difficulties for the port to transport materials. Legislation and regulations restrict the transport of certain materials.



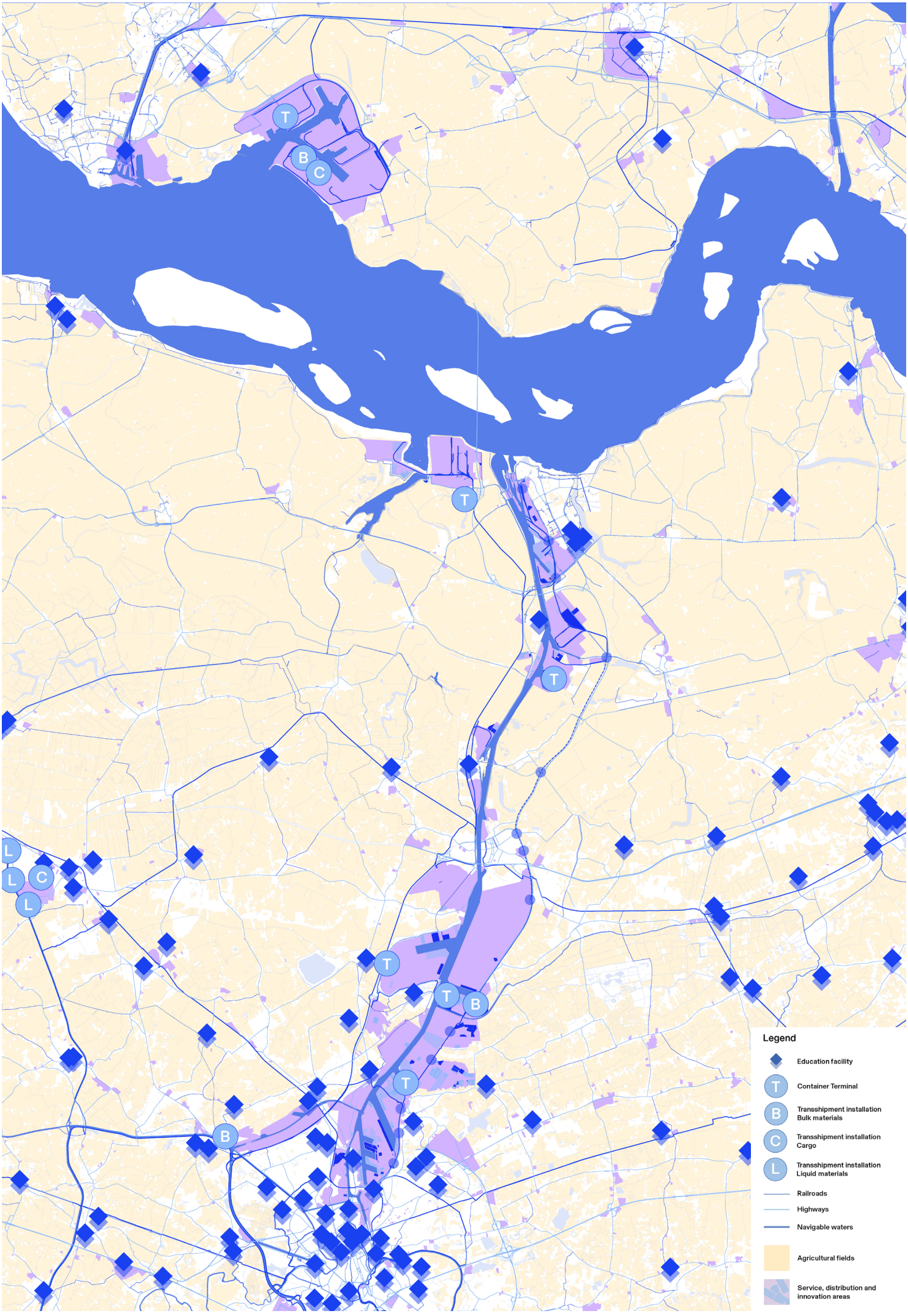
Map 'Recycling of materials' - North Sea Port District © AWB

3 Orchestrating new streams

North Sea Port is well positioned in light of mobility: it is well connected with the hinterland via the sea, waterways and road. Currently, the port authority is investing in making the modal shift happen. Together with the governments and other parties, a new railway on both sides of the canal (Rail Ghent-Terneuzen) will be constructed, which will increase the possibility to transport existing and new streams in a sustainable way. This will also attract new initiatives that want to transport in a green way.

Next to the modal shift, the biobased economy (eg. Flanders Biobased Valley) is growing massively inside the North Sea Port, thanks to the Bio Base Europe Pilot Plant. In this Pilot Plant, ideas for new biobased solutions are tested and scaled-up. This presents a great incentive for the many industries in the port area to renew their way of working and to replace certain materials with biobased solutions.

Furthermore, new streams could still be connected to the activities in the port: there is still a potential to connect the port activities with the agriculture present around the port. Next to that, the vicinity of many residential areas offers the opportunity to work more with the distribution of building materials and the collection of demolition waste in a more sustainable way.



Map 'Orchestrating new streams' - North Sea Port District © AWB

> Potentiality for Building Blocks

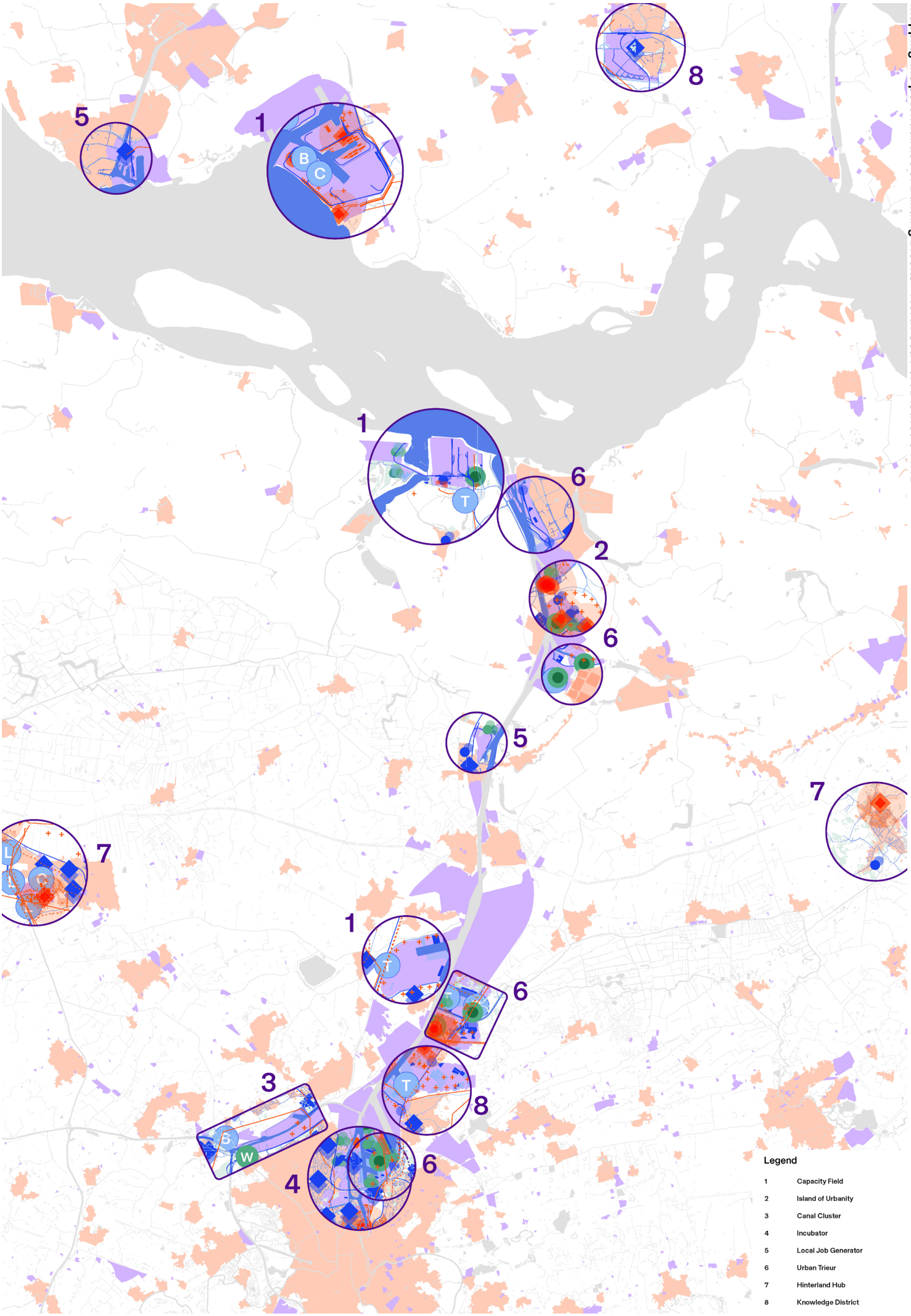
North Sea Port consists of very differentiated landscapes, both spatially and in terms of activities present in the port and its broader region. There is potential for various Building Blocks: they should take up a place inside the existing value chains or position themselves where there is a missing link in a circular chain.

Spaces close to residential areas are the places where Local Job Generators (5) and Urban Trieurs (6) can play a crucial role. The Local Job Generator forms a bridge between the inhabitants and the productive activities in the port. It provides educational activities to sensibilize inhabitants and programs to enhance skills of current or new workers, in order to connect the needs of the industries to the demand for work. Currently there is Dockwize in Vlissingen, where start-ups can take place. The Urban Trieurs position themselves in between residential and productive areas and create a physical space to sort out different streams between these two areas.

Incubators (4) are already present in the area for the biobased economy, like the Bio Base Europe Pilot Plant. This successful story should be translated to other kinds of materials, flows and sectors as well.

The vastest industrial areas have the potential to become Capacity Fields (1). They are currently used for different kinds of materials (eg. cars), but can be transformed into places where new materials can be collected and stored, such as organic waste or biobased fuels and other products.

In order to help facilitate the modal shift, spaces such as the Urban Trieur (9) and the Hinterland Hub (7) will play a crucial role. These will not only support existing activities in the port, but will also attract new players, who handle new flows of materials.


