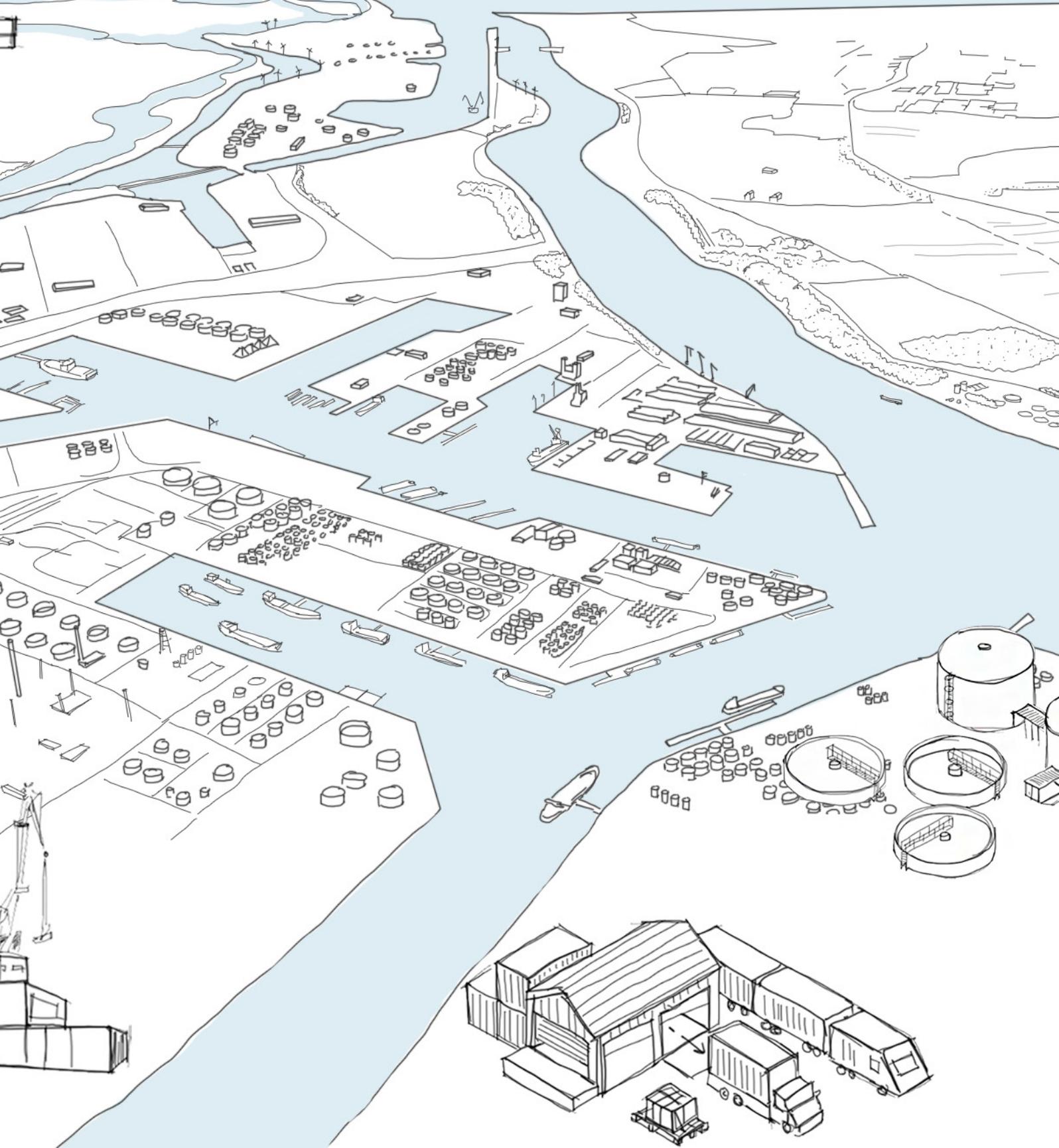


# PORTS PORTSCAPES PORT LANDSCAPES

The 100 year vision and strategy for circular and just spaces



# Abstract

Ports are one of the most important hubs in the global economic system that facilitate the movement of goods and shape the socio-economic conditions of their surroundings. However, in times of climate change, they face unprecedented challenges to completely transform their current ways of operating and fully reduce their contribution to a linear economy and socio-spatial injustice. These challenges go far beyond purely economic considerations and calls for a closer analysis of their current spatial impacts and system flows.

Despite their significance, the spatial effects of Ports and their role in a shift towards sustainability and circularity is rarely the main focus of urban and regional design efforts. Drawing upon key theories such as circularity, decentralisation, socio-spatial justice, and sustainable land use, our approach involves a multidisciplinary analysis of ports and Ports in the Eurodelta portlandscape in North-Western Europe. Through analysis we have identified the different functioning of portscapes, the stakeholders they encompass and the spatial dynamics shaping ports, Ports and Port Landscapes.

Our goal is to develop a strategy for the future of the European Port after a successful transition towards circular and just development to create a sustainable Eurodelta. This is achieved through a set of five objectives; integrating the ports, Ports and portlandscapes; increasing the resource efficiency of Ports; regenerating Ports for humans and nature; embracing technological innovation; facilitating a socially just transition.

The spatial implications of these five objectives should not be neglected, and our strategy outlines what changes need to happen and when. In four Phases of spatial interventions and regulatory frameworks, we propose to build a just and truly circular Port, in harmony with the Eurodelta Port Landscape.

This report holds key implications for both academia and practice, as further light is being shed on the spatial dynamics of Ports and potential transition pathways. By understanding the interplay of ports with their surrounding environments better, policymakers, urbanists and other related stakeholders can make informed decisions that promote sustainability and resilience. Ultimately, our efforts regarding the creation of more sustainable Ports contribute to broader (global) goals of addressing climate change, promoting socio-spatial justice and ensuring inclusive development.

## Colophon

This report summarises the results of a 9-week studio project on the theme of Ports, Ports and Port Landscapes and potential transitions towards a circular future. The focus area was the Eurodelta in North-Western Europe.

The studio was organised in a manner where groups of five students initially concentrated on the analysis of the topic, as well as coming to terms with the theoretical part behind it, and the subsequent development of regional design vision, followed by a strategy that lays out the implementations needed to arrive at that future. Two weekly tutoring sessions with Birgit Hausleitner and Alexander Wandl guided the development of these products.

This document is set up as follows:

Firstly, the scene is set by defining the scope, the topic and elaborating on key theories, which leads to our research question. A thorough analysis follows, which also gives more specific definitions of our guiding terms “port”, “Port” and “Port Landscape”. The structure of the studio is then mirrored with one chapter on the vision, followed by another one on the strategy, which concludes by answering our research questions. Finally, the report closes with a reflection on the studio process.

TU Delft, April 2024

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# 01

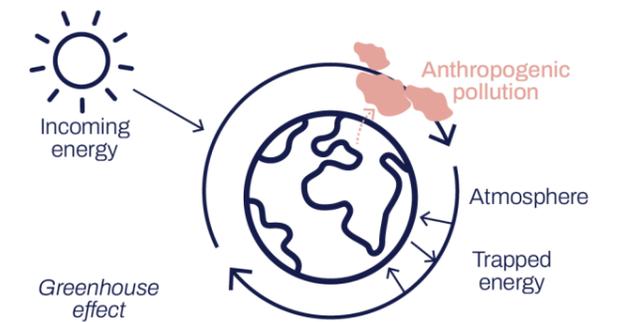
## Introduction

### Setting the Scene

#### Climate change

##### Ports as cause

A key factor in the current and future development of ports is climate change. Human activities have a decisive influence on the development of the global climate. The IPCC states that this influence is clear and recent anthropogenic emissions of greenhouse gases are the highest in history (IPCC, 2014, p. 2). Particularly due to the growth of economy and population, emissions have risen sharply since pre-industrial times. Concentrations of carbon dioxide, methane, and nitrous oxide in the atmosphere are at levels not seen in 800.000 years. The impacts of this can now be observed throughout the global climate system. Consequently, it is highly likely that they are the main cause of global warming (IPCC, 2014, p. 44) The resulting effects are graphically described in figure 1.



##### Main effects in the Eurodelta

Acceleration of sea level rise	Wetter winters
Increase in average temperature and heat	Increase in extreme summer showers
More sunshine	Possibly stronger gusts of wind
Increase in droughts	Little change in wind speed and direction

Figure 1: Climate change and the Eurodelta

##### Ports as victims

The main effect of climate change on ports is sea level rise (SLR) (Figure 2). The UN Intergovernmental Panel on Climate Change uses Representative Concentration Pathways (RCPs) to project future scenarios regarding greenhouse gas and air pollutant emissions in the 21st century, which form the base of SLR projections. RCP2.6 envisions significant emission reductions, aiming to limit global warming to below 2°C, while RCP8.5 depicts continued high emissions with minimal mitigation efforts (IPCC, 2014, p. 59). Depending on the scenario, varying levels of sea-level rise are predicted by the IPCC, with RCP8.5 even suggesting a 2-meter increase by 2100 (although with low confidence). Regarding our study area, it can be stated that SLR along the Dutch coast has closely mirrored the global average over the past century (KNMI, 2023)

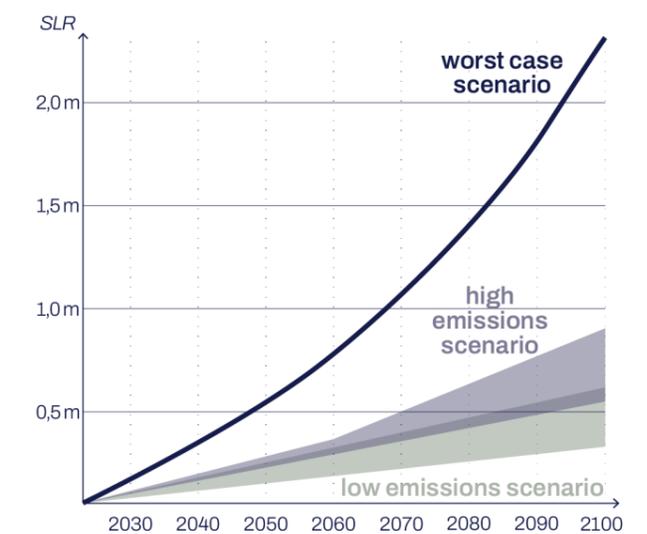


Figure 2: Sea Level Rise scenarios

# Setting the Scene

## Scope of study

### Ports in North-West Europe

Historically, ports have been the centre for human global development via trade and transport, as demonstrated by the 91% of European ports located either in or in very close proximity to an urban area (ESPO, 2019, p.29). After the industrial revolution and industrialisation, European nations and port cities dominated and controlled global harbours (Hein, 2013, p. 809), being central in the flows of goods and people. Since then, globalisation and containerisation have reshaped all ports and port cities, putting them in the centre of their relative governments' sight-line (Hein, 2013, p.809).

Today, ports' influence stretches further than simply handling cargo, and their impact, both positive and negative, spreads both across the sea and deep in the hinterland (Bergqvist & Monios, 2019, p.1). At the crossroads of sup-

ply chains, they regroup transport, energy, industry and blue economy (ESPO, 2019, p.4). Their importance has become clear in the face of recent trade route disruptions, the global pandemic, energy transition, technological innovation and demographic and geopolitical shifts (Deloitte & ESPO, 2021, p.4)

### Hubs for Humans

From governance to employment, leisure or simply as end users, citizens are embedded in port organisation and development, in particular from population growth resulting in demand growth (Deloitte & ESPO, 2021, p.20).

### In the centre of change

As both contributors and victims to key crises, in particular the climate emergency as seen above, European ports and their managing bodies are a strategic partner in

responding to today's main challenges of decarbonisation and digitalisation. (ESPO, 2019, p.4)

### Space for ports

More than a collection of social, environmental and economic functions, ports are also defined by their major spatial implications. Indeed, a port comprises a series of interacting spaces and actors, forming a holistic machine. With 50% of global trade in value terms being maritime, and cross border infrastructure key in port operations (Verschuur et al, 2022, p.2), ports hold not only a virtual but spatial importance in the global and more specifically European landscapes.

Although the overall value of ports is well established and researched, the spatial impact of the port on its surrounding landscape, and that of the necessary transition are less commented on.

This report looks at the spatial relationships for port transitions. For this, we focus our study on three key scales, which we explore, define and analyse in the following chapters:

- Ports
  - Portscapes
  - Port Landscapes
- (Figure 4)