Mapping the potentialities of Building Blocks - North Sea Port District © AWB
Legend
1 Capacity Field
2 Island of Urbanity
3 Canal Cluster
4 Incubator
5 Local Job Generator
6 Urban Trieur
7 Hinterland Hub
8 Knowledge District



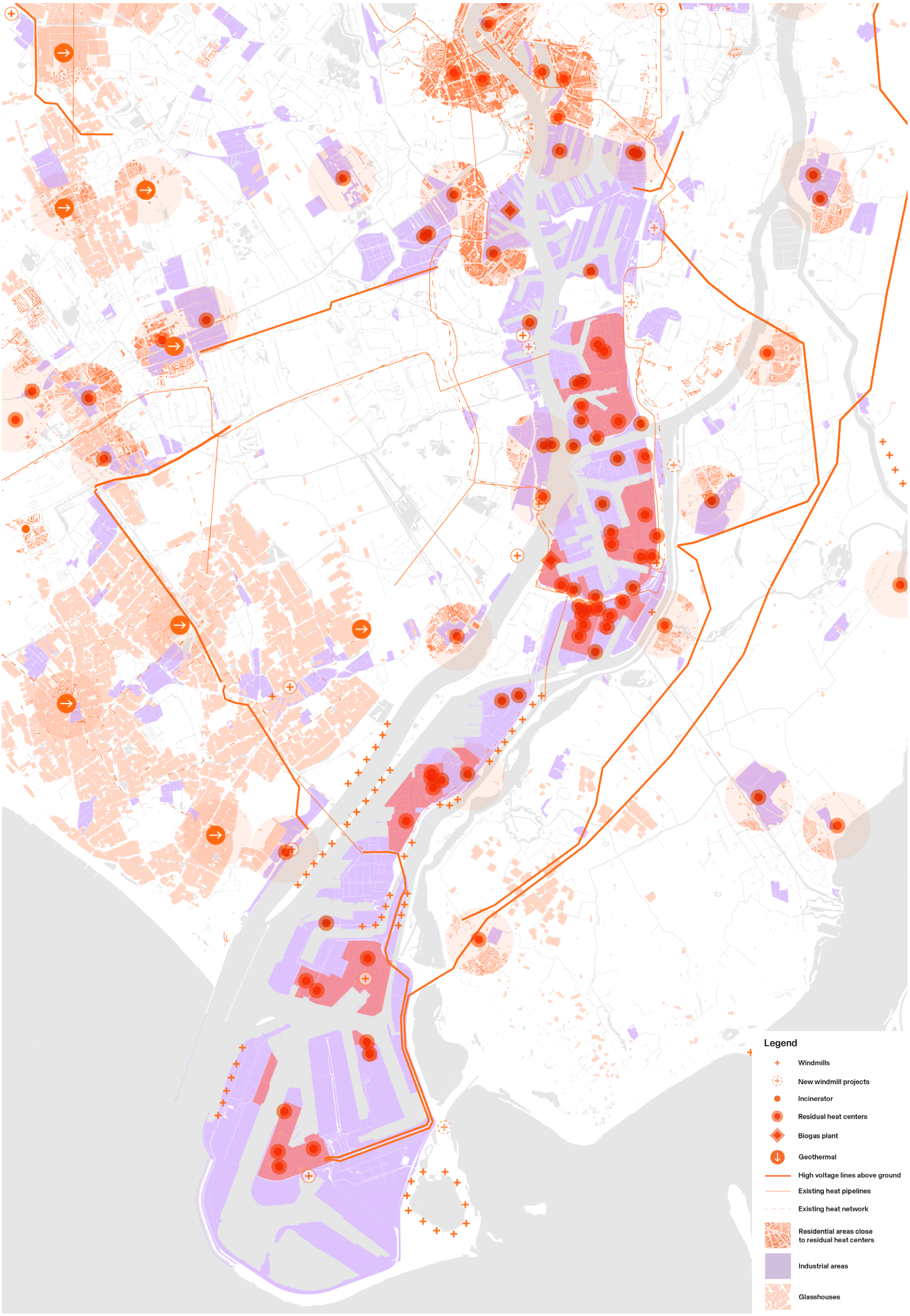
B Port of Rotterdam

The Port of Rotterdam is the largest port of Europe, representing one of the most important gateways for the international shipment of goods. The port is also known to be focused on fossil-based fuels and materials and is thus facing a big change in the future. In the last few years, it is actively advancing four circular strategies in collaboration with a range of partners to make the port and port-based supply chains more circular. It is clear that there is an effort to support new innovative practices locally by setting up the right environment to experiment and grow in the field of circularity. Moreover, research and experimentation is done in the field of the upcycling of materials and they haven been looking for new chains of exchange and collaborations. Investments have been done in order to build the right infrastructure to allow the exchange of products and residual streams.

The port authority and a coalition of industrial companies in the port have developed a shared vision on how to achieve the circular ambitions for this port in transition, and more broadly on how to achieve the ambitious climate goals in a local industrial context. This collaborative process led to the definition of a shared roadmap for the port toward this transition.

1 Energy recovery

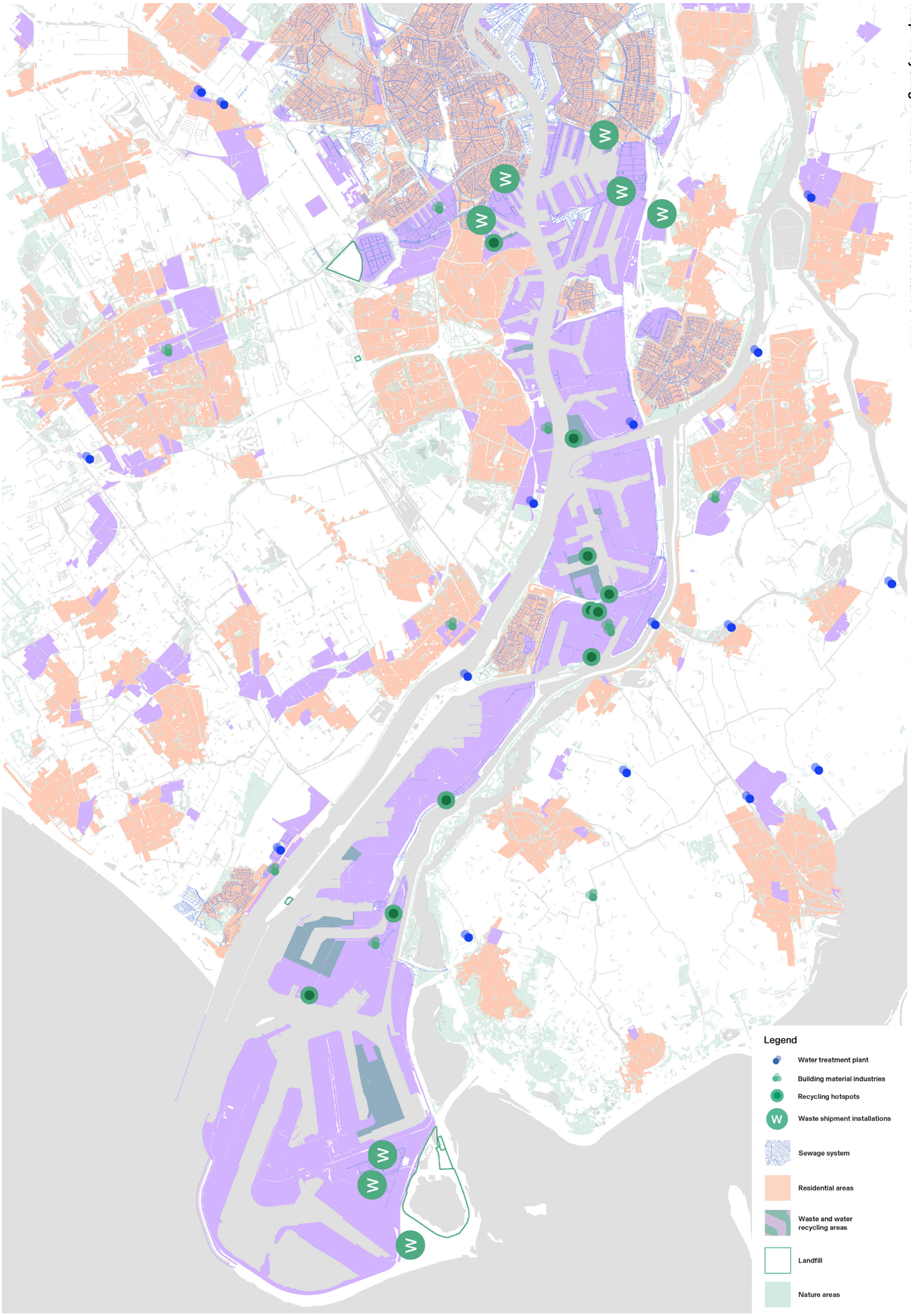
Starting with the ambition of building and enhancing local industrial symbiosis, and thus reducing and decarbonising the activities taking place in the port, new infrastructure has been developed locally, such as CCUS facilities and steam exchange support. In fact, the infrastructure will help the industry to start exchanging steam and transporting CO2 for re-use and storage. This will also allow the use of residual industrial heat in greenhouses, private homes and offices, initiating a process of transformation in light of renewable energy, not only in the port, but also in the living environments. At the same time, new clean energy production projects have been planned, such as the implementation of geothermal energy in the western section of the port, since the port is steering the shift of the whole system to a non-fossil based sourcing.



Map 'Energy Recovery' - Port of Rotterdam © AWB

2 Recycling materials

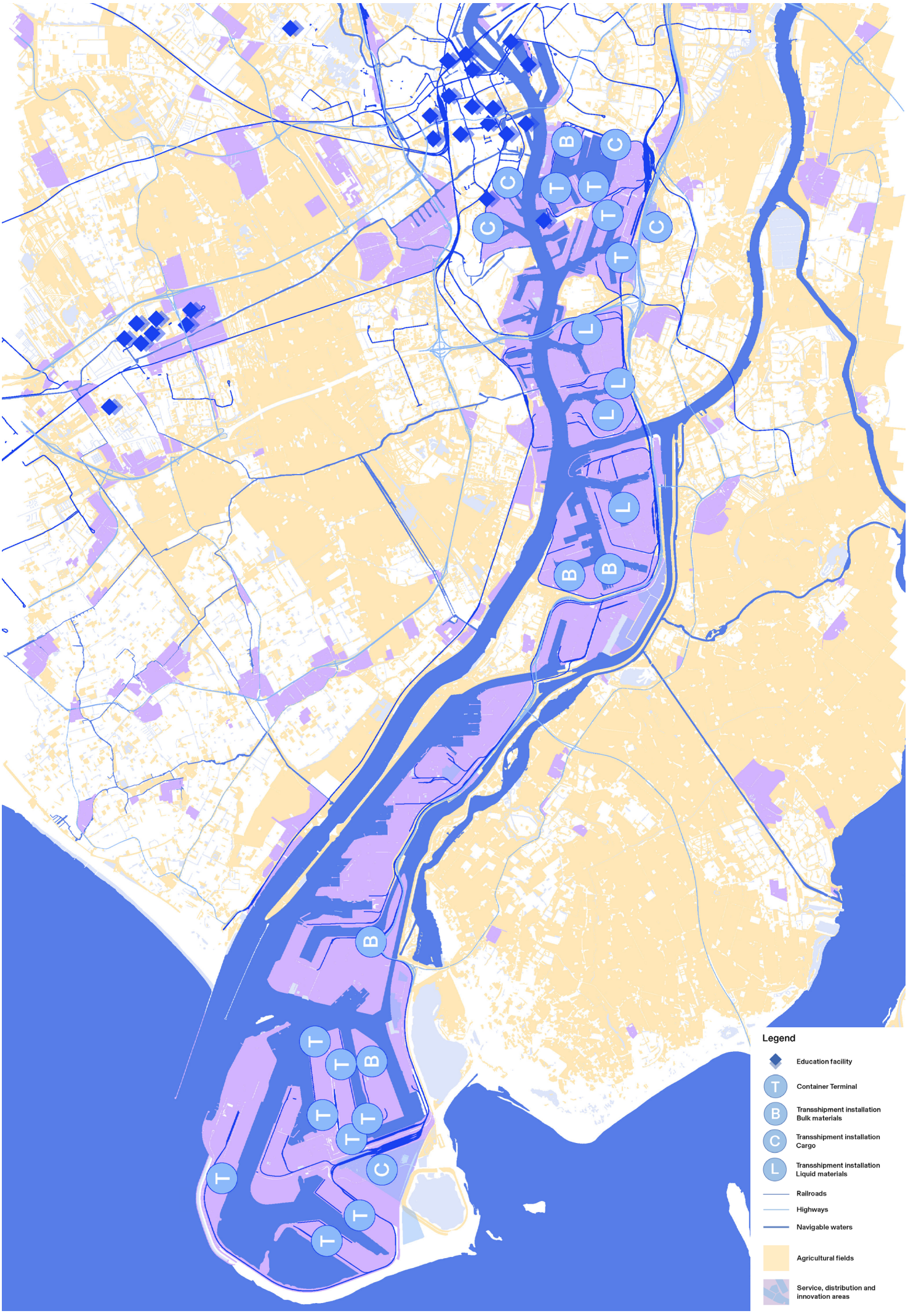
The Port of Rotterdam strives to transform its current petrochemical sector into a sustainable industry that recycles materials and greatly reduces CO2 emissions. The port already has a large cluster of activities for the recycling of materials, and also bio-based and other new raw materials production. One of the routes to accomplish this shift is to cooperate with leading companies, both within and outside of the port, to develop Waste-to-Value chains, giving an added value for the port area and the broader economy at the local level. This would go hand in hand with building a closer connection with the city flows, in order to start to use it as a resource for the port activities. Therefore, the shift to recycle materials also means that we have to recognize and use new raw materials. This also allows the building of new material chains and exchange, which creates on a local level different kinds of symbiosis between the port and the city. In this sense, it is crucial to start developing the right space to host these new dynamics and activities such as the envisioning of a waste hub, biomass hub and CO2 hub.



Map 'Recycling of materials' - Port of Rotterdam © AWB

3 Orchestrating new streams

The Port of Rotterdam is an important environment in regard to international and european import and export of flows and goods. The port authority has the ambition to redesign and redevelop the logistical activities in the Rotterdam cluster to become a more circular port in the coming years. This looks into a modal shift, starting to use and value the local waterways, which connect the port environment to the hinterland and the city. The connection with the Port of Dordrecht represents in fact a big potential for connections with a vast inland network of waterways. Moreover, the Port of Rotterdam seeks for more sustainable ways of moving flows locally and internationally. If moving toward a circular functioning of our ports, this would then mean to establish more locally embedded cycles and logistic infrastructure to allow such a shift. This will go hand in hand with the development of new specializations and it will have to link with other relevant sectors, such as the sector of food production, and envision new logistical modus of operation with these.



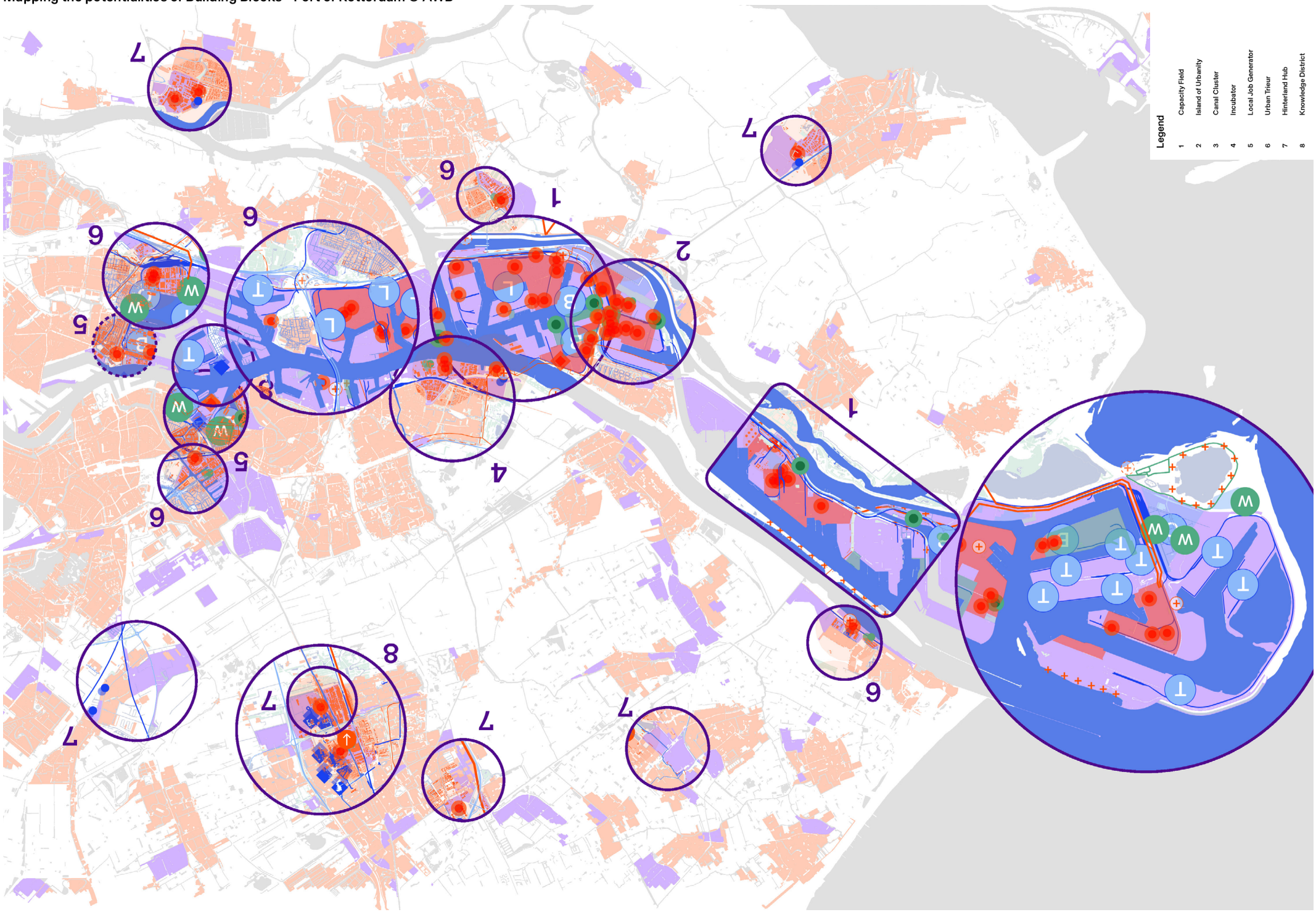
Map 'Orchestrating new streams' - Port of Rotterdam © AWB

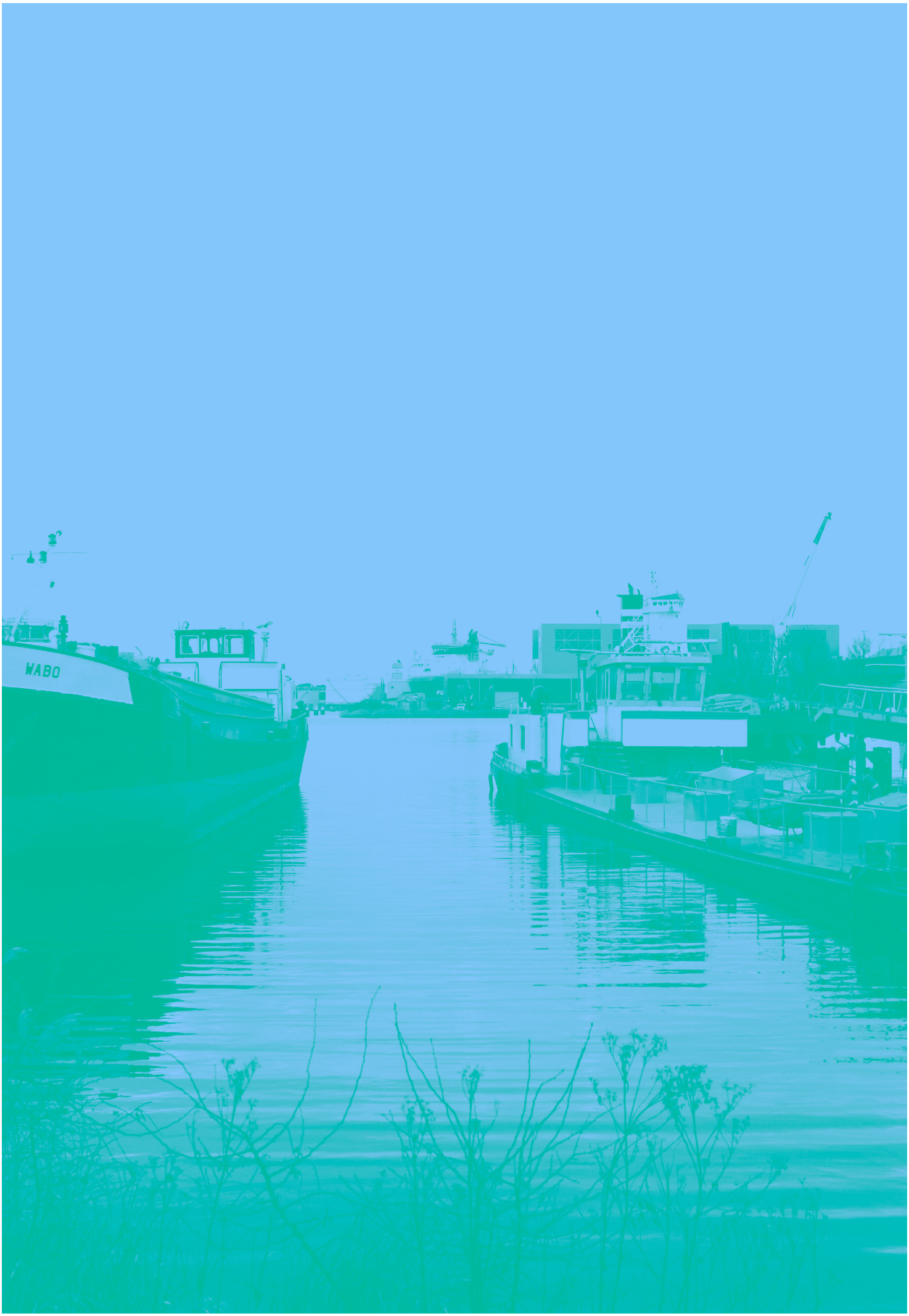
> Potentiality for Building Blocks

The already present transhipment and cargo areas in the Port of Rotterdam represent a pivotal environment for the development of circular activities. Since the presence of many differentiated infrastructure and the close vicinity to the water and other existing types of organisation, places like the Maasvlakte, offer the potential space for new innovative practices to grow. These bigger areas can store and tranship goods, so they have the potential to become Capacity Fields (1). At the same time, the identity of the Port of Rotterdam today, in close relation with the strategic ambition to shift to a more local economy, allows one to imagine different Urban Trieurs (6) in which the connection with the city and the hinterland can be developed via Hinterland Hubs (7). The collection, storage and upcycling of materials will be augmented in the future, and will be positioned within specific locations where interactions between different sectors and environments will be made possible.