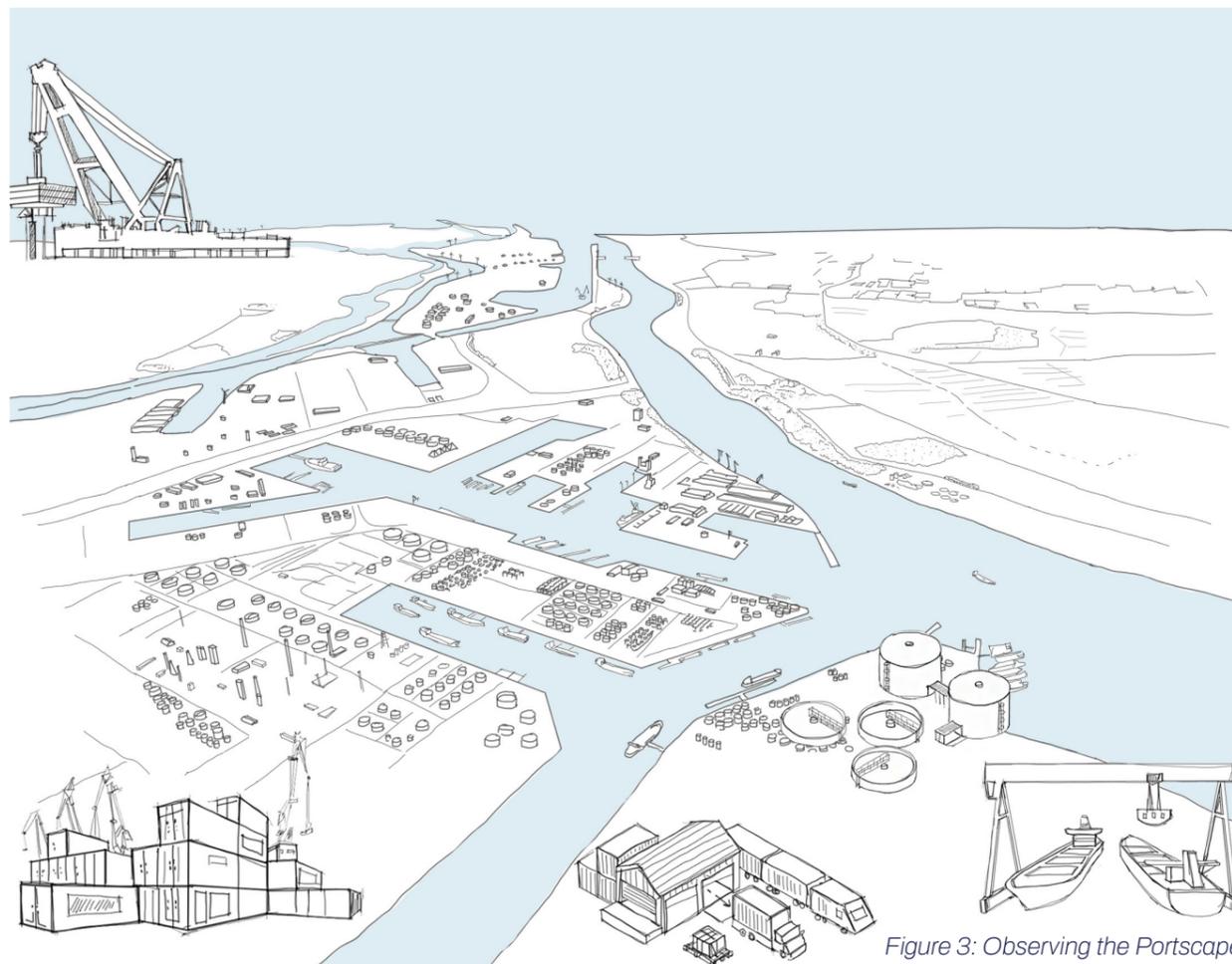


Figure 3: Observing the Portscape

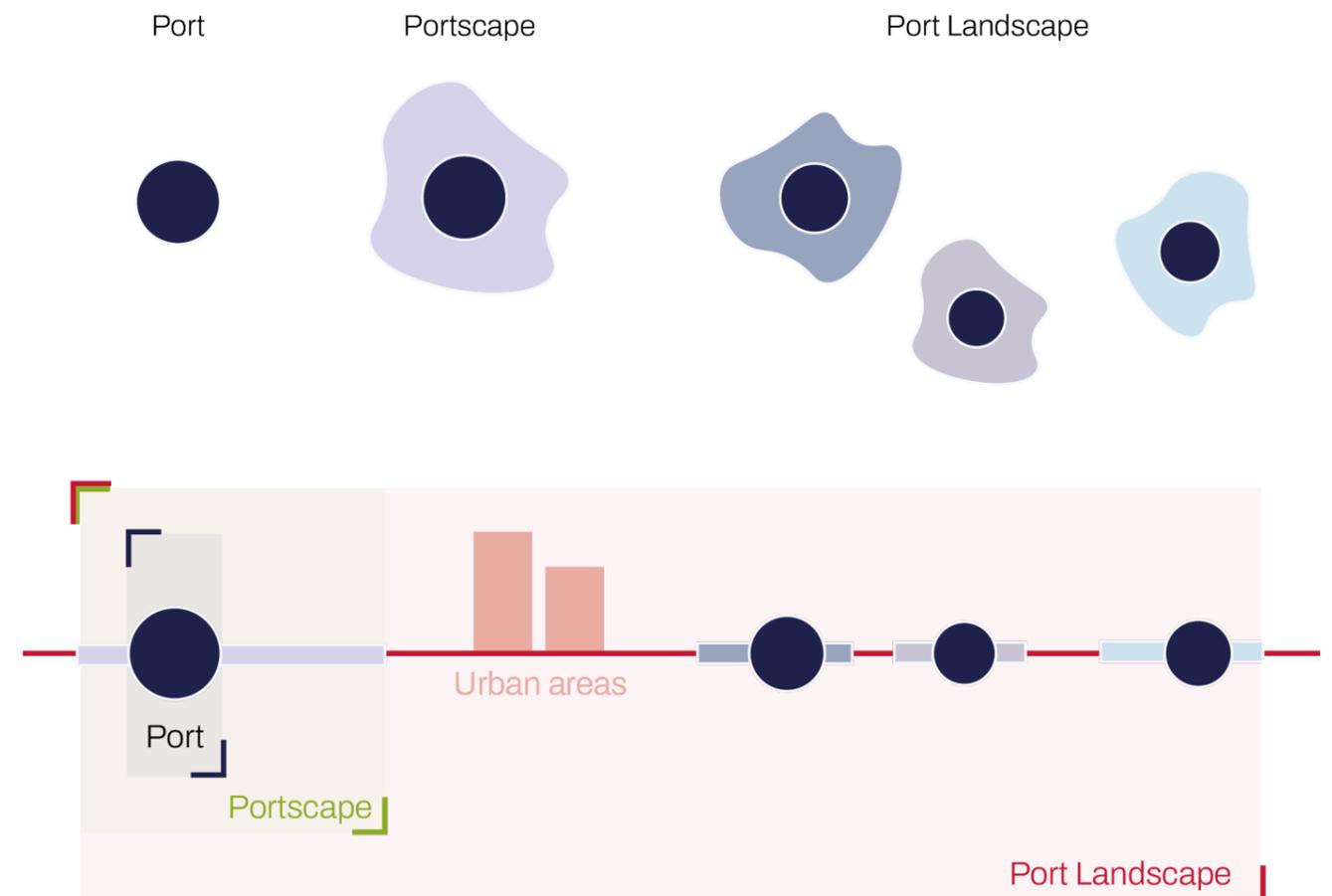


Figure 4: Scope of Study

# Setting the Scene

Ports in the centre of change



“The diversity of economic activities in the port-industrial complex [...] **presents numerous possibilities for setting up circular activities**”

BVR/Ecorys for the Province of Zuid-Holland. (2022). *Circulair Zuid-Holland spatial strategy; strategic study*

“Strategic connectivity of companies and organizations within the Port of Rotterdam contributes to **innovation and renewal** in the Netherlands”

Erasmus University. (2022). *The strategic value of the Port of Rotterdam for the international competitiveness of the Netherlands.*



“At the same time, ports themselves are a **major source of greenhouse gas emissions and local air pollution**”

Environmental and Energy Study Institute (EESI). (z.d.). *Issue Brief EESI*. <https://www.eesi.org/papers/view/issue-brief-climate-change-mitigation-and-adaptation-at-u.s-ports-2022>

“Ports will play a **pivotal role** in Europe’s **decarbonisation agenda**”

InnoEnergy. (2022). *A practical guide to decarbonising ports: Catalogue of innovative solutions.*

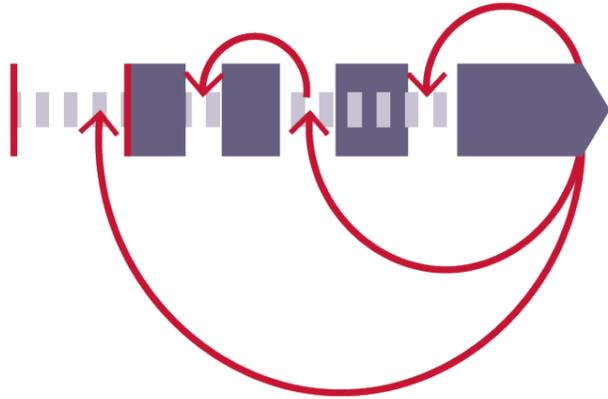


Figure 5: Current strategies

# Setting the Scene

## Theoretical framework

### CIRCULAR ECONOMY



#### Theory

Circular economy is a response to the linear economy processes commonised by the spur of consumerism, materialisation, capitalism (Friant et al, 2023) and globalisation. Indeed, while the current processes tend to have one single lifespan, circular economy processes aim to view an asset's life as multiple loops, redefining waste as a resource (Ellen McArthur Foundation, 2024). Aiming to decouple economic activity from the consumption of finite resources, the core principles of circular economy are:

- Demand reduction
- Resource efficiency to minimise waste and pollution
- Regenerated nature

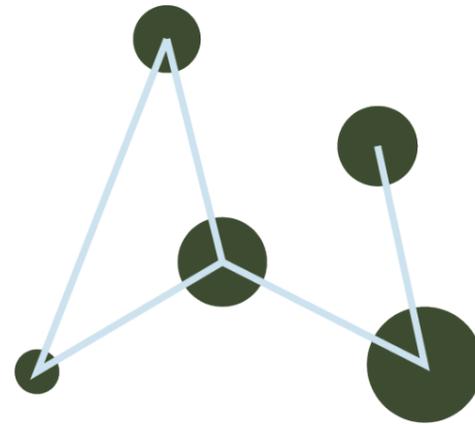
Different stakeholders have diverse understandings of what a Circular Economy is and it is common for it to be summoned in order to justify consumerism (Evenhuis, 2024). Indeed, Circular Economy, when applied superficially, encourages consumption in favour of recycling and alternative (low carbon) production routes (Savini, 2023). In opposition, Friant et al (2023)'s argue there are 7 cycles of circularity.

#### Spatial implications

While it is easy to agree with the concept of Circular Economy, it is much more difficult to actually implement it. Indeed, depending on the meaning given to it, Circular Economy will have different spatial consequences. These might range from:

- Phasing out of fossil fuel infrastructure
- Green energy infrastructure
- Repair centres
- Recycling centres
- Regenerated green spaces

### DECENTRALISATION



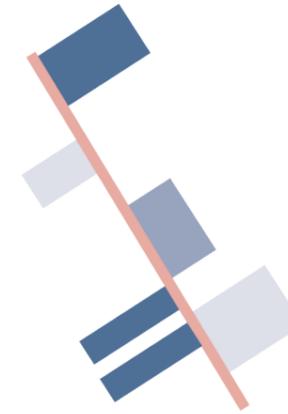
#### Theory

Decentralisation refers to the process of transferring powers, responsibilities and resources from a central body to local bodies, the latter thus gaining a degree of autonomy (OECD, 2020) (Khambule, 2021, p.5). Typically, this refers to national government to subnational government, however, more than political, decentralisation can also be expressed in fiscal or administrative processes. The actual benefits of decentralisation have been contested by some, especially fiscal decentralisation, deemed controversial (Clifford et al, 2023, p.1173). However, it should be noted that political decentralisation increases the power of democracy and strengthens community and engagement. (OECD, 2020)

#### Spatial implications

On top of administrative, political and fiscal decentralisation, within the scope of this study, we understand this theory to apply to processes as well, in particular energy, materials, knowledge and ecosystem assets, which is there decentralisation can be manifested spatially. For example, in the current energy system, fossil fuels are at the centre, in particular oil. A decentralised energy network would involve multiple smaller scale, local energy generation modes - solar panels on the roof, wind turbines in the sea etc... The benefits this brings is flexibility and security, as a decentralised network is more resilient than a central one. Similarly, a decentralised materials network would imply that the demand for raw resources is spread out rather than intensified on one element (e.g. alternative low carbon construction materials rather than shifting all to timber).

### SOCIO-SPATIAL JUSTICE



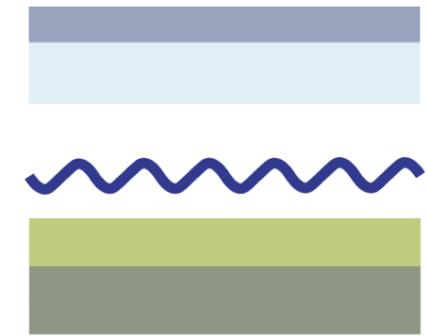
#### Theory

Cities are successful at linking people from different places, but less so for people within the same place (Healey, 1996), contributing to a lacking sense of space. Spatial (in)justice is an international and focused emphasis on the spatial or geographical aspects of justice and injustice, specifically, the fair and equitable distribution in space of socially valued resources and the opportunities to use them (Fritsch et al., 2024).

#### Spatial implications

Growing inequality, socio-spatial fragmentation, and lack of access to public goods are threats to the sustainability of our cities (Rocco, 2022) Socio-spatial justice is one of the greatest global contemporary challenges and one of those modern wicked problems, as decisions doing good in one aspect of sustainability might lead to adverse consequences on another (ie regenerated greenery amenities in a deprived neighbourhood for Environmental Sustainability might ripple into gentrification, detrimental to Social Sustainability).

### SUSTAINABLE LAND USE



#### Theory

The United Nations defines sustainable land use as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions" (FAOUN, 2024) The success of a sustainable land use is determined by the interactions between land resources, climate and human activity. Indeed, more than ever, what could be a symbiosis between People and Planet has turned into a parasite, with humans destroying their host. Despite Nature Based Solutions and sustainable land consideration and use in general being key in achieving the Sustainable Design Goals (OECD, 2020), there is still lacking coordination, with competition for land use preventing holistic strategies.

#### Spatial implications

Spatially, sustainable land use can be categorised into 4 services:

- Provisioning services – physical things we can take from the environment
- Regulating services – ensuring we have an environment fit to live in
- Cultural services – the benefits we get from the environment that are perceived by us
- Supporting services – the processes that ensure that ecosystems are healthy and can continue to supply the benefits above in the long term

(Scottish Government, 2021)

Figure 6: Key Theories

# Setting the Scene

## Theoretical Framework

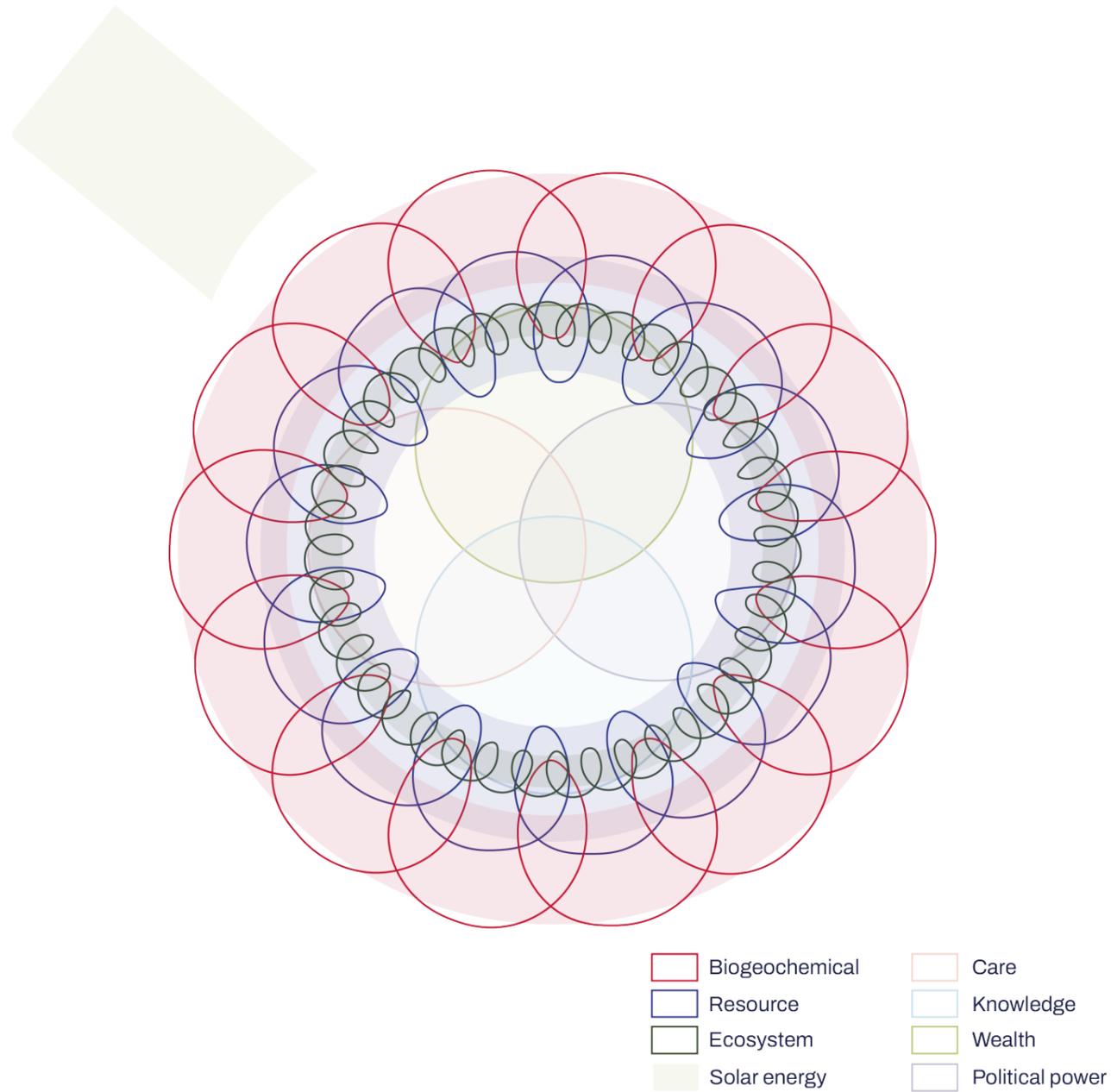


Figure 7: 7 Cycles of circularity

Understanding circularity in the context of human societies and planetary well-being requires an exploration of diverse socio-ecological cycles. Through critical review in the recently published study by Friant et al (2023), seven pivotal cycles have emerged as essential frameworks for comprehending circularity's implications. These cycles intricately weave together, forming an integrated understanding of sustainability and circular economy challenges.