By observing the territory, the existing activities and the close proximity of living areas, the Incubator (4) and Knowledge District (8) can be envisioned, such as the existing RDM Campus or the PlantOne Rotterdam, where facilities are offered to test and validate sustainable process technologies. Moreover, the value of the living-producing proximity also allows one to imagine a Local Job Generator (5), where potential education activities can take place, as well as specific skills can be taught, and thus empowering the local population to enter the job market, in connection with the activities of the port. The Rotterdam Makers District is, among its other functions, one example of the development of such a successful dynamic.

Mapping the potentialities of Building Blocks - Port of Rotterdam © AWB



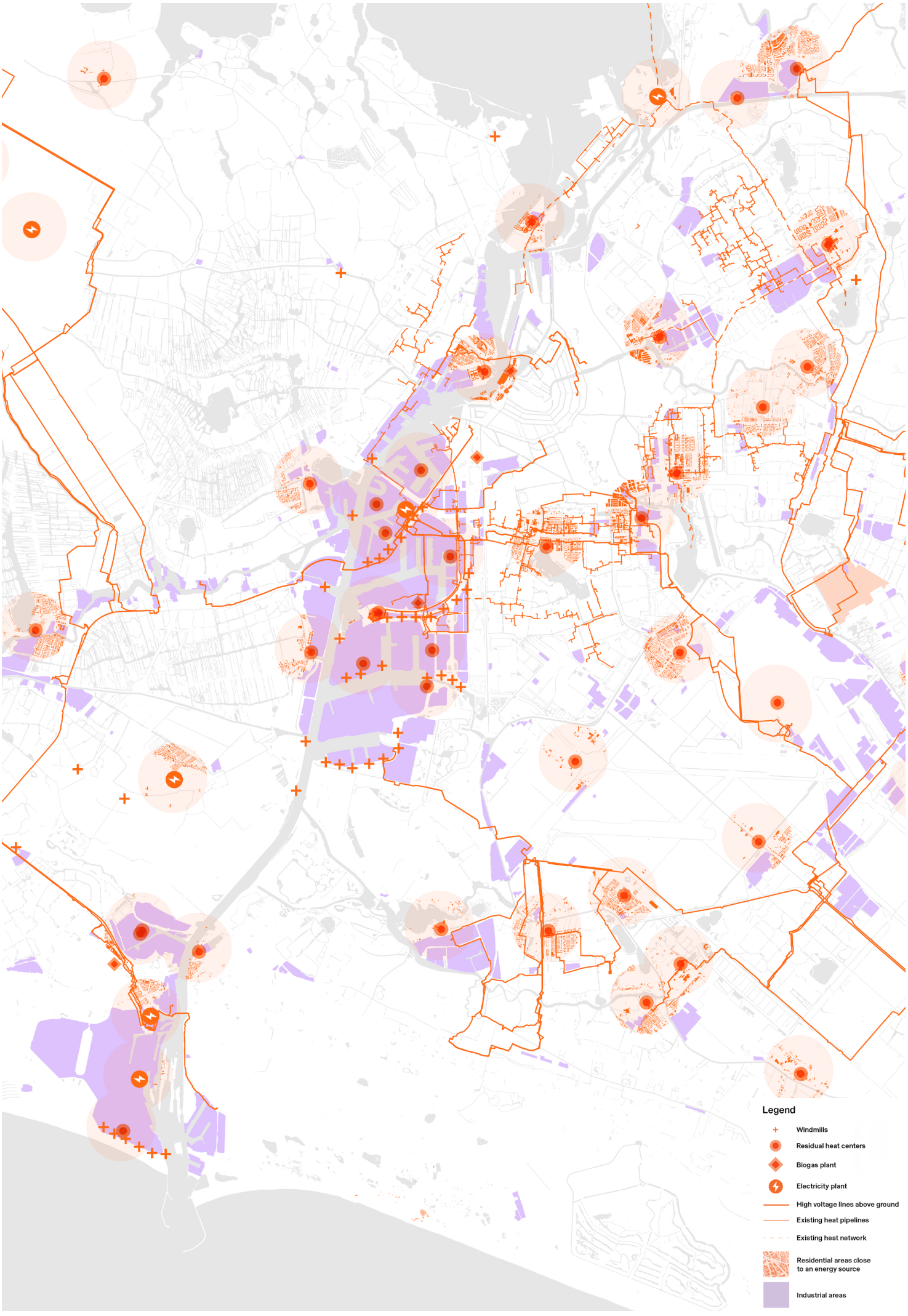

WABO

C Port of Amsterdam

Amsterdam nowadays is specialized in the supply, storage and transit of fuels, in particular gasoline. At the same time, the port authorities and the different industries and sectors located in the port have the ambition to initiate the transition toward a circular economy. In fact, circularity in the Port of Amsterdam can find its way through the infrastructure of the “old industry”, which can easily be transformed for the bio-based economy. On the same trend, to involve old industries in the transition, the port authority is committed to attract new technologies and to facilitate start-ups to further develop their products and to allow it to grow into their industrial port. This ambition has been carried out by providing space for experimentation, where different means of support were presented by the port (infrastructure, network of other local companies, etc.). This space of experimentation also allowed these innovative practices to later scale up and grow into a company in the port itself. The fact that the space in the port is scarce and under the continuous pressure of housing development, led the authorities to carefully strategise upon the activities and practices that they wanted to attract, in order to build a local process of transition. This transition is based on local opportunities and potentialities, such as the bio-based economy, linked with the food sector.

1 Energy recovery

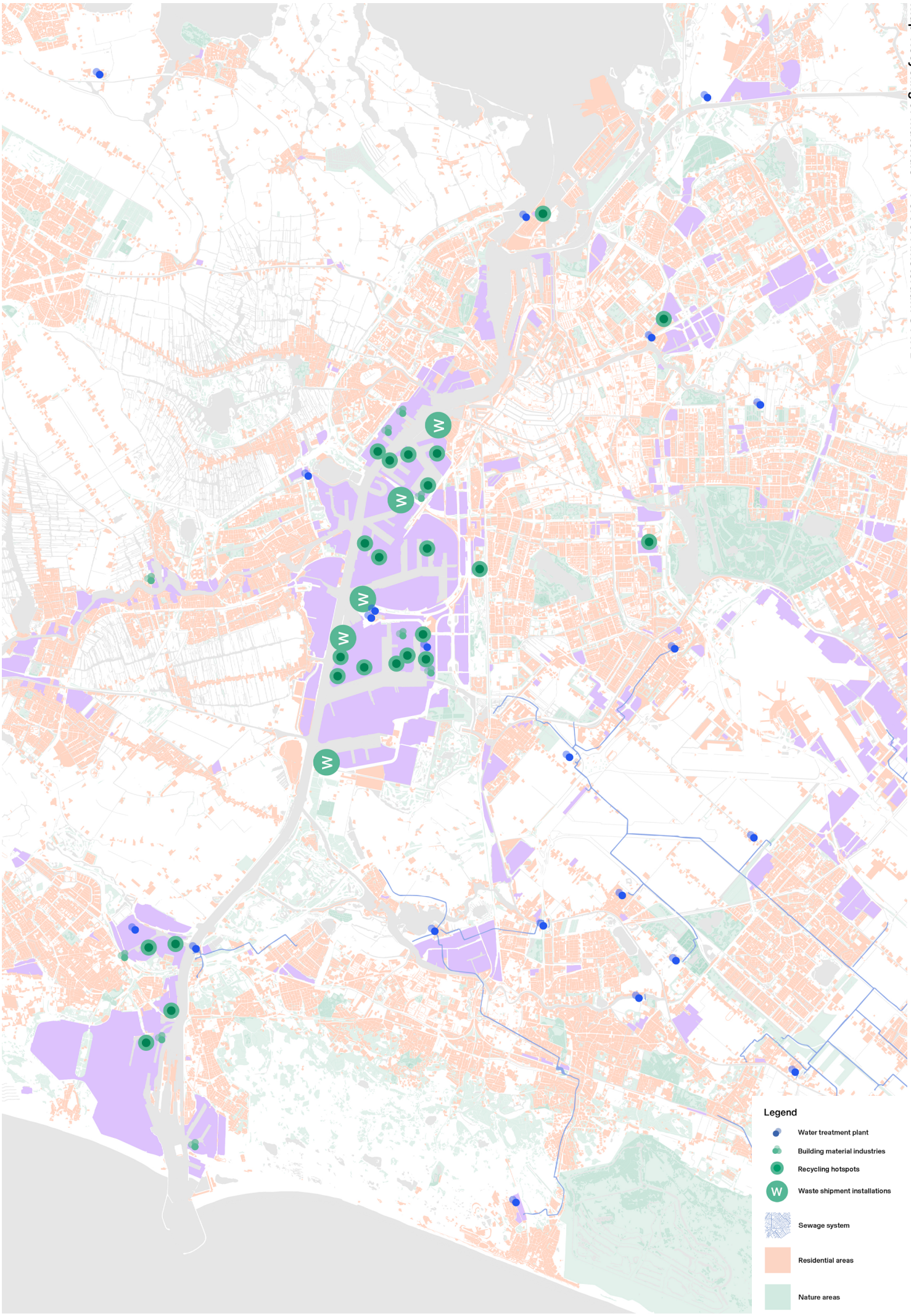
The extensive network of pipelines, starting from the port in connection with the surroundings, unravel the history of a fossil-based port, but also show the potential to transform these into a circular mainframe for new energy flows, such as hydrogen and biofuels. This network presents the high ambition and the long-ago initiated strategies toward a sustainable port in light of the energy transition. In addition to this mainframe, the Port of Amsterdam, in collaboration with the city, is reserving space for clean energy production. At the same time, in collaboration with local start-ups and organisations, they are investing in new infrastructure to scale up sustainable energy production and to plan and organise the distribution and storage of it. In order to produce locally as much clean energy as possible and to build up specific dynamics of industrial symbiosis, the port authority has initiated a network of professionals, who together discuss different strategies toward the energy transition.



Map 'Energy Recovery' - Port of Amsterdam © AWB

2 Recycling materials

The strong presence of the food sector in the port allows the implementation of several facilities for treating and using waste streams as resources. At the same time, there is the ambition to push the development of circular materials further. In fact, the port is trying to set strategies to facilitate the production of circular raw materials that can be used locally. Inside the ports' borders, it is possible to recognize different spatial environments dedicated to the purpose of storing, recycling, and upcycling of different kinds of flows. However, in the surrounding areas, this cannot be found. Therefore, in order to start to connect the port with the surrounding living and production areas, it is important to start to envision the type of projects and environments that can allow the building up of different supply chains.

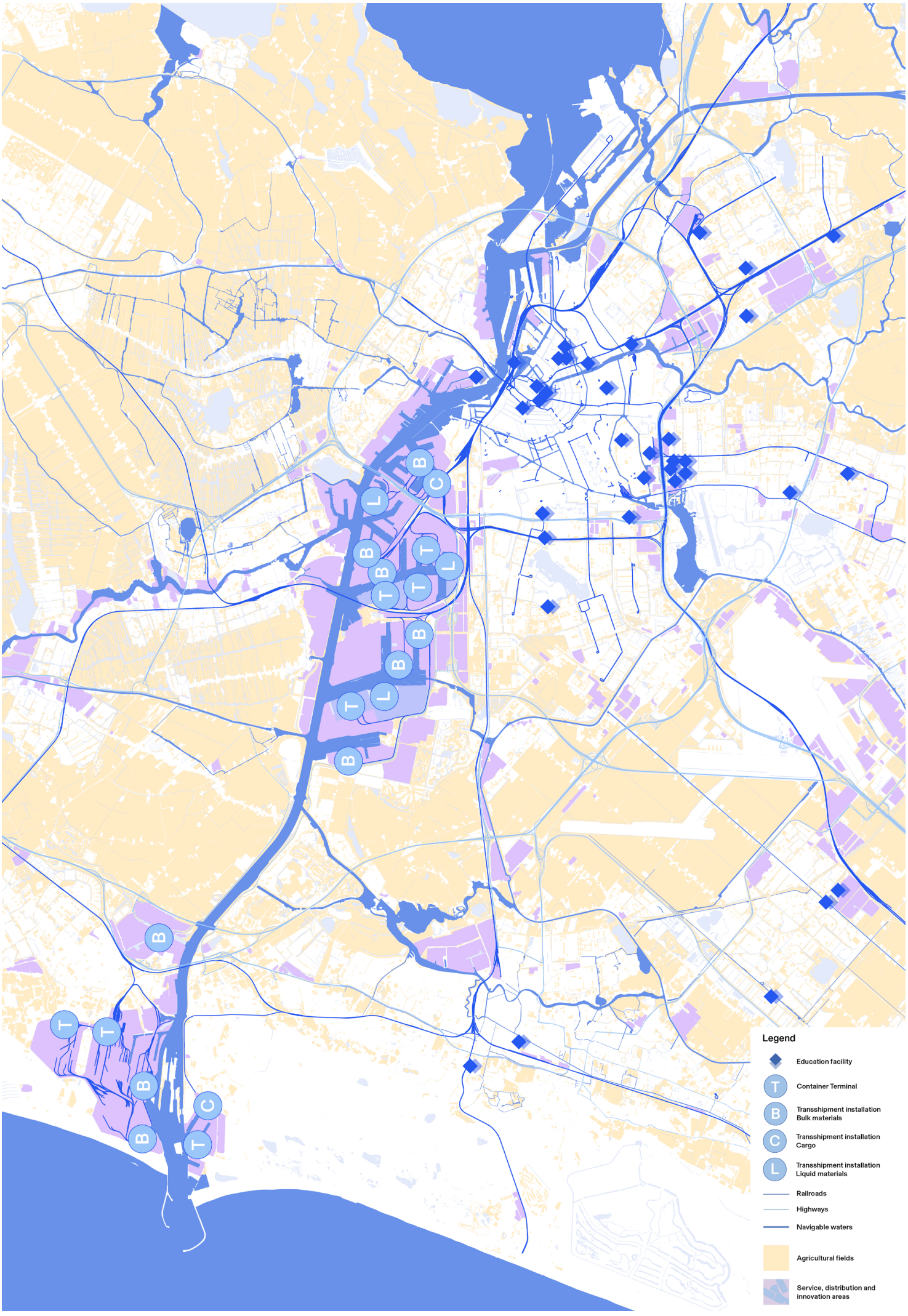


Map 'Recycling of materials' - Port of Amsterdam © AWB

3 Orchestrating new streams

The Port of IJmuiden in connection with the Port of Amsterdam along the North Sea Canal area represents a logistical corridor for differentiated materials to be transported and then distributed to the city and beyond. In this sense, the Port of Amsterdam has initiated, in collaboration with the city, an innovative process of last mile logistics in order to bring in goods to the city, to implement the use of waterways and to initiate more sustainable means of transport.

Moreover, the Port of Amsterdam is also looking into new activities and specialization based on local resources and opportunities. The biobased industry is one of the crucial sectors that the port is supporting in its further implementation. This is done, starting from the strong presence of the food sectors, by connecting the food cluster with institutes of knowledge and experts or with other sectors, to try to steer and reinforce biobased and circular activities. Following the same logic, they have developed a knowledge and exchange platform to develop usable raw materials and to make residual flows accessible. This has been linked with a knowledge and educational platform to further develop research activities toward the development of circular materials.



Map 'Orchestrating new streams' - Port of Amsterdam © AWB

> Potentiality for Building Blocks

The ongoing innovative practices, together with the spatial configuration of the North Sea Canal, Port of Amsterdam and Port of Ijmuiden, show the potential for new circular projects. It is clear that the port does play a relevant role in the region in which it is positioned, and where the different parts of the region play different roles.

The North Sea Canal area is in transformation, where there is potential for Distribution Hubs (9) and Urban Trieurs (6) to collect and manage waste and materials coming from the port and city. Further, there are the decentralized Hinterland Hubs (7), where distribution, flow management and new modes of transport are used.

We can clearly imagine inside the port areas different Building Blocks, based on the local activities. Knowledge Districts (8) can be set up in-between the environments of port and city. This goes hand in hand with the development of new experimentation areas for innovative activities, like the Island of Urbanity (2), next to the ones that are already in place today (eg. Prodock). In addition, potential hotspots where activities of port and city can be linked, will be needed more in the future. The Local Job Generator (5) is such a place, where the sensibilization of the public for these new economies can take place and where new skilling activities can be held.

The recognition of these spaces starts to envision this region as a broad ecosystem of potentialities. It allows us to build practices and spatial settings that do live in symbiosis, based on local opportunities and the local resources, in order to build up new local value chains.

Mapping the potentialities of Building Blocks - Port of Amsterdam © AWB

04 Circular Mainframe

There is a potential in port regions to implement certain Building Blocks to accelerate the circular transition, as has been shown in the exemplary cases of the three NOVI-port-regions. Next to that, it is important to note that the implementation of solely circular projects will not suffice. The synergies and interrelations of the circular projects with each other and with their broader ecosystem is crucial for their success in making the economic system shift. In order to make exchange possible between them, a good network of infrastructure - a mainframe for circularity - is needed. This mainframe is necessary inside the port borders in order to make industrial symbiosis happen, but as important is the build-up of a mainframe beyond the port borders, in connection with the hinterland, cities, agriculture, green houses, other ports, etcetera. At this moment, there is already a functioning network of infrastructures, often to transport fossil-based products. In a future circular functioning of our economies, this mainframe shall have to be adapted in order to transport other goods, like hydrogen, biofuel, etcetera.

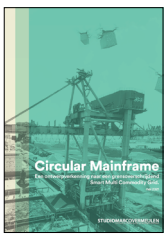
The design exploration ‘Circular Mainframe. Een ontwerpverkenning naar een grensoverschrijdend Smart Multi Commodity Grid’ by Studio Marco Vermeulen (2021), and its precedent 'Via Parijs. Een ontwerpverkenning (2019), has studied the current infrastructure network and the different flows on the scale of the Netherlands and Belgium in order to project the possibility of a Circular Mainframe in 2050.

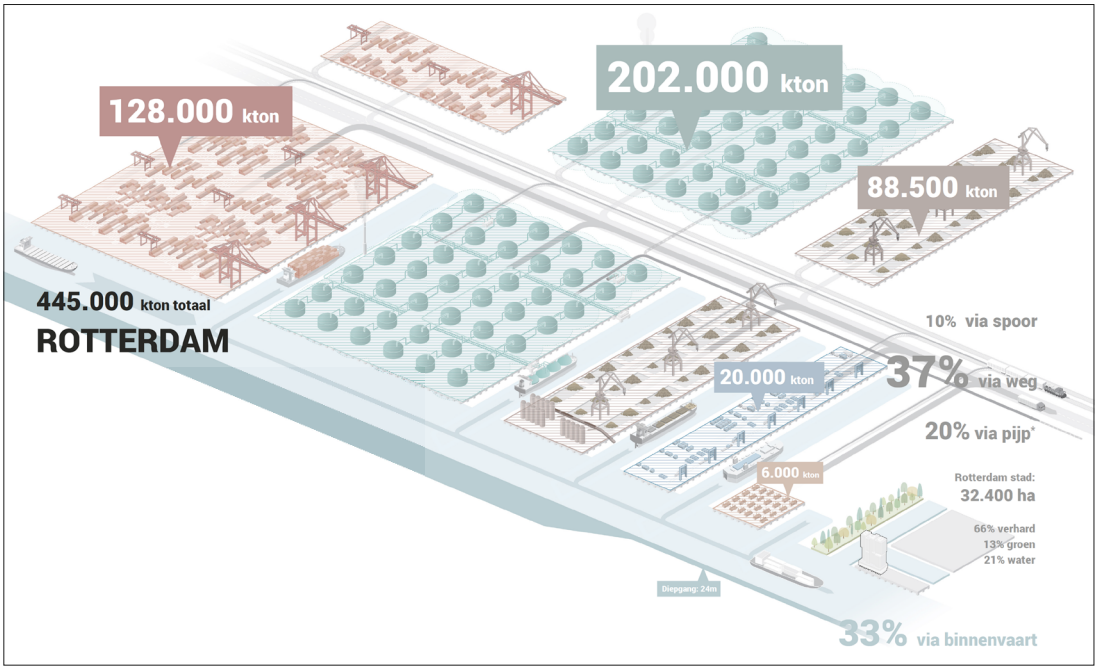
Starting from the concept of circularity and the current and future energy- and flowsystems, the study looks at the European scale and on how flows are organized. The design exploration then dives deeper into different seaports and shows how they function as nodes in the broader system. The three ports, around which the NOVI-areas are defined, and their current transshipment of goods are shown on the adjacent page. Each of the ports has, based on the activities that are there, different profiles for the circular economy.