### 1. Bio-geochemical cycles of the Earth

- Earth's bio-geochemical cycles, encompassing water, carbon, nitrogen, and other elements, regulate matter and energy circulation.
- Disruptions, particularly in the carbon cycle, due to human activities threaten global weather patterns, atmosphere integrity, and food production.



### 2. Ecosystem cycles

- Biodiversity and ecosystem cycles sustain life through energy and nutrient circulation.
- Human activities, including habitat destruction and pollution, contribute to biodiversity loss and ecosystem collapse, exacerbating the sixth mass extinction event.



### 3. Resource cycles of materials and energy

- Human economies rely on resource cycles, from extraction to disposal or recycling.
- Unsustainable resource management leads to waste accumulation, ecosystem degradation, and potential resource shortages, highlighting the urgency for sustainable resource use.



### 4. Political cycles of power

- Political structures determine power distribution, impacting governance, decision-making, and societal well-being.
- Inequitable power dynamics pose threats to democracy, emphasising the need for inclusive institutions and mechanisms for citizen participation.



### 5. Economic cycles of wealth, capital, and money

- Wealth, capital, and money flow within economies, influencing societal prosperity and stability.
- Accumulation of wealth in a few hands leads to inequalities and ecological degradation, necessitating re-distributive policies and democratic control over resources.



### 6. Knowledge cycle of technology, information, and education

- Knowledge dissemination and technological innovations shape societal progress and equity.
- Barriers such as patent laws and privatisation hinder equitable knowledge sharing, highlighting the importance of open-access initiatives and inclusive education.



### 7. Social cycles of care

- Cycles of care, often undervalued, are fundamental for human well-being, community resilience, and ecosystem health.
- Neglect of care cycles leads to societal crises and hampers resilience against environmental challenges, emphasising the need for prioritising care in social and environmental policies.

# Setting the Scene

## Research questions and conceptual framework

### Conceptual framework

When striving for sustainability, it is essential to consider the 5 P's. In our analysis, vision and strategy making for future Ports, Portscapes and Port Landscapes, we are guided by the following frameworks and their associated based concepts. (Figure 6)

In practice, Planet and Prosperity are the most considered, and despite the emergence of the People, Peace and Partnership notions (albeit slow and still underexplored (Rocco, 2022)), there is still one major gap: the multidimensional approach. Indeed, it is extremely difficult to formulate a well defined and holistically integrated analysis, vision and strategy which considers not only the individual requirements and benefits, but also the ripple effects, the co benefits, the complementary or clashing elements. Within the scope of possible, this multifaceted and layered approach is the one we are taking in trying to consider the Ports, Portscapes and Port Landscapes of the future.

In addition, while circular port strategies are emerging throughout the European government landscape, these limit circularity to the resource cycles, mainly translating in an energy and materials focus. Our approach stands out by understanding the different nuances of circularity and incorporating those 7 cycles as the base for all our processes. Naturally, some cycles are better suited to some P's (e.g. Ecosystem cycle and Planet), however, we do not exclude the possibility of interaction between each P and each cycle (e.g. Ecosystem and Prosperity).

### Research questions

It is now clear that ports have and will continue to be linchpins of modern regional planning. In order to create a 100 year plan for the future of Ports, Portscapes and Port Landscapes, we ask ourselves the following guiding questions. These are split into 3 steps:

- ↳ 1. Definition  
**How can Ports, Portscapes and Port Landscapes be defined?**
- ↳ 2. Spatial relations  
**What is the impact of Portscapes on surrounding environments and communities?  
What is the Portscape of the linear economy?**
- ↳ 3. Envisioning the future  
**What is the Portscape of the future?  
How can Portscapes be key in the transition to a Circular Economy?  
What role do they play in ensuring a just transition?**

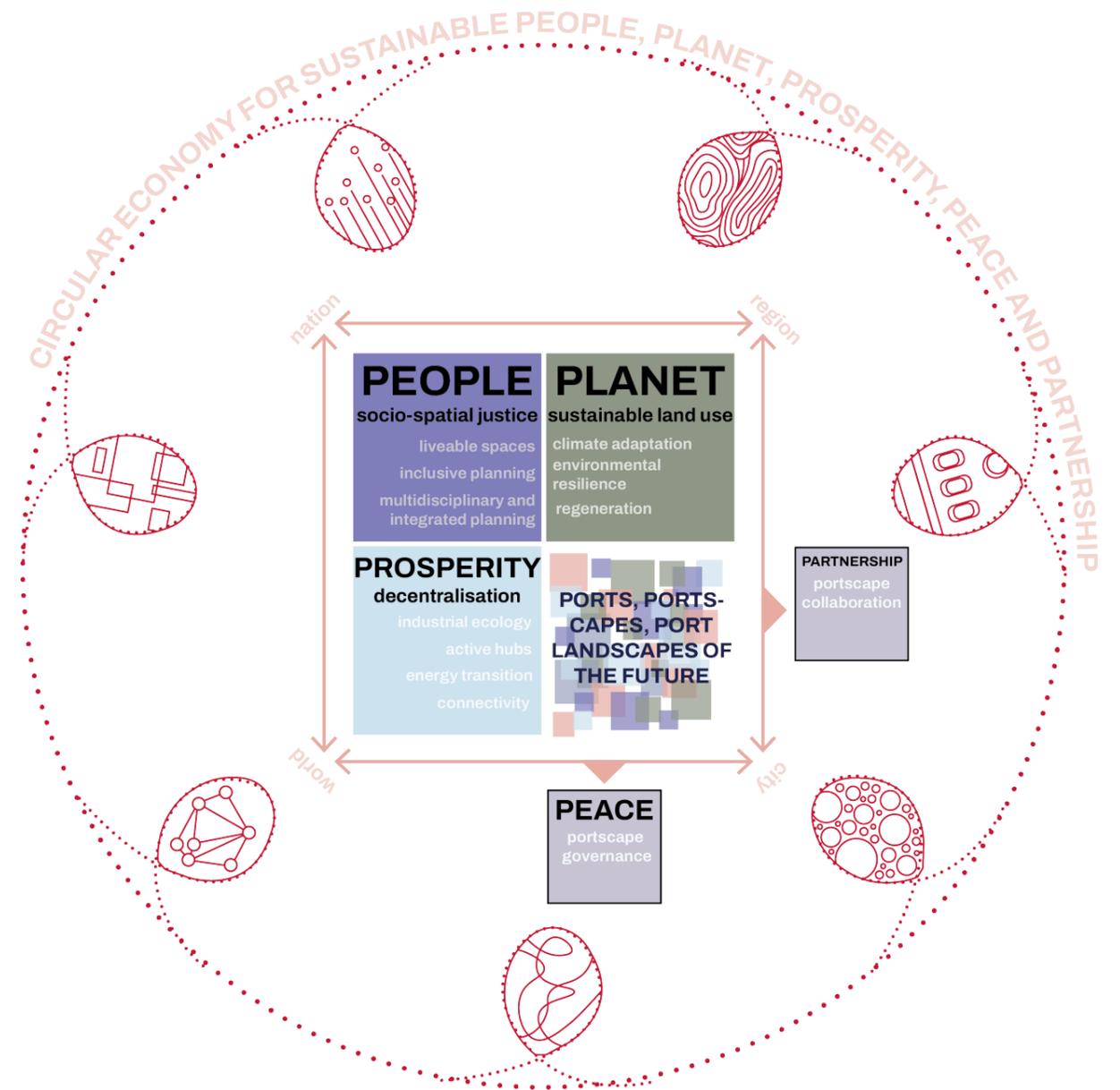


Figure 8: Conceptual framework

# 02

## Analysing Ports, Portscares and Port Landscapes

### Scope of Analysis

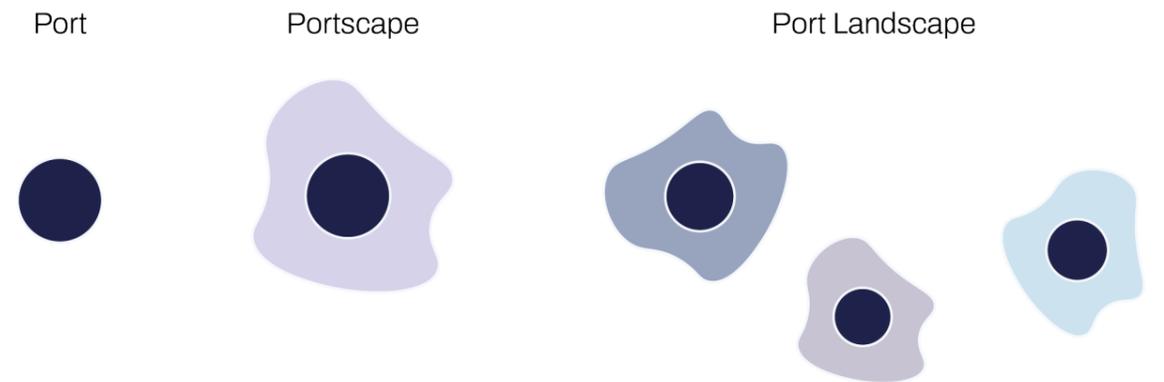


Figure 9: Scope of analysis

In order to answer our key research questions, we focus our analysis on key spaces and key scales. Namely, Ports, Portscares and Port Landscapes, starting from the North-West European scale to South Holland. Indeed, with European port cities at the heart of European development for centuries, it is essential to start with a broader scale understanding of spatial and virtual relations (Hein, 2023,p.32). Then, with each port city territory having distinct spatial strategies, flows and stakeholders (Hein, 2023, p.32), it is the logical sequence to dive deeper into specific port cities of South Holland, taking Rotterdam as a case study in a few occurrences.

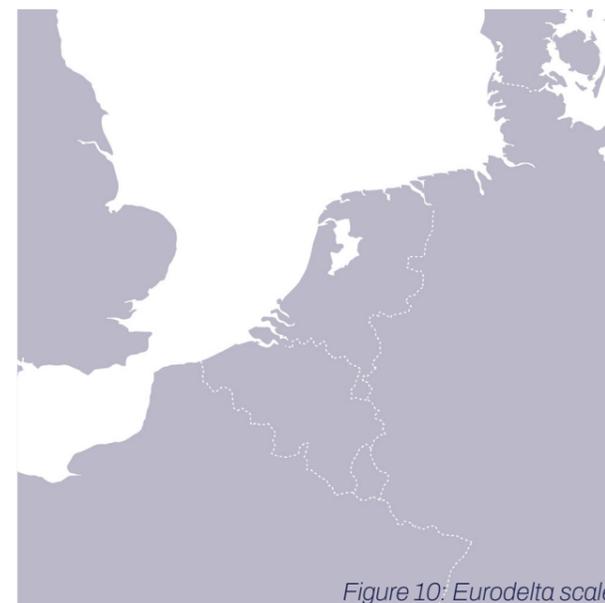


Figure 10: Eurodelta scale



Figure 11: South Holland scale

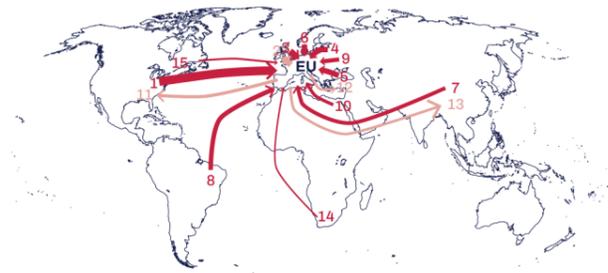
# How do Ports Work?

## Northern Europe is shaped by harbour landscapes

Throughout Europe's history, maritime transport has significantly spurred economic development. Facilitating trade and connections among European nations, it secures the supply of energy, food, and commodities. It serves as the main mode for European imports and exports: Seaborne trade accounts for nearly 90% of the EU's external freight trade, with short sea shipping comprising a third of intra-EU exchanges in ton-kilometres. European ports annually cater to over 400 million passengers, while maritime industries significantly contribute to employment and income in the region. (European Commission 2024)

Figure 12 shows how the global movements of goods unfold by highlighting the top 15 flows to and from the EU seaports. Global maritime traffic experienced less impacts from the pandemic than feared, with a quicker rebound compared to past recessions. The EU boasts around 300 TEN-T maritime ports and roughly 250 inland ports, integrated into a 20,000 km network of waterways (ERA 2020: 4) As figure 16 shows, these ports are located all across North-Western Europe, both along the shores and inland.

Yet, as can be seen in figure 13, the volumes of cargo transported vary greatly between the different ports. The biggest share in EU seaborne cargo is held by ports located along the North Sea, commonly called the „Le Havre-Hamburg range“ (European Parliament 2015: 19). However, even within this range, there are considerable differences, with Rotterdam being by far the leading port, followed by Antwerp and Hamburg (ERA 2020: 7) Over the last decades, competition between ports over cargo loads and the hinterlands and networks they serve has risen, turning port markets from being monopolistic or oligopolistic to competitive. The main reasons for this trend are the rise of the container, the liberalisation of transport modes in the EU and the hinterlands themselves becoming more and more discontinuous. It has to be noted that this intermodal market is highly volatile (Notteboom 2008: 4).