On the following spread (p. 70-71), the spatial components of the energy and raw materials system are shown in an abstract way. The different activities, clustered in the four categories of heat, electricity, hydrogen and biobased industries, are positioned in and connected to the broader framework of the Circular Mainframe. It is clear that activities and their functioning cannot be seen in isolation, but should always be framed in the bigger network and in relation to other activities. Next to that, it is unmistakably important that this infrastructure network functions well and is well adapted to the needs of a circular system. As has been shown earlier (Chapter 1 and 2), the Building Blocks can each form a node for a different port strategy. Moreover, each Building Block is an element in this bigger system shown on the next spread.

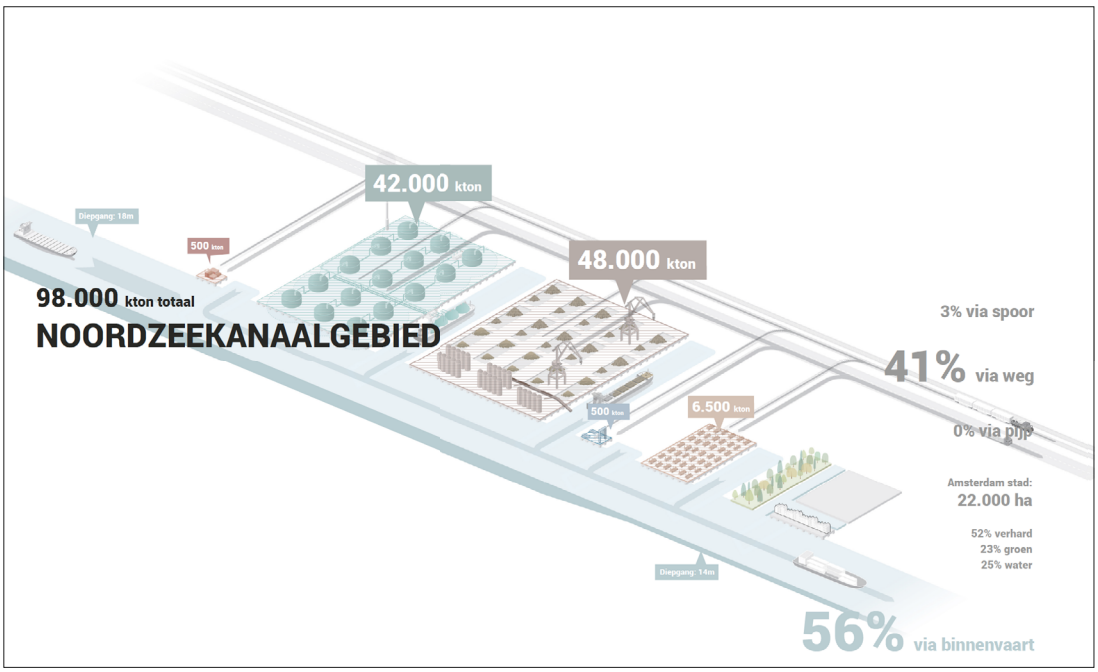
Source material:

Circular Mainframe. Een ontwerpverkenning naar een grensoverschrijdend Smart Multi Commodity Grid.
Studio Marco Vermeulen, 2021, commissioned by Ministry of Infrastructure and Water Management (Energy & Environment) of the Netherlands

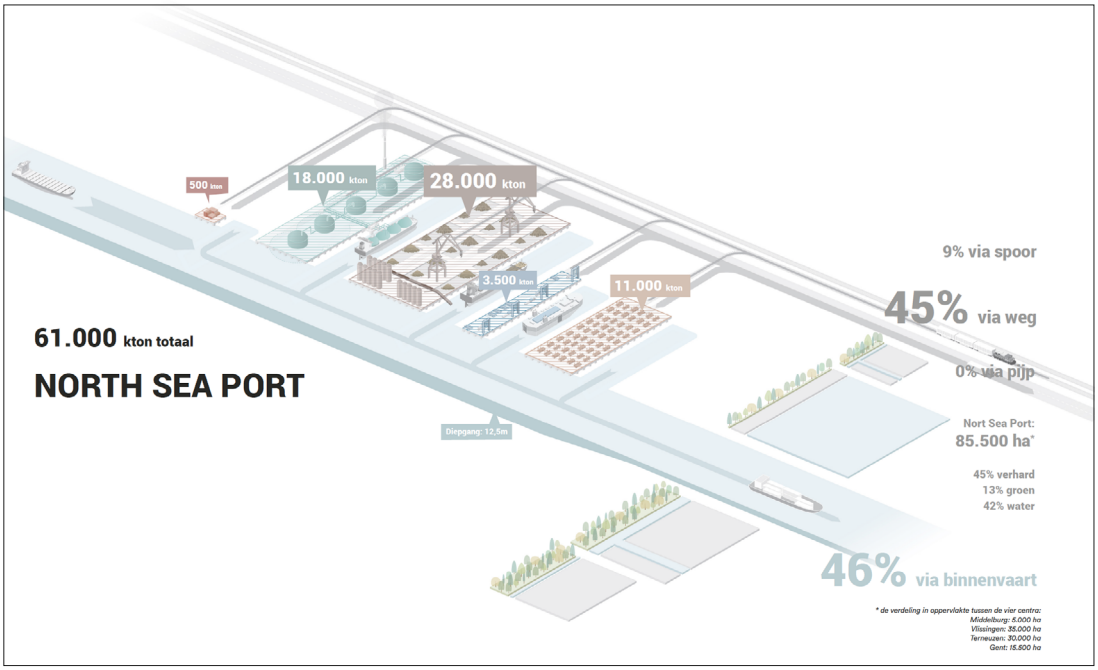




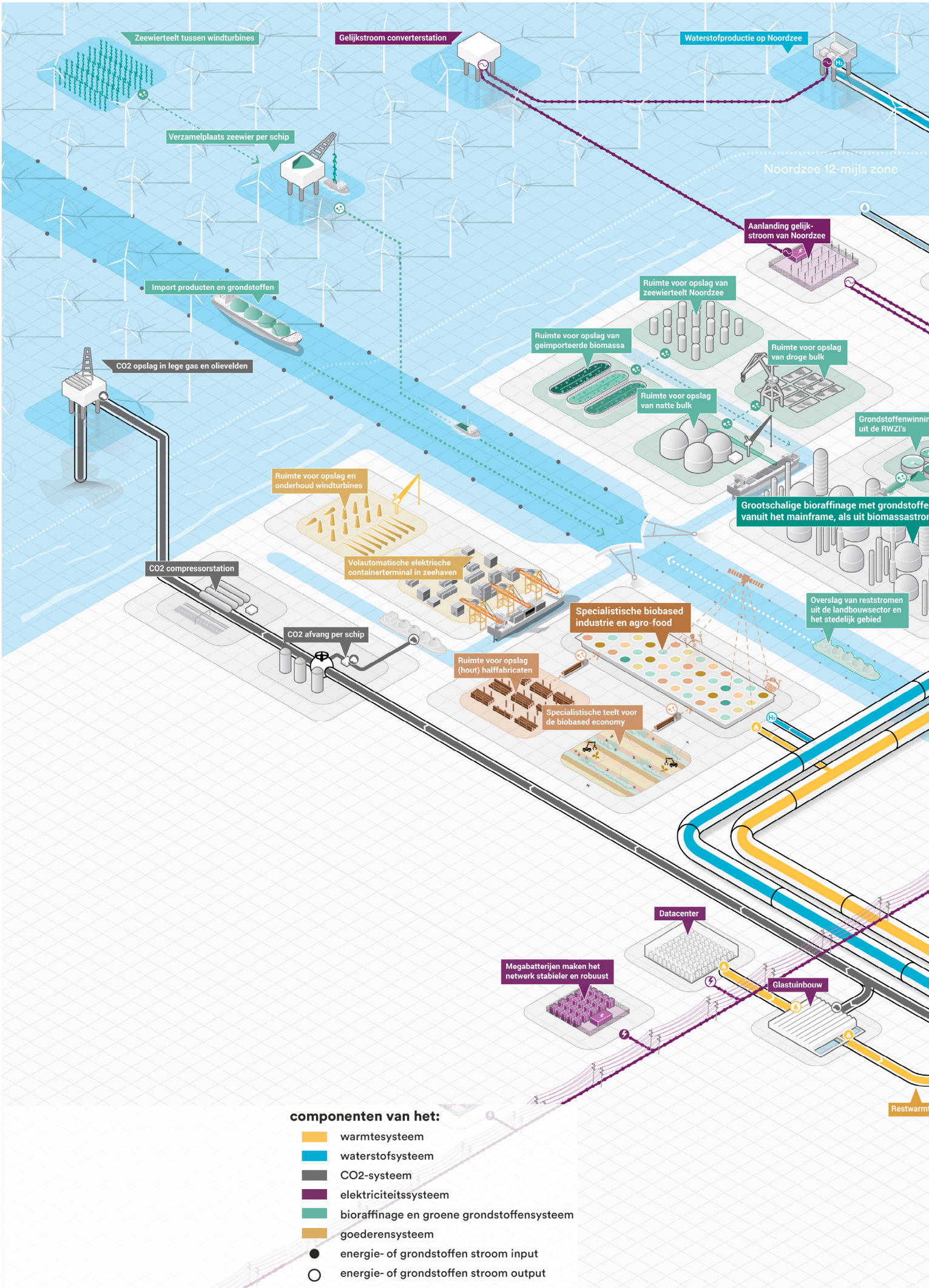
Port of Rotterdam - overview transshipment of goods © StudioMarcoVermeulen

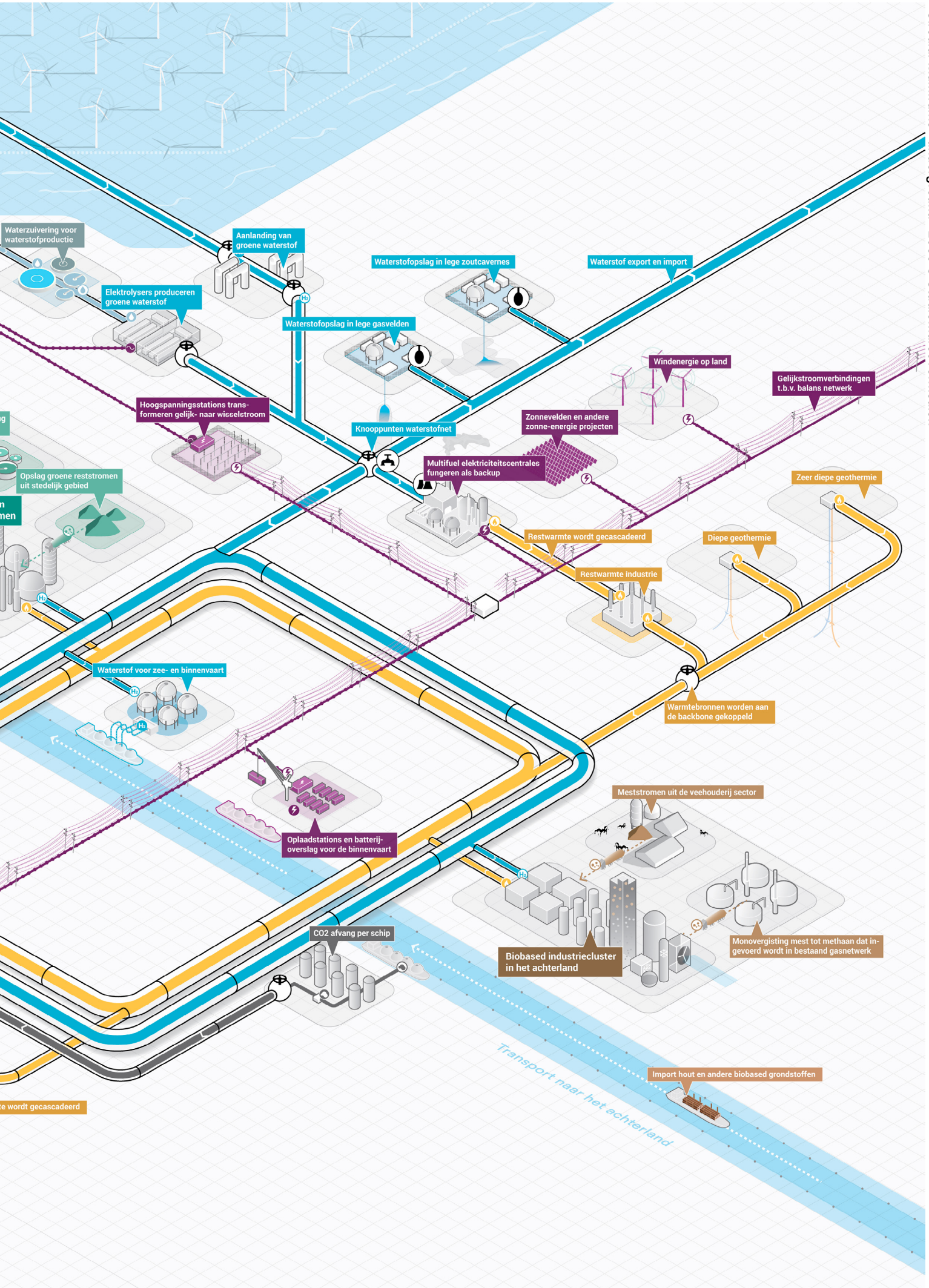


Port of Amsterdam (Noordzeekanaalgebied) - overview transshipment of goods © StudioMarcoVermeulen



North Sea Port - overview transshipment of goods © StudioMarcoVermeulen


Zeewierteelt tussen windturbines
Gelijkstroom converterstation
Waterstofproductie op Noordzee
Verzamelplaats zeewier per schip
Noordzee 12-mijls zone
Aanlanding gelijk-stroom van Noordzee
Import producten en grondstoffen
Ruimte voor opslag van zeewierteelt Noordzee
Ruimte voor opslag van geimporteerde biomassa
Ruimte voor opslag van droge bulk
Ruimte voor opslag van natte bulk
CO2 opslag in lege gas en olievelden
Grondstoffenwinnin uit de RWZI's
Grootschalige bioraffinage met grondstoffe vanuit het mainframe, als uit biomassastror
Ruimte voor opslag en onderhoud windturbines
Volautomatische elektrische containerterminal in zeehaven
CO2 compressorstation
Overslag van reststromen uit de landbouwsector en het stedelijk gebied
Specialistische biobased industrie en agro-food
CO2 afvang per schip
Ruimte voor opslag (hout) halffabricaten
Specialistische teelt voor de biobased economy
Datacenter
Megabatterijen maken het netwerk stabieler en robuust
Glastuinbouw
Restwarmt
componenten van het:
warmtesysteem
waterstofsysteem
CO2-systeem
elektriciteitssysteem
bioraffinage en groene grondstoffensysteem
goederensysteem
energie- of grondstoffen stroom input
energie- of grondstoffen stroom output



Circular Mainframe - underground - 2050 © StudioMarcoVermeulen

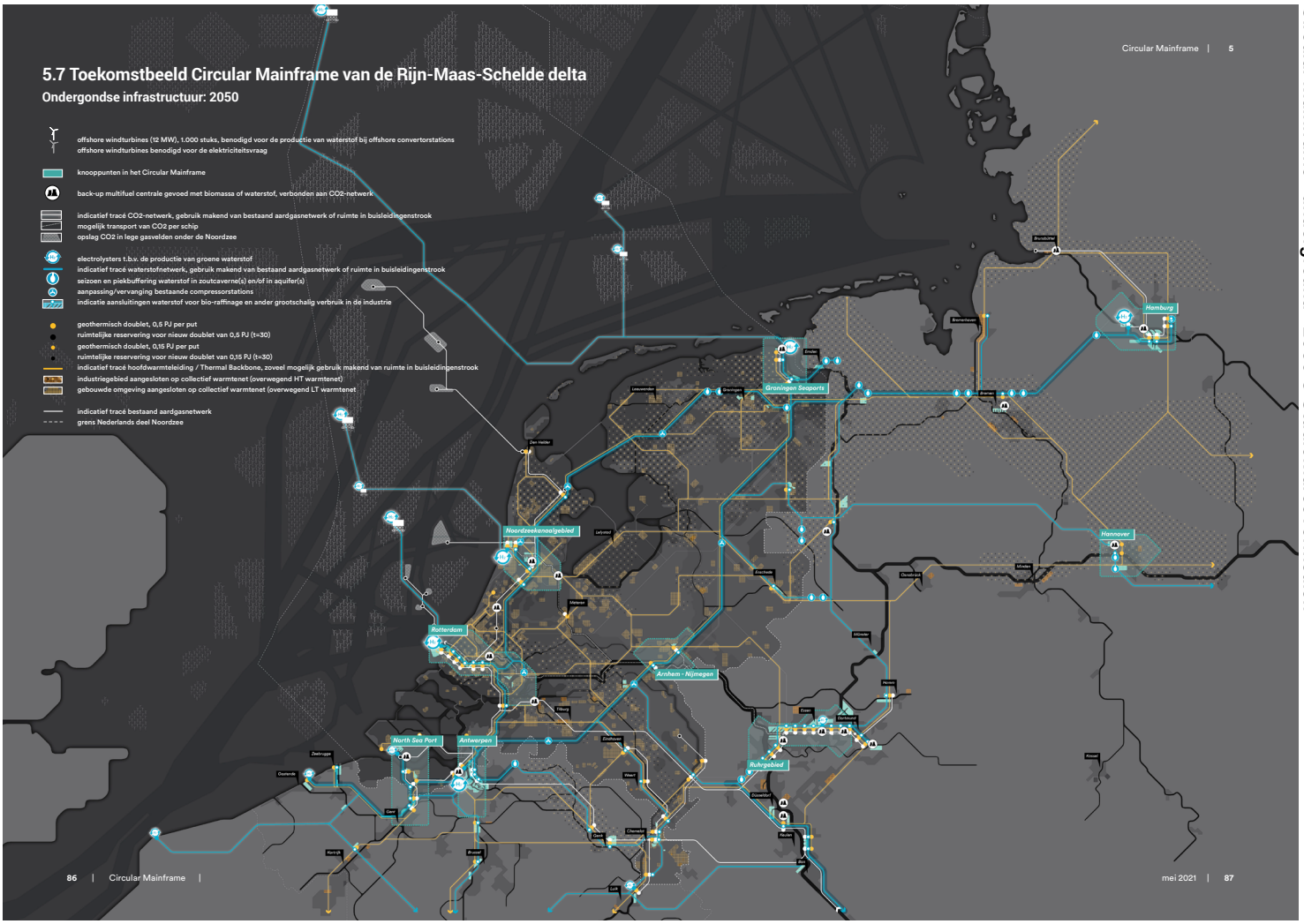
On the adjacent page, the Circular Mainframe is shown for 2050, both underground as above ground. The Mainframe will have a spatial impact on each scale: ‘it involves a lot of "hardware" that will land sometimes on a small scale on your own roof or facade, sometimes on a neighborhood or city level, and sometimes on a regional or even national scale.’ (StudioMarcoVermeulen, p. 84, 2021). Important to note is that there is a need for a planning in three dimensions: ‘spatial planning in three dimensions is necessary to make good use of the opportunities offered by the subsurface and to ensure that different systems do not interfere with each other’(StudioMarcoVermeulen, p. 84, 2021).

While the study of the Circular Mainframe seems relevant, the intermediate scale of the port region, between the bigger mainframe on the Delta scale and the different circular initiatives or Building Blocks on the smallest scale, is a scale that needs further investigation. The exploration of the NOVI-port-regions (Chapter 3 of this document) looked at the potentiality of circular projects or Building Blocks inside three specific port regions, each with their own ecosystem, but also with their own current mainframe of infrastructures.

A next step would be to connect the different findings of each scale (Circular Mainframe to Building Blocks) in these specific port regions: what will the mainframe look like, for example, in the region around the Port of Rotterdam? How can new infrastructure be a leverage for implementing new circular projects? This could be an interesting research for the different NOVI-port-regions, and one much needed in order to accelerate the circular transition.