Inward / outward, in million tonnes					
1 USA (East Coast)	147	6 Norway	90	11 USA (East Coast)	54
2 UK	113	7 China	79	12 Turkey	46
3 UK	107	8 Brazil	76	13 China	41
4 Russia (Baltic Sea)	91	9 Russia (Black Sea)	73	14 South Africa	38
5 Turkey	91	10 Egypt	55	15 Canada	35

Figure 12: Global flows



Figure 13: Ports' cargo sizes



Figure 14: Ports' cargo sizes

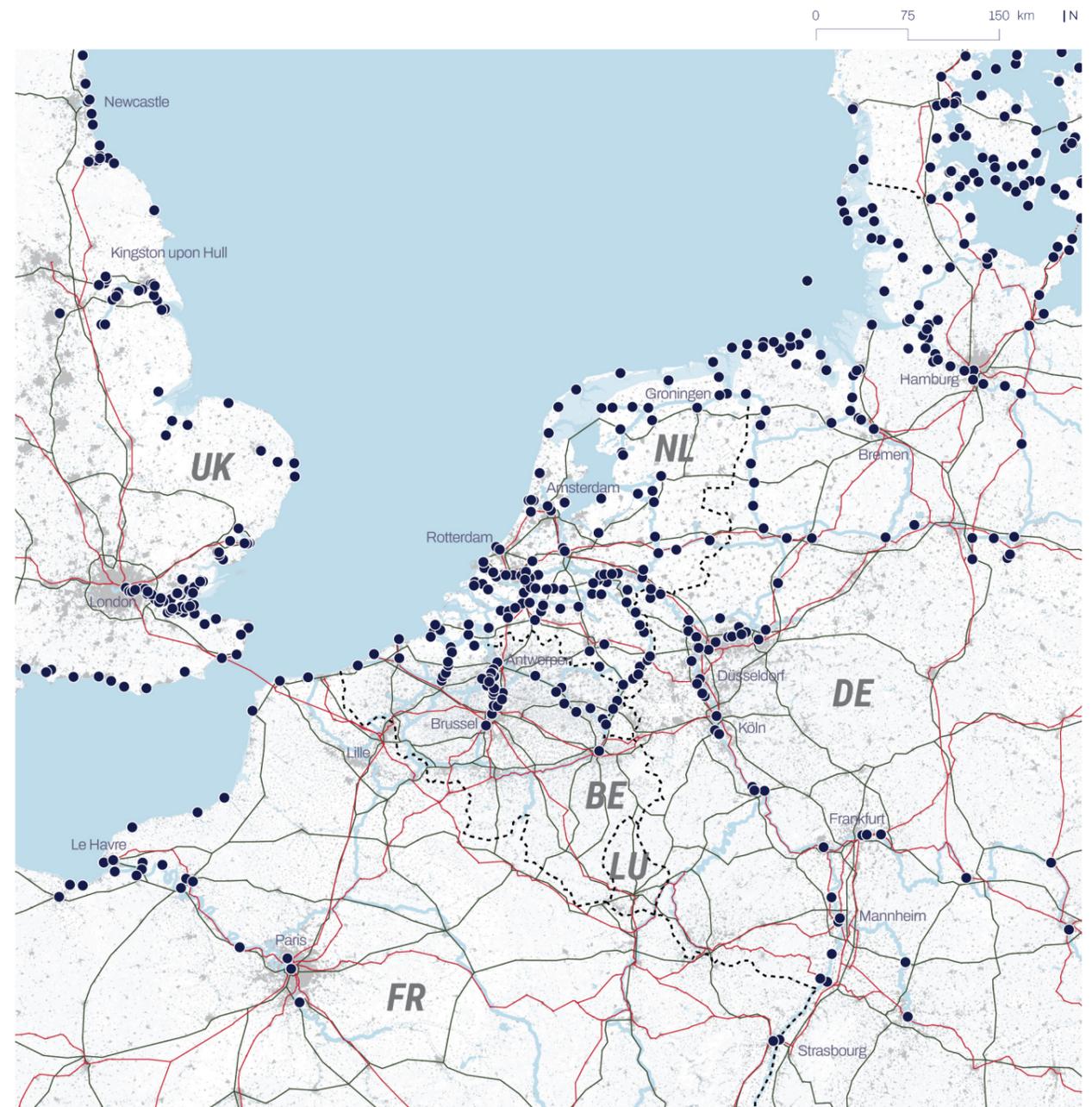


Figure 15: Portscape buildup 1

Figure 16: Key ports in North-West Europe

# How do Ports Work?

## Ports work together with Europe's transport infrastructure

Figure 17 illustrates various modes of hinterland transport. Across EU countries, road transport is generally predominant, while the use of rail and water transport for freight varies due to geographical, economic, political, and environmental factors. Inland waterways are heavily utilised in regions like the Rhine-Scheldt delta, as well as along the Rhine. Notably, German ports like Bremen and Hamburg handle substantial rail traffic. Just as competition between ports, the modal choice is dependent on economic factors, including transport cost, time, and reliability, alongside constraints like load dimensions and cargo type. (European Parliament 2015: 8-9)

Regarding the different cargo flows in European seaports, five primary markets exist, each with unique dynamics, as can be seen in the table below (adapted from European Parliament 2015: 34) Port specialisation is common, with Rotterdam leading in multiple categories, Hamburg focusing on containers, and Amsterdam on liquid bulk. Ports intensify inter-modal networks to key logistics core regions in France, Germany, the Alpine region, and East and Central Europe. (Notteboom 2008: 19).

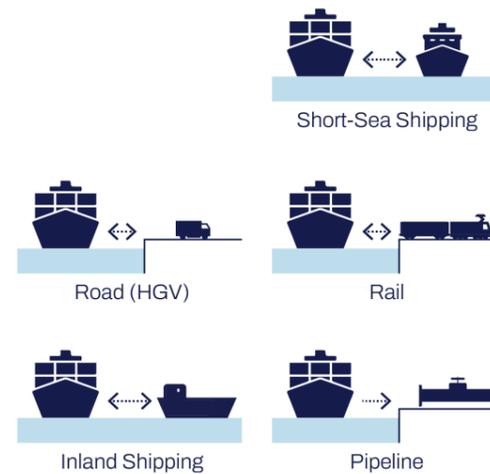


Figure 17: Transport mode scenarios

Type of Load	Distance	Mode preferred	Constraints / Peculiarities
<b>Bulk</b>	Often short (e.g. power plants / refineries / heavy industry plants) Longer distance more frequent in case of transit traffic	Pipeline for oil and gas Rail/barges for dry bulk (coal/grain) Road used for smaller/occasional loads	Low value goods Demand not easily contestable
<b>Container</b>	Mostly within a radius of 300 km Up to 1000-1500 km	Road for short distance (lower lead time) IWW where available (low cost, high capacity) Rail for regular/frequent services	Traffic more contestable (attracted by different ports) Road preferred for high value and refrigerated cargoes
<b>Ro-Ro</b>	In general less than 300 km	Road More rarely rail (combined or rolling motorways)	Flexible for short distance traffic High cost for long distance
<b>General cargo</b>	In general within a radius of 400-500 km	Road (more flexible, for smaller loads) Rail and IWW (if available)	Higher cost for road Specialised cargoes (e.g. coils / bars / pipes), different types of wagon needed High volumes (timber, building materials, etc)

Figure 18: Transport mode characteristics

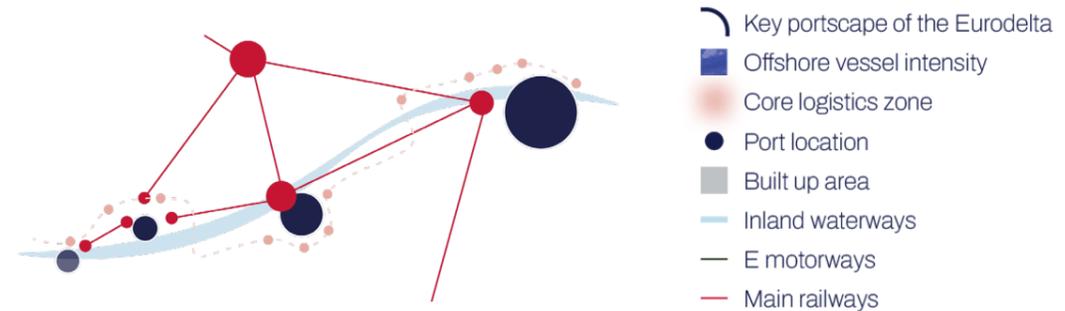
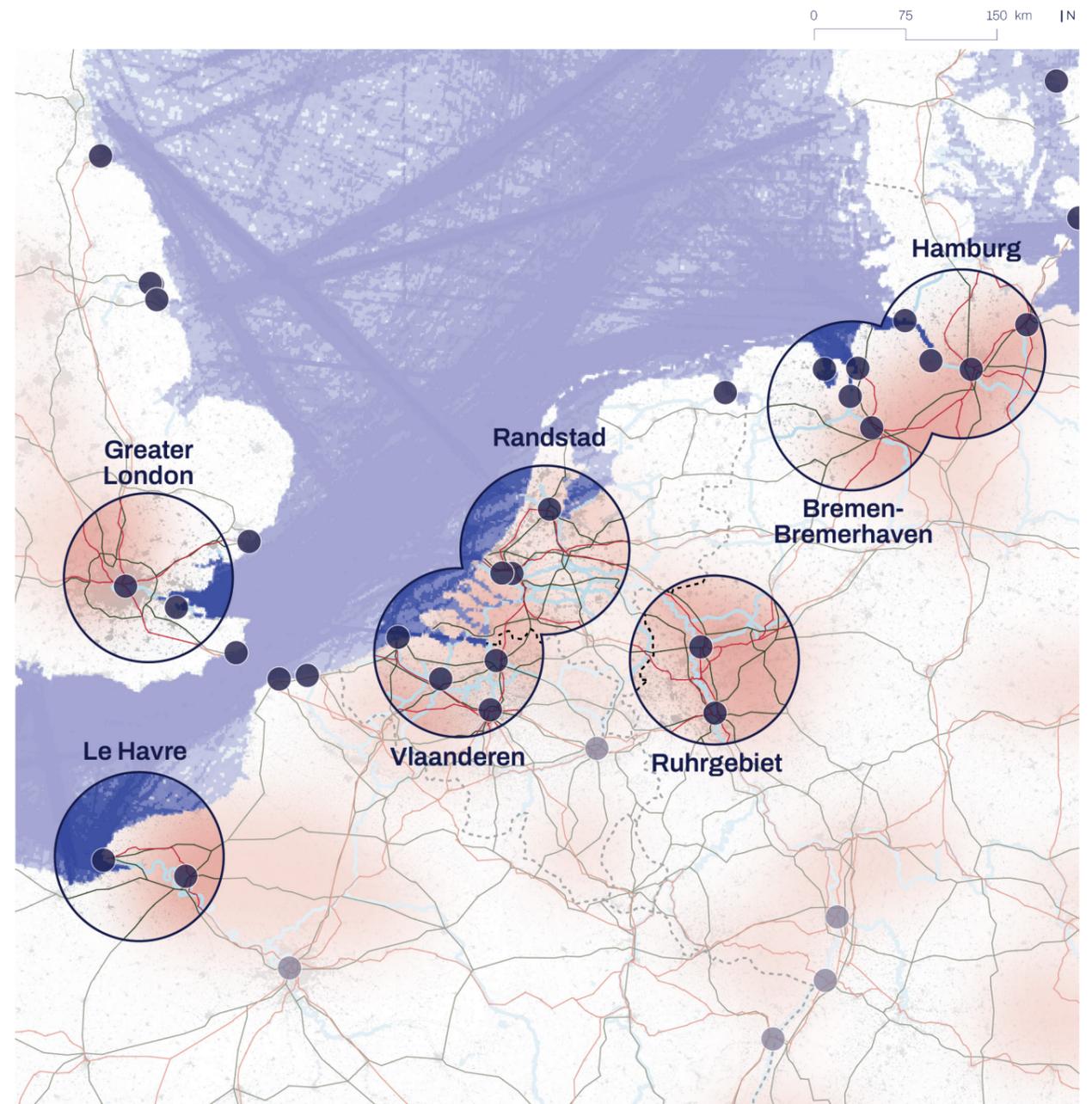


Figure 19: Portscape buildup 2

Figure 20: Eurodelta transport infrastructure

# How do Ports Work?

## Port are governed by a number of public actors

Due to their locations within different national and regional systems, Portscapes across the Eurodelta feature different systems of governance. For this reason, we present that one of the Port of Rotterdam as an example to illustrate functions and effects.

As one of Europe's largest ports, the Port of Rotterdam and its surroundings form a complex system. Within it, various stakeholders influence and play pivotal roles in shaping the port's operations, policies, and development strategies. The stakeholder analysis reveals the diverse range of actors involved, each with different levels of interest and power.

### Public bodies

The governance structure of the Port of Rotterdam involves regulatory oversight from the European Union, Dutch national government, South Holland Province, Municipality, and Port Authority, each playing distinct roles in trade, environmental regulations, infrastructure development, and port management.

### Businesses

More than public actors, private companies also have a great impact on ports. Indeed, diverse stakeholders, including energy, chemical, and cargo companies, waste management and construction firms, local residents and employees, NGOs, and academic institutions, contribute to its economic growth, environmental sustainability, and community well-being.

### Financial Capital

Finally, various stakeholders such as landowners, investors, and housing corporations possess diverse interests crucial for port economic development. Effective collaboration and strategic planning are essential to address shared goals, although navigating these dynamics can be challenging. Nevertheless, identifying and engaging key stakeholders is vital for successful realization of development projects, and further, regional planning.



Figure 21: Current public actors in the port

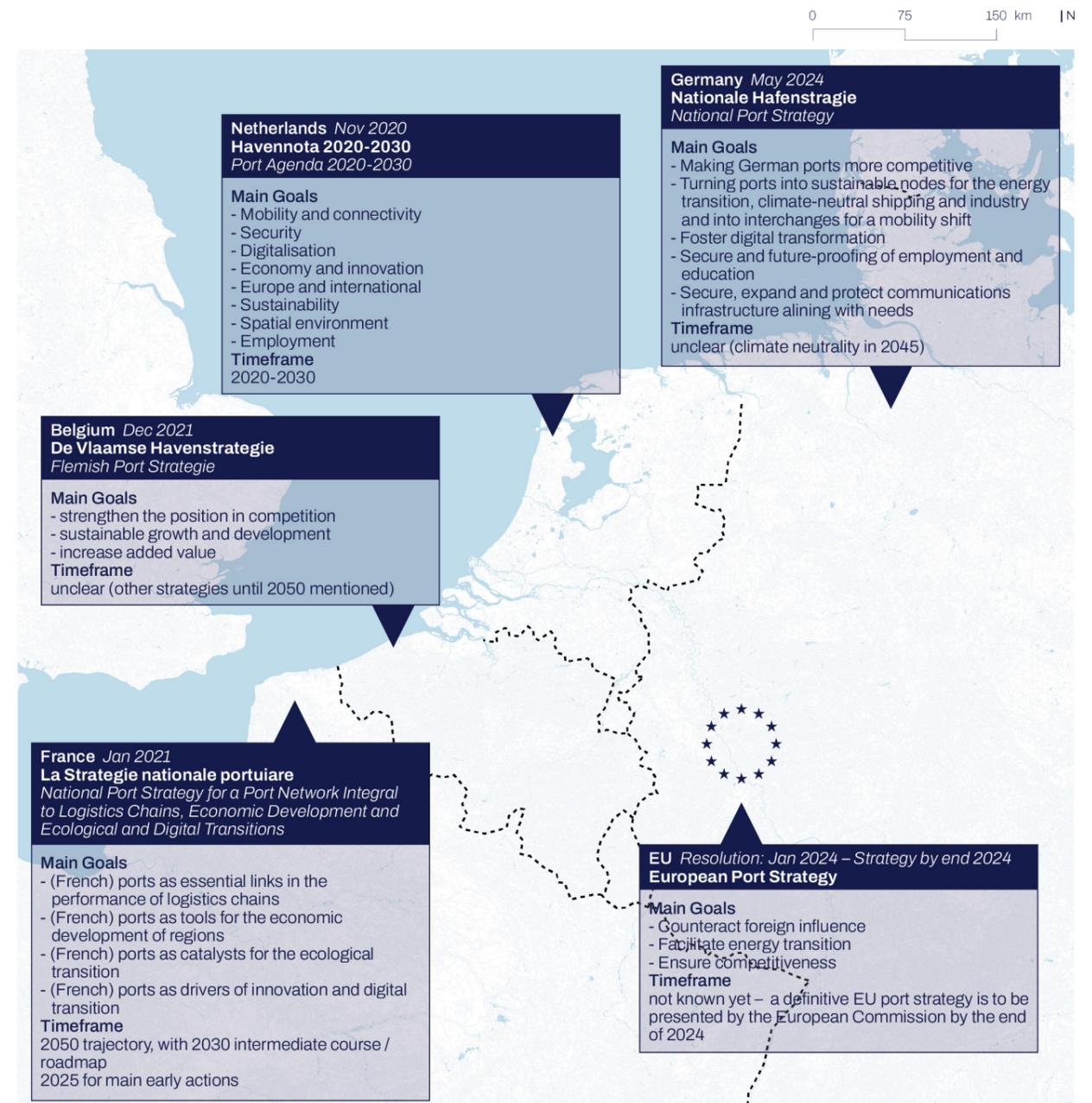


Figure 22: Eurodelta governments' port policies

# How do Ports work?

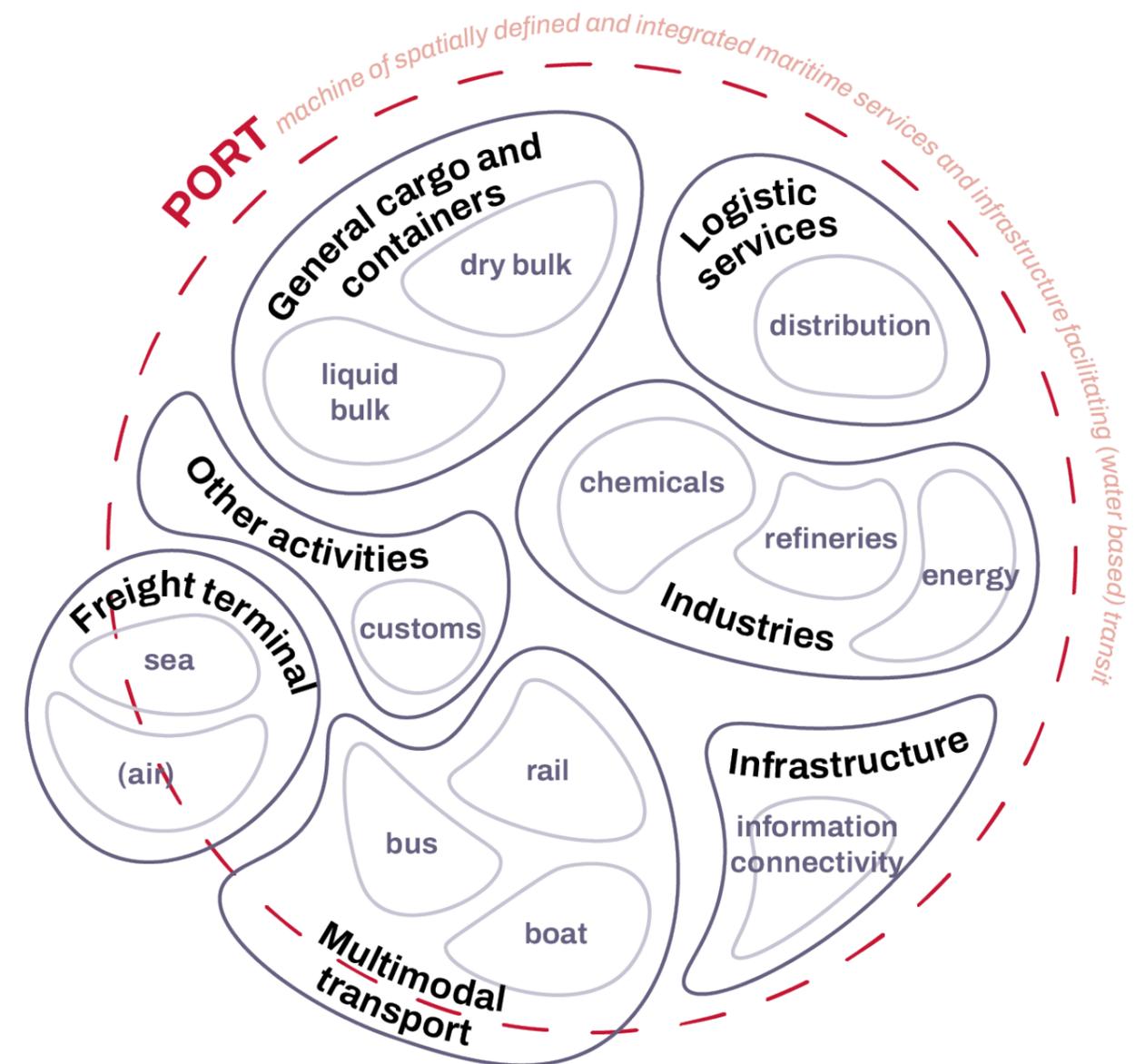
## Defining the Port

Our analysis encompassed the multifaceted dynamics of ports.

European ports have historically served as vital engines of economic development, facilitating trade, energy supply, and passenger transport.

The intricate interplay of functions and stakeholders, including public services, businesses, communities, knowledge institutions, and financial entities, shapes port operations and development strategies. Competition among ports for cargo loads and hinterland connections underscores the importance of logistical efficiency and economic factors in port governance.

From this, we come to our definition of Ports below. As visually represented in Figure 23, ports are characterised by a clearly defined spatial boundary and coherence, where every element fits with the other, with ships and transport infrastructure facilitating the crossing of this boundary.



↓

# Port

*noun*  
/pɔ:t/

**a machine of spatially defined and integrated maritime services and infrastructure facilitating (water based) transit.**

Figure 23: What is a port?

# What is a Portscape?

## Ports work in conjunction with their hinterlands

### Port locations

Portscapes typically overlap with a type of territory that cannot be classified as being distinctly urban and rural. It is therefore crucial to better understand this type of space that can also be called a peri-urban area. While many definitions exist, they generally represent transition zones where urban and rural elements coexist. Peri-urban areas sprawl along the urban edges, which makes them encompass scattered settlements and urban clusters around transport hubs. They undergo rapid urban expansion, often intruding marginal agricultural lands, which is resulting also in a functionally fragmented mix of urban and rural (Wandl & Magoni, 2017, p. 1).

Due to this multifaceted nature and the fluid boundaries, it is difficult to specifically delineate peri-urban areas. A multidimensional approach that integrates physical, economic, social and personal aspects is thus necessary to fully grasp them in their diverse and complex nature (Geldermans et al., 2018, p. 18).

A feature that these areas nevertheless have in common is an interconnected urban fabric rather than being discrete cities in a rural landscape. Infrastructural networks shape their spatial layout, which leads to coexistence of functionally linked areas next to local patches that remain disconnected. Additionally, these areas are remarkably diverse functionally, with job-to-resident ratios often surpassing those in inner cities (Wandl et al., 2017, p. 57).

### Mapping peri-urban areas

We mapped the patterns of peri-urban areas in the Eurodelta and overlaid the port network to identify potential patterns. For this, we used an adapted method by Wandl et al. (Geldermans et al., 2018, p. 17-18):

Dividing the area into grid cells of 1000m x 1000m;  
 Selecting those cells with a population between 152 and 5000 inhabitants;  
 Adding grid cells, with a population of 152 or less that overlap with areas of the CORINE land cover classes industrial or commercial units, port areas, airports, mineral extraction sites, waste sites, port and leisure facilities, and all major roads and railway tracks and associated land;  
 From all these cells, subtracting those that are classified as continuous urban fabric according to CORINE.  
 The most striking feature of the result is the different national patterns of the distribution of peri-urban areas. Alongside, it is visible that each port is also embedded in a structure of peri-urban areas. Thus, it can be concluded that Portscapes are – at least to a very large extent – characterised by aspects that are typical to peri-urban areas.

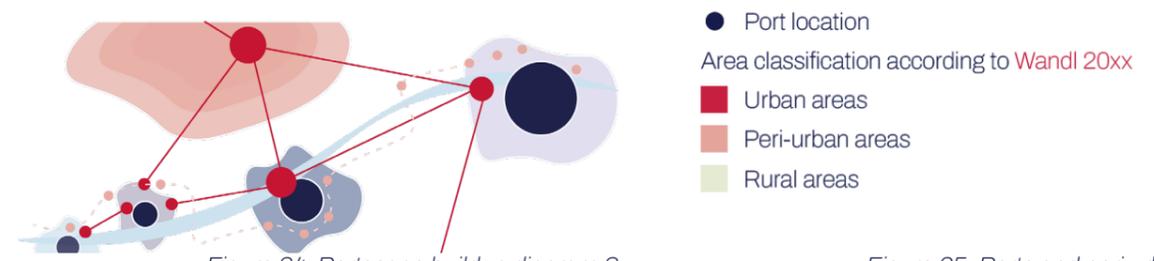
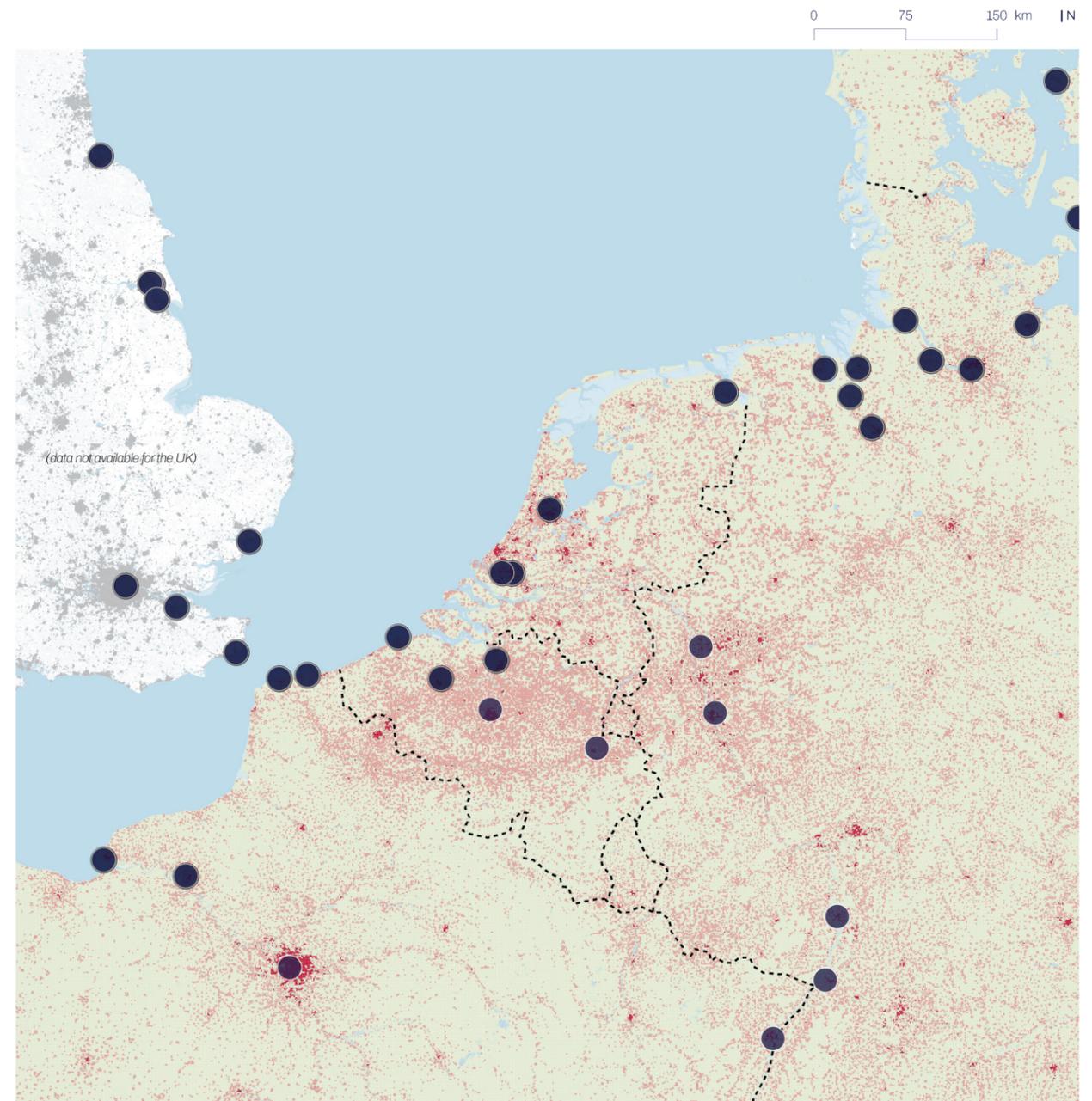


Figure 24: Portscape buildup diagram 3

Figure 25: Ports and peri urban areas

# What is a Portscape?

## Portscares and natural areas

### Land-cover

Figure 28 shows a direct connection between the location of ports and the land-cover. Most of the ports are not adjacent to forestry land-cover. The reason for this is that ports need to be easily accessible to maritime transportation networks, which include shipping lanes and navigable waterways. Forested areas may not provide the necessary access to these networks, which are crucial for the movement of goods and cargo to and from the port. Ports are often located at even topography which is better for the construction of port infrastructure such as docks and storage buildings. Flat, open coastal areas or estuaries are better for port development. These areas are better for infrastructure constructions. Forested areas have uneven topography and dense vegetation which can cause challenges for developments of the port.

### Natura 2000

It is remarkable that multiple ports are adjacent to Natura 2000 areas. Besides, there are high natural values in the immediate vicinity of the ports. This may seem illogic, as industrial areas can be polluting to nature due to their port activities. The reason for this relationship between ports and nature areas is the location of the ports in estuaries. This location close to water provides possibilities for flora and fauna. Estuaries are incredibly diverse ecosystems, where freshwater from the rivers meets the saltwater from the sea. This creates a unique environment that supports a variety of plant and animal species. This causes that ports located in estuaries are often surrounded by biodiversity. This may include marshland, mangroves and mudflats, which can serve as habitats for species. However, the development of ports in estuaries can lead to habitat loss, which has negative impacts on the flora and fauna. Dredging, construction activities and land reclamation can destroy habitats, such as these marshlands, which are essential for many species like birds and fish.

Some port areas even host permanent nature, where biodiversity values or protected species might already be present. These are the Natura 2000 areas. The Rhine-Meuse delta with its sandy soil forms the perfect habitat for animals and plants.

Unfortunately, ports can be huge sources of pollution, including oil spills and chemical contaminants. This can have harmful effects. On top of that, pollution can harm the water quality and threaten the health of many species.



Figure 26: Portscape land use aerial

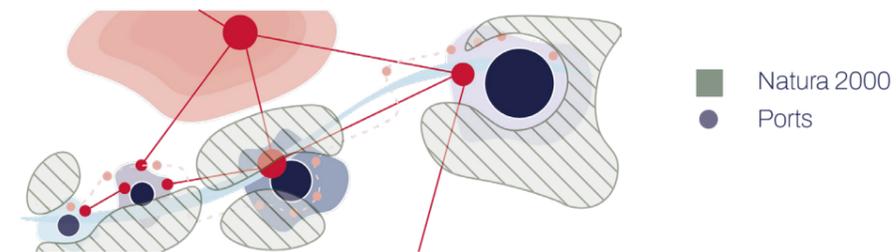


Figure 27: Portscape buildup diagram 4

Figure 28: Eurodelta's natura 2000

# What is a Portscape?

## Portsapes and people

### Planet, Prosperity and...?

Port managing bodies have both private and public performance goals, traditionally focusing on economic growth, developing competitive ports with maximum positive outcome for the adjacent area (the Portscape) and the companies within the port itself (Bergqvist et al, 2019, p.231), the competitive element dominating the Port Landscape too.

More recently, extensive climate adaptation and mitigation goals, of which the performance can be assessed with monitoring devices and quantitative measurements. This leaves us wondering about the third P - People. How can a machine such as the port, so integral to human settlements and relations, both spatially and virtually, not have social a sustainability agenda or performance goals?

Indeed, there has been a lacking knowledge and general academic interest to measure social and socioeconomic impacts of ports (Bergqvist et al, 2019, p.232) and in broader terms, Portsapes.

### Quality over quantity

With the understanding that it is difficult to accurately assess the social sustainability performance of ports in quantitative ways, our approach has taken a more qualitative approach. People have stories, convictions, commitments, rights, needs.. and feelings!.

### People stories

Here, we look at 6 personas, related to the port either directly or indirectly as part of the Portscape. We wonder what the port mean to them, what role they play in it and how these help define what exactly a Portscape consists of.



**Abdulmalik, the Remote Crane Operator (Hamburg)**

Abdulmalik controls a massive gantry crane remotely from a control room overlooking the port of Hamburg. Through advanced digitalised technologies, he maneuvers cargo containers with precision and efficiency, coordinating with ship crews and ground personnel to ensure smooth operations. While worried about the future in light of automatisation, he feels connected to the global trade flowing through the port of Hamburg.