5.7 Toekomstbeeld Circular Mainframe van de Rijn-Maas-Schelde delta

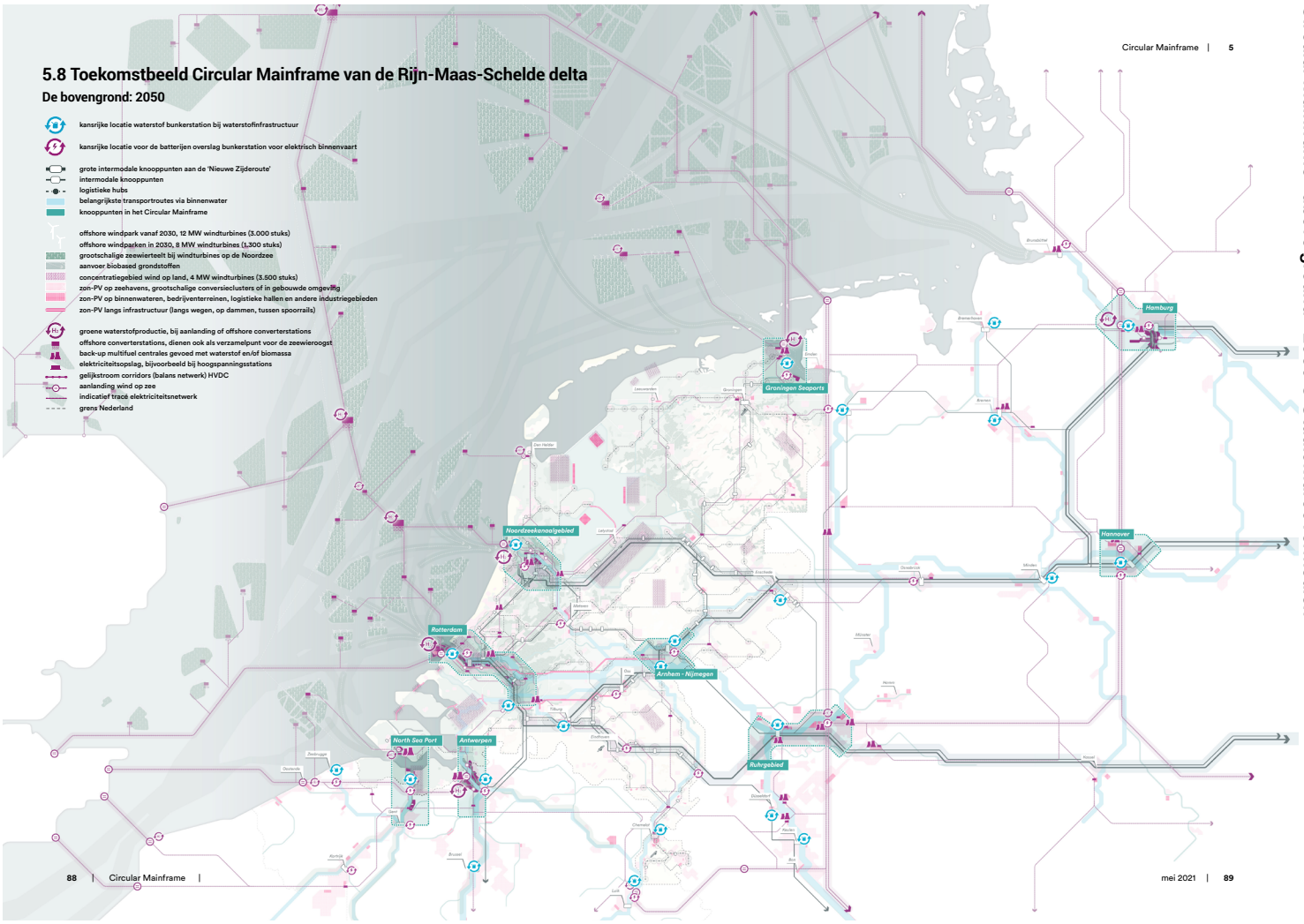
Ondergondse infrastructuur: 2050



Circular Mainframe - underground - 2050 © StudioMarcoVermeulen

5.8 Toekomstbeeld Circular Mainframe van de Rijn-Maas-Schelde delta

De bovengrond: 2050



Circular Mainframe - above ground - 2050 © StudioMarcoVermeulen

05 Conversation starters

This document investigated the different scales of circular projects and their implementation and relation to port strategies. It showed the potentiality of the port region to play a crucial role in the circular transition and the importance to connect projects, as pinpoints in the value chains inside ecosystems, to a good Circular Mainframe. The different chapters showed for each scale the different aspects and possibilities, but clear is the need for a strong connection and interlinking between these scales. It highlights the urgency for a structural connection between these various scales, in each of the regions, but also in between regions.

The current momentum of defining the NOVI-regions represents an interesting environment, where the investigation at the regional scale can be further developed and where the inter-scalar exchange and connection can be strengthened. This document wants thus to conclude with five conversation starters for future regional conversations and investigations.

Many different initiatives, as well as circular projects intertwined with local ambitious circular strategies, represent crucial seeds for change and clear signs that this transition is taking place already on the ground. At the same time, it is not yet possible to recognise a comprehensive system working coherently toward this pivotal shift. Therefore, the question is: how do we build differentiated circular systems, and envision new value chains in a coordinated and integrated way, in order to achieve the goals we have set? Five conversation starters, introduced by a hypothesis, aim to open up the conversation of the circular transition on a regional scale, in connection with the ongoing activities of and the ambitions set by ports.

1 A learning environment between different (port) regions will accelerate the circular transition, where the current momentum of the NOVI-port-regions can play a crucial role to house such an environment.

There is already a lot going on inside ports and port regions, but it is clear that there is still a long way to go in order to fully embed circularity in these environments and build a circular system. In this sense, recurring challenges and common open questions seem to arise. It ranges from understanding how to support the existing circular initiatives and further implement new circular projects, to how to stretch beyond the port borders and envision new local value chains in relation with already existing activities.

Therefore, port regions should find a shared environment in which they can learn from each other, but where they can also formulate difficulties and opportunities to unlock. The framework of the NOVI-regions, where the three port environments discussed in the Chapter 3 are framed in, offers the space in which this exchange can start to take place, helping to envision together a pathway toward the development of a circular system. In this way, a series of discussions and a new modus operandi can be seen in light of this regional development, and an overarching coordination of the exchange process can be foreseen by formulating common intentions for further learning.

2 A Circular Project Bureau supports the development of circular projects in port regions, whereas the mapped potentialities of the three NOVI-port-regions could be used to further investigate the needed coalitions and side conditions for circular projects.

Circular projects are blooming in each of these regional environments. The short investigation, carried out on the three NOVI-regions reported in Chapter 3, opens the discussion on how each port region can implement and strategize upon diverse circular projects, starting from local opportunities and existing dynamics. At the same time, a project-by-project approach does have its limitations. Therefore, a circular program to support a coherent development of local projects and further analyse the development of innovative value chains seems needed. In this sense, the concept of a Circular Project Bureau can be presented, where experts, local authorities and representatives of port communities can come together. Together they build a step-by-step approach in order to facilitate and further implement the evolution of circular projects by accommodating local needs and indulging local potentialities.

In this sense, the first potentiality mapping of the three NOVI-port-areas in this document gives first insights on the potentialities for circular projects. The coalitions that are needed in order to initiate those initiatives should be further analysed: an overview of the different actors that need to be involved in order to implement change on the ground, is necessary.

3 The port region is an important scale to connect the Circular Building Blocks with the future Circular Mainframe: the port region - as part of a larger corridor - represents an ecosystem where the Mainframe and Building Blocks are closely connected. The three NOVI-port-regions should actively take up the findings of the different studies and researches, in order to find out how the circular transition will change the port region and actively steer it within the NOVI framework.

The port region is a scale where many aspects come together. Circular projects in both the port, the city and the broader region should be tackled and looked at in one go, since they are part of one ecosystem and should not be seen in isolation. Next to that, the Circular Mainframe, envisioned for 2050, will have to implemented in the ports and port regions. It is important that the circular transition, in all its aspects mentioned above, should be tackled in an integral way.

The three NOVI-port-regions should start up and actively take up a stance in the research of the circular transition and how it will transform the spatial development of the region: going from the smallest scale circular projects to the bigger infrastructure works needed to implement a resilient Circular Mainframe. Many elements can already be found in the studies and researches mentioned in this document.

4 A monitoring principle helps to steer and guide the circular transition process and puts it higher on the agenda, where the three heterogenous NOVI-port-regions could be pilot cases in order to develop such a monitoring principle.

In order to further guide and understand each regional transition, monitoring is needed. By measuring and monitoring circularity better, it gives more knowledge on the circular projects, their dynamics and their impact. It also gives leverages to position circularity higher on the agenda, and to guide and steer the transition process more clearly. In order to establish this monitoring principle, the regional scale, due to its spatial heterogeneity and functional diversity, does represent the right environment to start experimenting and testing possible innovative principles. This could represent the first step in building up a monitoring structure that could be working transversally in the whole Delta. Collaboration with local universities and field experts could start opening up the discussion around which monitoring principle could be crucial to test. This monitoring will play a crucial role in transforming old or embedding new infrastructure in order to build a resilient Circular Mainframe.

The three NOVI-port-regions could be three test cases to start to develop this monitoring principle at the scale of the port region. The Port of Amsterdam already started this investigation for the port itself, but going beyond the port border seems pivotal in this case.

5 A regional investment agenda can interlock the local needs to national and international investment logics, where the three NOVI-port-regions could test such an investment agenda and be priority areas to attract these investments, also in connection with the future new or transformed infrastructure of the Circular Mainframe.

The overview of the different port strategies for the three NOVI-port-regions highlights the presence of already numerous public and private investments in light of this transition. At the same time, by mapping the potential circular projects, it makes it even more clear that those different high objectives and local potentialities also need more and more differentiated investments in order to be implemented. A regional investment agenda would help to organize the different investments and to put investments in the right circular project at the right time. This agenda should interlock the local needs to national and international investment logics.

The three NOVI-port-regions should scan the different possible investments and make an agenda in order to connect their ambitions to possible investment logics. The Circular Mainframe will play here a crucial role: many investments will have to be made in order to make a resilient infrastructure network. It is crucial to connect these infrastructure investments to the regional ambitions.

Delta Atelier
www.deltaatelier.eu

Ministry of the Interior and Kingdom Relations
of the Netherlands
Hans ten Hoeve

Architecture Workroom Brussels - AWB
Joachim Declerck
Chiara Cicchianni
Emma Bierens
Sara Leroy
Vincent Van Praet

Graphic Design
Vrints-Kolsteren

Illustrations p. 6 - 23
1010 architecture urbanism

Illustrations p. 24 - 65
Architecture Workroom Brussels

Illustrations p. 66 - 73
Studio Marco Vermeulen

To cite this report:
Architecture Workroom Brussels (AWB), 2021, Circular Ports: Exploring the Port Region, commissioned by Ministry of the Interior and Kingdom Relations of the Netherlands

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