**Jan, the Urban Planner (Rotterdam)**

Jan grapples with the complex relationship between the city and its Portscape. He recognizes the economic significance of Europe's largest port, yet he is also mindful of its impacts on the surrounding communities. Jan strives to balance industrial and economic development with urban livability, advocating for sustainable practices and inclusive planning processes. At the same time he is aware of the need for Rotterdam to remain in a competitive position.



**Lisa, the Artist (Rotterdam)**

Lisa is a contemporary artist whose studio overlooks the port of Rotterdam. Inspired by the industrial landscape and maritime heritage of the Portscape, she incorporates its sights, sounds, and textures into her artwork. Through her work, she tries to create a dialogue with the local community in the neighbourhood which used to be home to many dock workers. She sees the port as inspiration, but at the same time feels the effect of gentrification.



**Marie, the Environmental Activist (Antwerp)**

Marie is passionate about environmental conservation and social justice. Living near the port, she witnesses firsthand the environmental degradation caused by industrial activities. She wants to hold corporations accountable and advocates for stricter regulations and greater transparency. She collaborates with local communities and environmental organisations. While facing resistance from powerful interests, Marie remains steadfast.



**Pierre, the Ship Captain (Le Havre)**

Pierre has navigated the seas for decades as a ship captain based in Le Havre. He is familiar with the rhythms of the Portscape. Pierre's job is not without challenges, as he navigates through busy shipping lanes, adverse weather conditions, and strict maritime regulations. Yet, he finds solace in the camaraderie among fellow seafarers and the sense of adventure that comes with life at sea.



**Sophie, the Fishmonger (Bremerhaven)**

Sophie's family has run a fish shop in Bremerhaven for generations, benefiting from the fresh seafood supply coming into the port on a daily basis. She cherishes the vibrant atmosphere but worries about changing regulations, environmental uncertainties and corporate competition. Sophie adapts, trying to preserve her family's legacy in the evolving Portscape of Bremerhaven.

# What is a Portscape?

## Portsapes and crime

Ports and Portsapes are often places of criminal activities. This is due to their isolated nature and disjointed functions, as a lack of urban integration might create opportunities for illicit trade, smuggling, and other unlawful endeavours. While criminals make use of the spatial complexity and limited oversight, while at the same time, many transport flows come together. Cocaine trafficking is a significant example to illustrate the role of Portsapes in criminal actions. Their spatial situation facilitates unsupervised movements which makes them well-suited for drug smuggling. Criminals may exploit gaps in surveillance in order to carry large amounts of drugs through the ports.

### Eurodelta's role in drug flows

Cocaine, following cannabis, ranks as the second most prevalent illicit substance across the EU, although usage rates and patterns vary significantly among the member states. (EMCDDA 2023) The knowledge of cocaine trafficking largely originates from law enforcement operations and intelligence gatherings. Details on seized drugs and shipment origins can provide insights into routes and transport modes used. Yet, such data may be influenced by the specific law enforcement strategies employed and available resources of the authorities and should therefore be interpreted with caution (EMCDDA 2022).

### The story of cocaine

Cocaine is produced using coca plants in South America and arrives in Europe via diverse channels. Cocaine enters the EU directly from production countries and neighbouring departure areas in South and Central America and the Caribbean. Here, Brazil, Ecuador, and Colombia are major departure points according to 2020 data (EMCDDA 2022). Notably, large cocaine volumes are trafficked through EU seaports using commercial containers, which significantly contributes to making the drug highly available. Several drug-related crimes are associated with this trafficking route, including supply chain staff corruption, intimidation and violence.

Moreover, competition within the European cocaine market drives drug-related crimes, including gang violence and homicides. These developments are especially evident in Belgium, the Netherlands, and Spain, countries which also have the highest amount in cocaine seizures (EMCDDA 2023). Cocaine trafficking then affects all EU states.

### Reaching the EU

Shipments are mainly transported via road in vehicles and lorries to the local markets after arriving at the port-based main distribution hubs. Alongside, trafficking inside the EU involves various other means such as commercial flights, light aircraft, helicopters, railways, sea transport and postal services. During these transport movements, cocaine is often hidden in sophisticated compartments, sometimes alongside other drugs, which also facilitates cash transport back to the distribution hubs. Moreover, the role of the EU not only as a place of consumption, but also of transshipment directed towards Africa, the Middle East and Asia appears to be growing. (EMCDDA 2022)

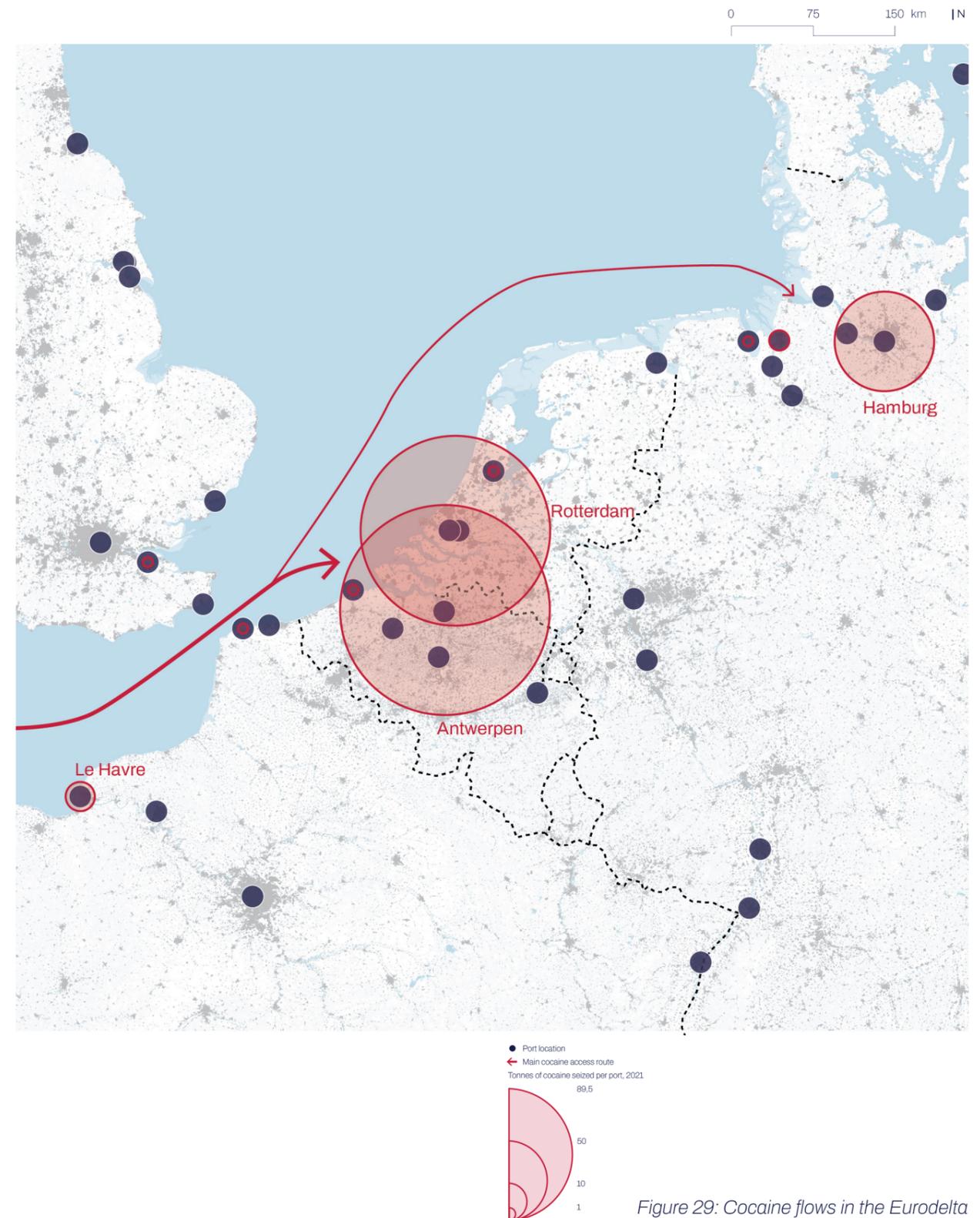


Figure 29: Cocaine flows in the Eurodelta

# What is a Portscape?

Views from the Portscape of Rotterdam



Figure 30: New residential development



Figure 32: An energy landscape



Figure 31: Collocation of cycle path and truck storage



Figure 33: New transport amenities



Figure 34: Port-side educational playground



Figure 35: Greenhouses

# What is a Portscape?

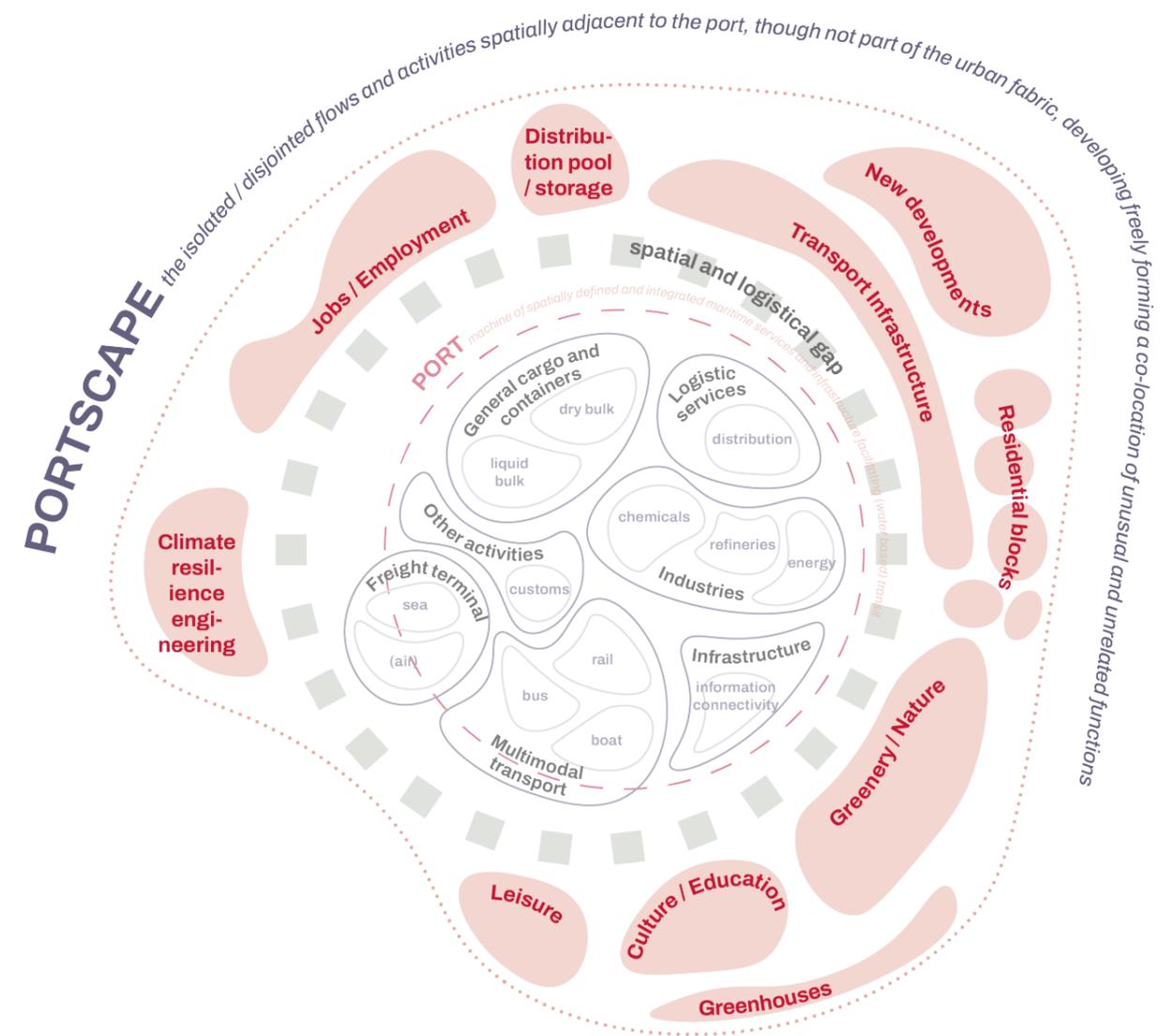
## Defining the Portscape

Portscapes, the landscapes around ports, encompass diverse spatial environments and interactions. Indeed, they often merge with peri-urban areas, creating transitional zones blending urban and rural elements, where rapid expansion occurs around transport hubs. Despite fluid boundaries, these areas share interconnected urban fabric shaped by infrastructural networks.

More than the built environment, Portscapes can also be defined by the non built area surrounding it. Indeed, Portscapes, though avoiding forested land, often coexist with natural areas, creating unique ecosystems that support diverse flora and fauna, despite potential conflicts with industrial activities.

One of the big disconnects identified in Portscapes is the abundance of people related processes (including crime) but lack of consideration for people in past or future planning.

Overall, our analysis has led us to define the Portscape as below. In contrast to the well defined and well functioning machine that is the port, Portscapes are characterised by a flexible and evolving boundary, encompassing a series of individually thought and planned spaces, limited by their spatial context and neglected by the port organisational frame.



# Portscape

noun  
/pɔ:t-skeɪp/

**the isolated / disjointed flows and activities spatially adjacent to the port though not part of the urban fabric, developing freely forming a co-location of unusual and unrelated functions.**

Figure 36: What is a Portscape?

# How do Ports impact Portscaapes?

## Ports pollute their surrounding areas

While ports have positive effects on their host cities and regions, primarily in terms of economic benefits, they also bring about various adverse impacts, particularly concerning environmental factors. These negative environmental externalities have effects both on a global scale, mainly regarding greenhouse gas emissions, as well as localised impacts like SOx, NOx, and particulate matter (PM) air pollution, alongside noise and light pollution (Roberts et al., 2023, p.1).

These problems are prevalent across ports globally, although the severity of each issue may vary from one port to another. The accompanying map illustrates NOx pollution levels across the Eurodelta, overlaid with port locations, which reveals a correlation.

Looking more closely the European context, the top ten environmental concerns of European ports in 2023 are outlined as follows (ESPO, 2023, p.17):

1. Climate change
2. Air quality
3. Energy efficiency
4. Noise
5. Water quality
6. Ship waste
7. Relationship with the local community
8. Port development (land related)
9. Garbage / port waste
10. Port development (water related)

The detrimental effects of port-related pollution extend beyond the port borders and immediate surroundings, which affects both ecosystems and public health throughout the Portscape. The impacts of ports in this field can be grouped in several sectors, as can be seen below in the graphic that further explains the dimension of pollution:

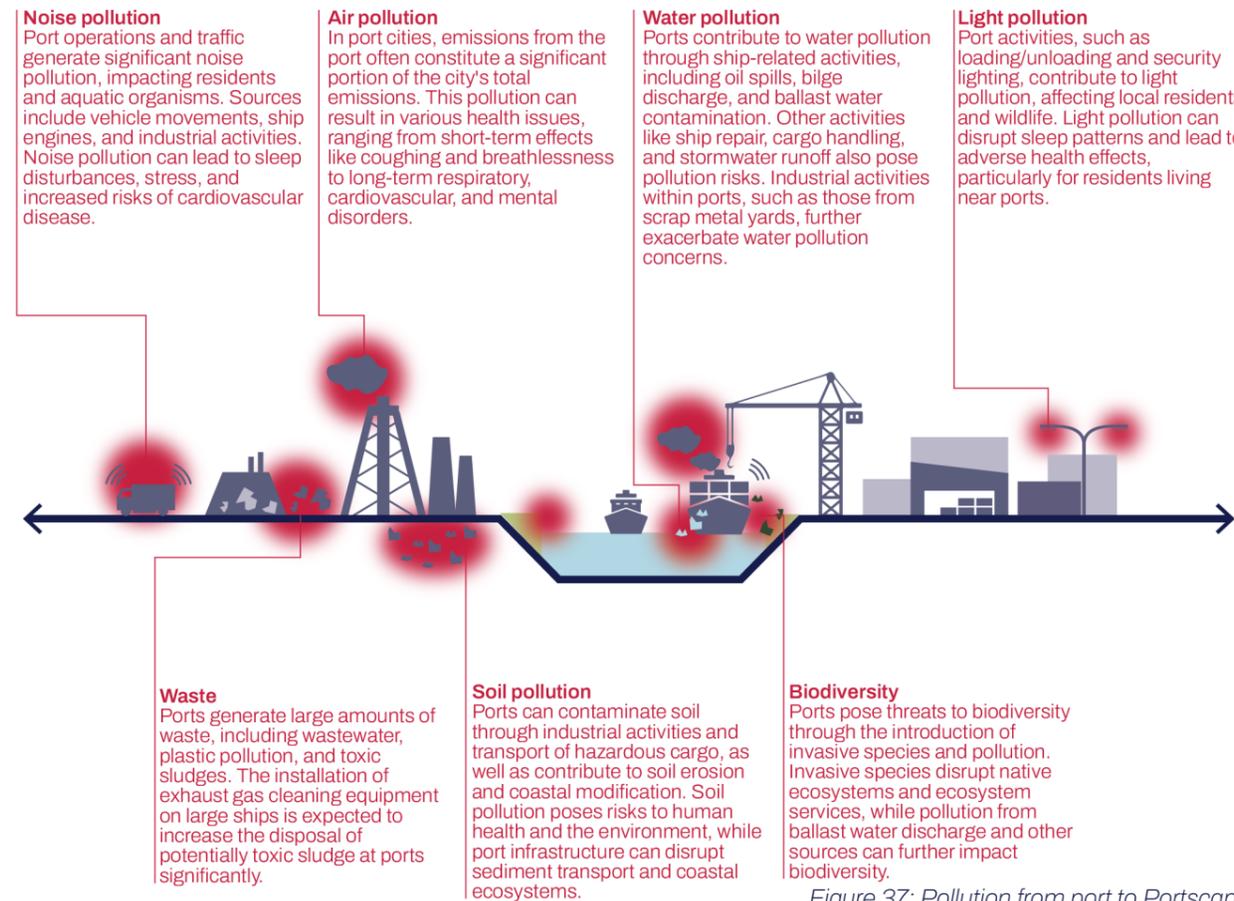


Figure 37: Pollution from port to Portscape

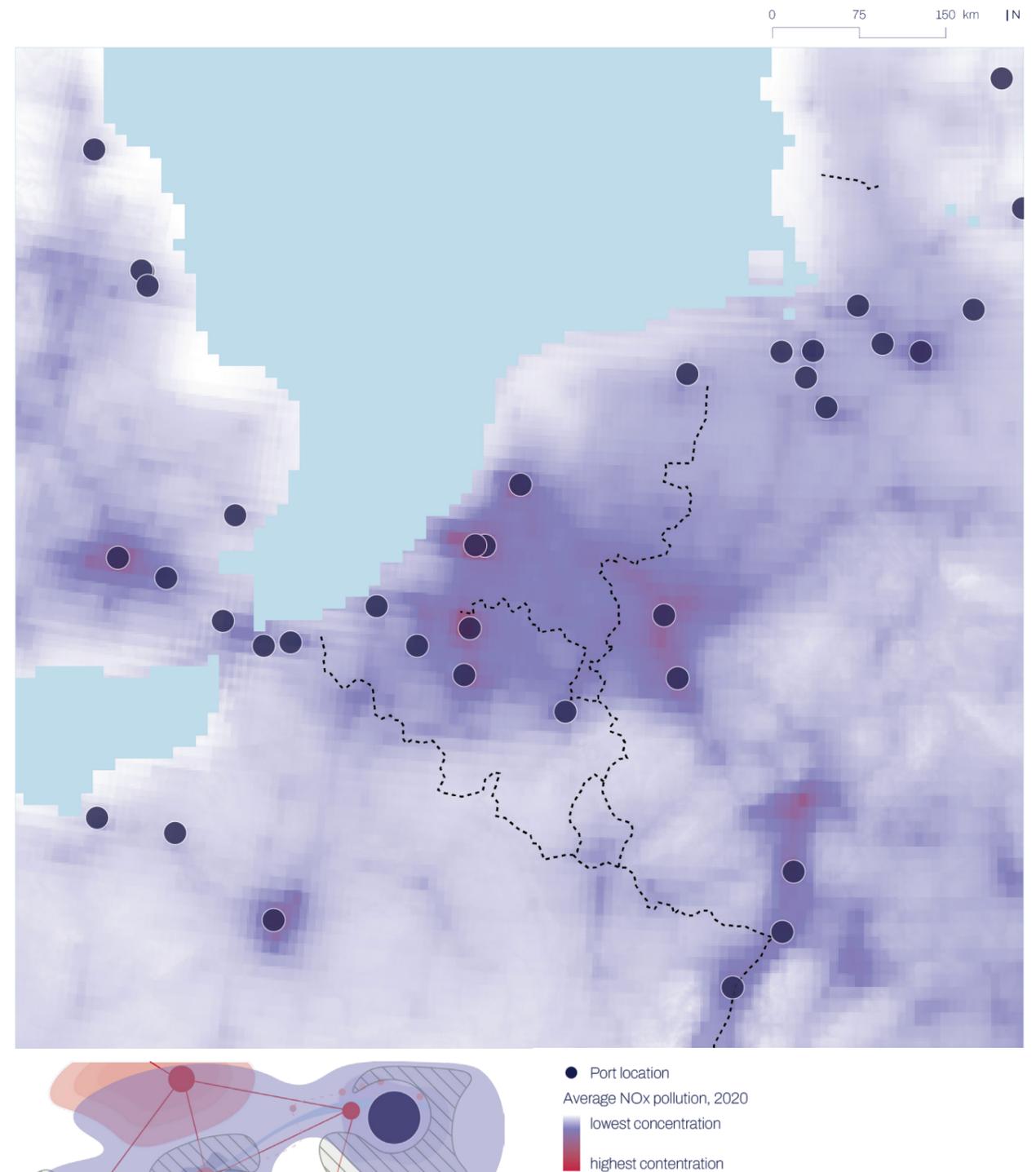


Figure 38: Portscape buildup diagram 5

Figure 39: NOx pollution in the Eurodelta

# How do Ports impact Portscapes?

## Portscapes work as economic hubs

### Port economy

Similar to other transport infrastructures, investments into port infrastructure bring about economic benefits. Ports historically fostered commerce and welfare, which resulted in the fact that the major cities worldwide are primarily port cities. Ports expand market opportunities for businesses, enable competition and therefore lower prices across sectors like manufacturing, heavy industries and retail. Their economic benefits are specific to their individual hinterlands, ranging from the direct handling of cargo to various types of support for manufacturing firms (Rodrigue et al., 2022). In this way, Ports act as economic catalysts, stimulating development in adjacent sectors and locations. Therefore, the economic effects can be categorised into direct financial gains/benefits, indirect benefits, and induced benefits (as can be seen in figure 40), although the latter two are challenging to isolate. While direct benefits are easily measurable, indirect and induced benefits necessitate careful assessment, as it is hard to attribute them directly to specific port investments to show cause-effect relationships (Rodrigue et al., 2022).

In the EU, the port industry likewise has influences on the port industry itself (direct impacts), down the supply chain (indirect impacts) and on the wider EU economy (induced impacts). Ports host diverse industrial activities, such as petrochemicals, steel, and automotive sectors, and support maritime clusters encompassing shipyards, marine equipment producers, and offshore companies (European Commission, 2013). Ports play a crucial role in the "wider waterborne ecosystem" (European Parliament, 2024) and North-Western Europe's economic landscape, as can be seen on the map to the right.

Evidence suggests that there is a substantial multiplier effect: research has shown that each dollar of cargo handled generates three to five dollars of additional output (Rodrigue et al., 2022). Likewise, in the Netherlands, for example, port activities contribute significantly to GDP, amounting to approximately 3% of total economic activity (European Commission, 2013).

### Employment

Employment in port regions correlates positively with port throughput, particularly in the industry sector. Different commodity sectors show varying employment impacts, with container and break bulk traffic having higher employment impacts than dry and liquid bulk traffic (Rodrigue et al., 2022). Again, in the EU these general attributions can be seen as well: Port activities directly contribute to employment, investment and GDP growth in the EU

maritime states. Here, the port industry employs around 110,000 port dockers and supports a much larger labour force in the Portscapes. There, various activities like maritime infrastructure maintenance, logistics and cargo services take place. Indirectly, ports generate up to 3 million jobs in the 22 maritime EU Member States (European Parliament, 2024).

### Modern change

As the 21st century progresses, ports are facing changing economic, technical, and organisational landscapes. Economic shifts, for example due to outsourcing processes and technical developments like larger vessels and automation are profoundly influencing the ports. Additionally, organisational changes, which are driven by strategic alliances and mergers occur, with the aim of achieving vertical and horizontal integration along the transport chain, thus shifting the power towards shipping line alliances. (Rodrigue et al., 2022). Adding on top of that, European ports face specific challenges and opportunities: The EU prescribes them a key role in the ongoing efforts for a decarbonised and sustainable economy, in supporting the blue economy, and in ensuring a successful energy transition, autonomy and security. In this light, they need to contribute increasingly to military and defence strategies (European Parliament, 2024).

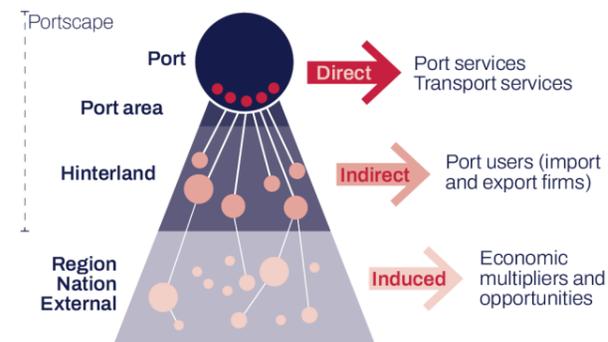


Figure 40: Economic effects

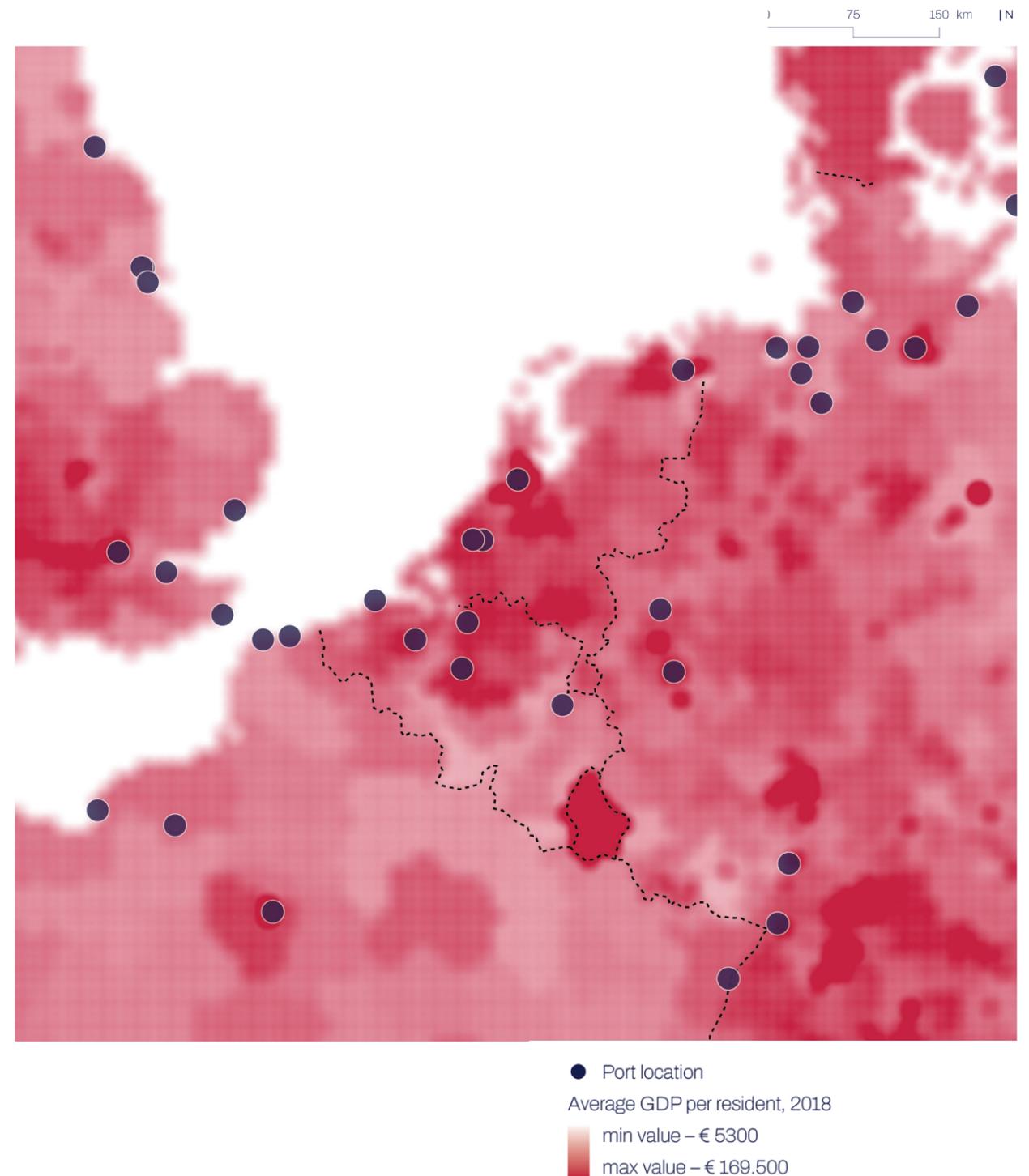


Figure 41: GDP in the Eurodelta

# How are Portscapes linear today?

## Portscape sections

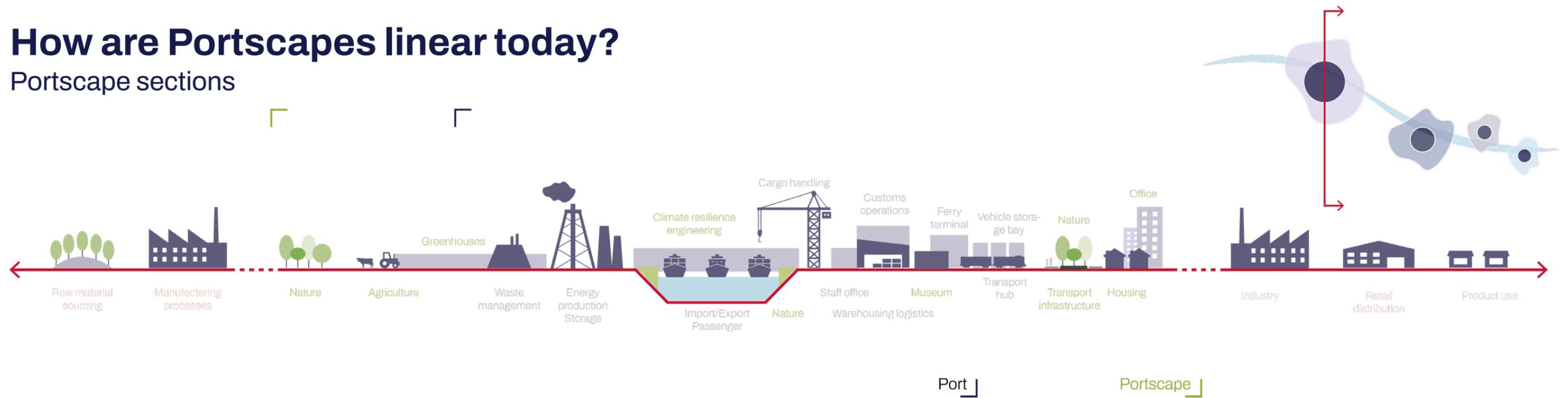


Figure 42: Cross section base

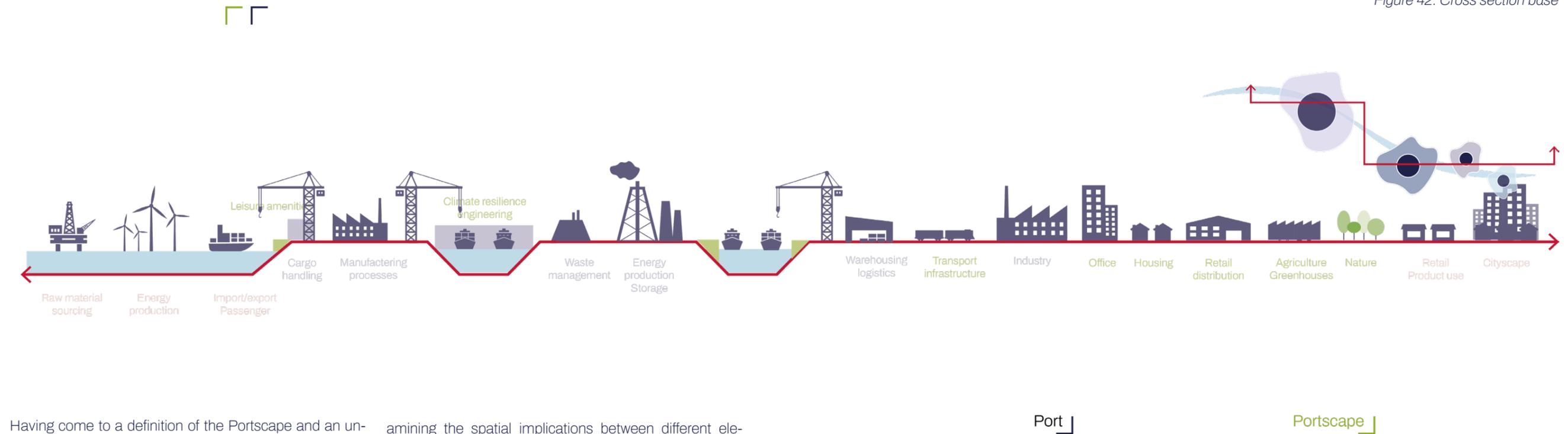


Figure 43: Long section base

Having come to a definition of the Portscape and an understanding of ways it is impacted by the Port, we now look into the different flows involved through the Portscape. Specifically, with circularity as underlay in our approach, and with common acknowledgment that ports are currently part of the linear economy, we seek to delve into how exactly ports are linear today, what are the key flows and what are the consequential co-detriments (or co-benefits) to those, with particular attention to the spatial dimension. Each topic will represent the flows firstly on a map, ex-

amining the spatial implications between different elements of one theme. Then, the relational implications will be mapped out on sections, using both a cross section through the water and a long section following a water body crossing it multiple times.

# How are Portscapes linear today?

## Ports are deeply embedded in energy flows

Most of the energy flows are from offshore, including powerlines, and oil-and gas pipelines. A big part of it comes from the wind farms and bore holes on the North Sea. These flows are transported to the ports, in this case, the Port of Rotterdam. The port provides possibilities for processing and storing the energy. After these processes, the energy flows will be distributed into the hinterland to provide energy to the residential and commercial areas there. From the port, there are several important pipelines, like the Central European pipeline, and the Rotterdam Rhine pipeline. The port of Rotterdam could therefore be seen as the 'energy backbone' of the Netherlands as it functions as a key distribution point for energy.

The energy system in the Portscape of Rotterdam is not a cyclic one. At this moment, the energy does not return to the offshore platforms nor the port; thus, the energy flows are linear.

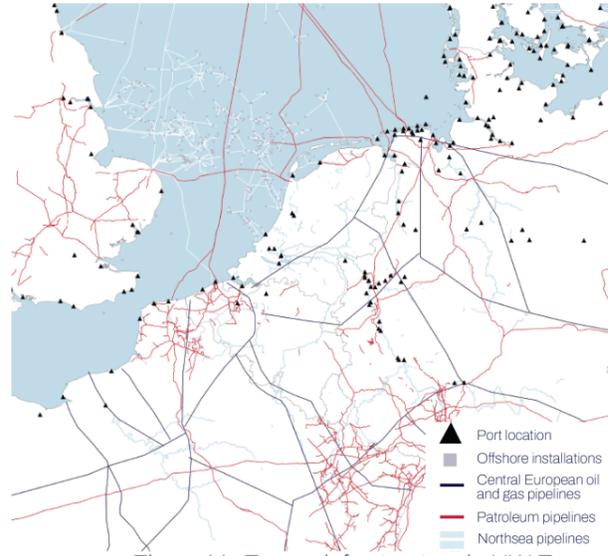
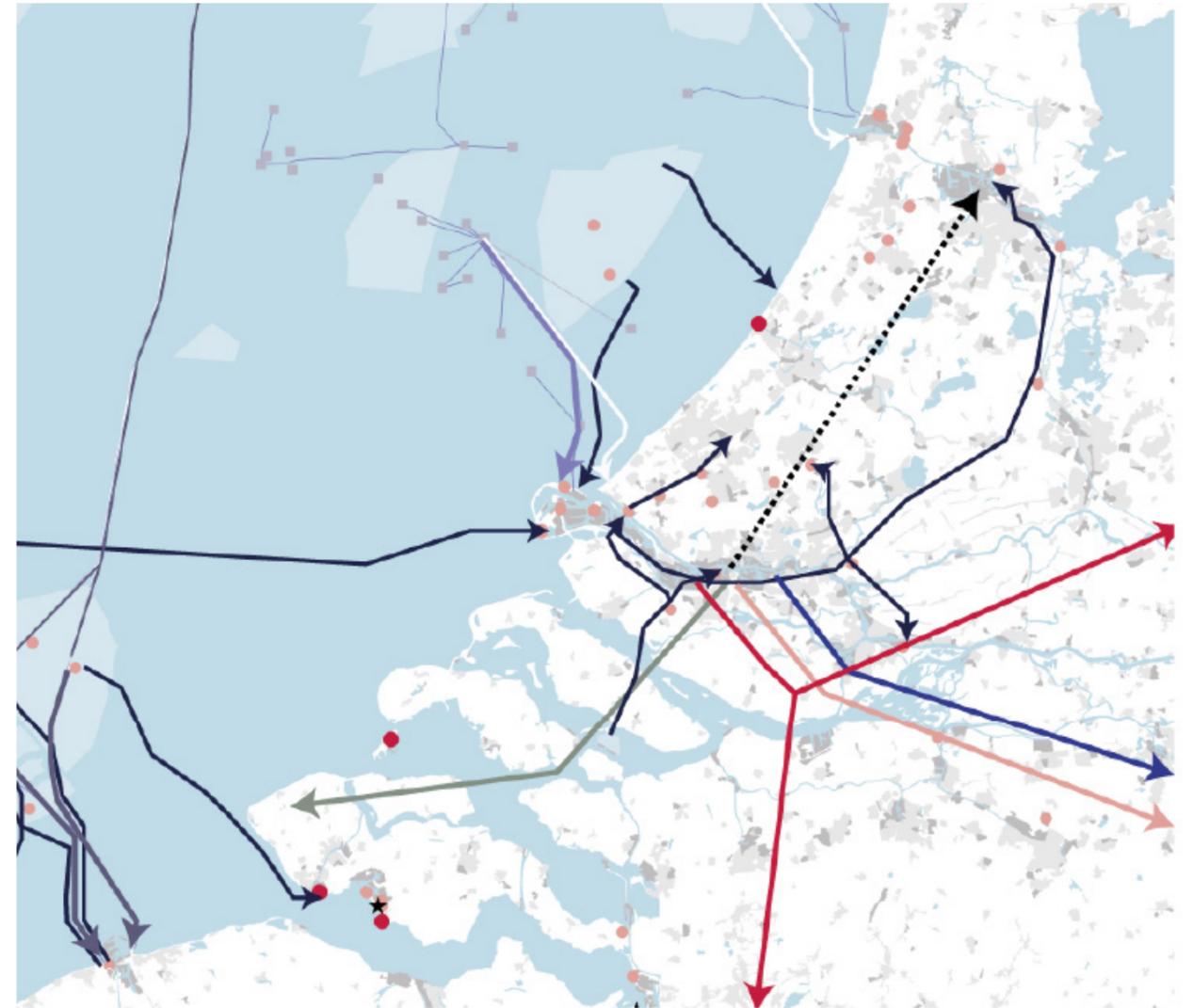


Figure 44: Energy infrastructure in NW Europe



0 10 20 km | N

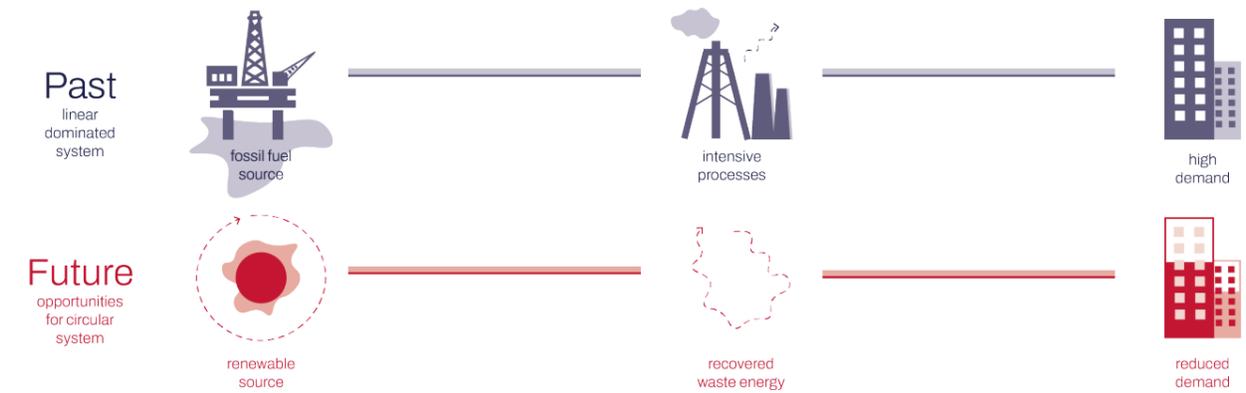


Figure 45: Linear energy landscape

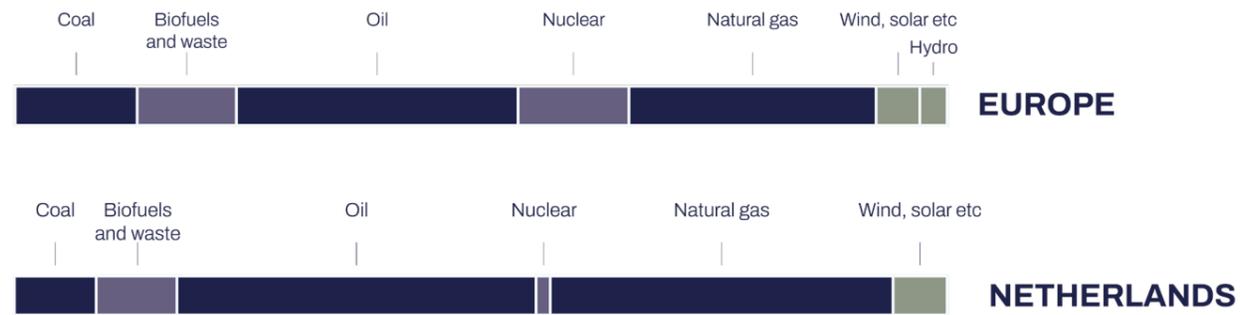


Figure 46: Total energy supply by source

Figure 47: Energy flows in NW Europe

# How are Portscapes linear today?

## Ports are deeply embedded in energy flows

The section in figure 48 shows how linear and carbon intensive the current energy flow system is moving through the Portscape. It is clearly visible in the section by the arrows that are not cycling back to the start point. The path is linear as the energy present in one step is transferred to the next; it moves in a fixed direction. This is seen in the energy flows of the energy distribution that are not returning.

In addition, the current energy system has a huge impact on the surrounding spaces of the Portscape because of the energy processes that are releasing air pollutants. The offshore raw material sourcing also takes a huge part in this.

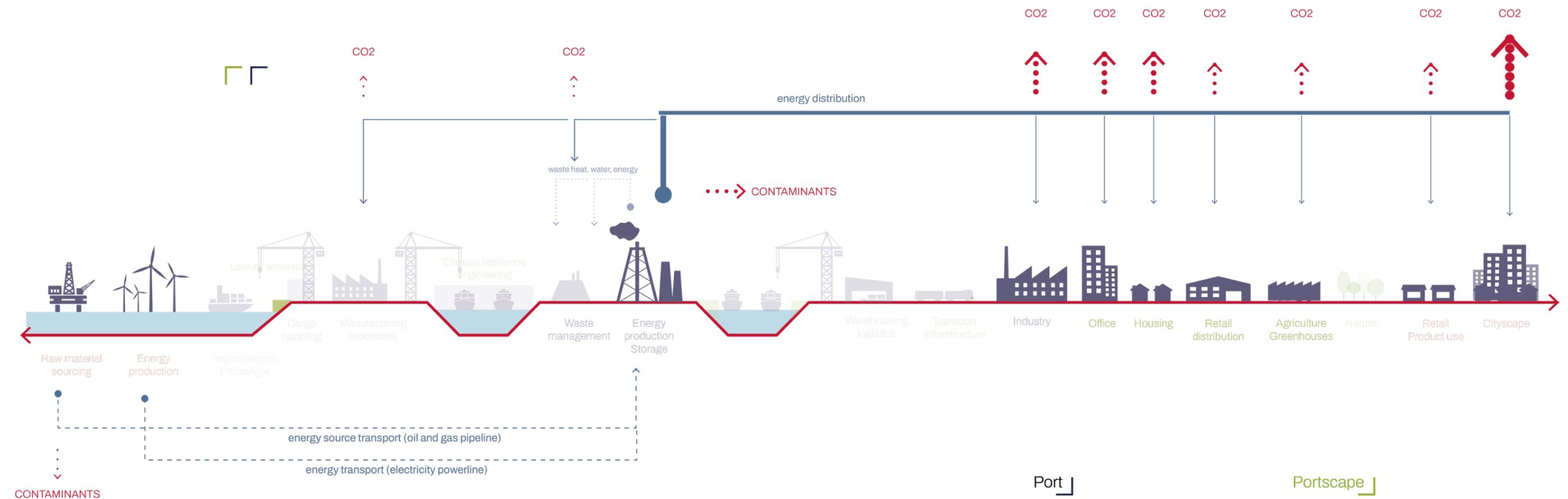


Figure 48: Energy flows in the Portscape

# How are Portscapes linear today?

## Portscapes currently support linear waste flows

The flows of the waste in the Portscape are part of this linear economy. Figure 50 shows that there are a lot of efforts in trying to close the loops, which can be seen by the amount of Milieustraten, Milieuparken and recycling centres. However, the current waste system is still very linear; most of the waste flows just go from industrial or residential area to the waste disposal. There are some recycling centres, but it is not enough to make it into a circular economy.

Another aspect that stands out is that there are more flows going towards the Portscape instead of going out of the Portscape. This can be explained because of the amount of waste disposal and waste processing companies in the Portscape.

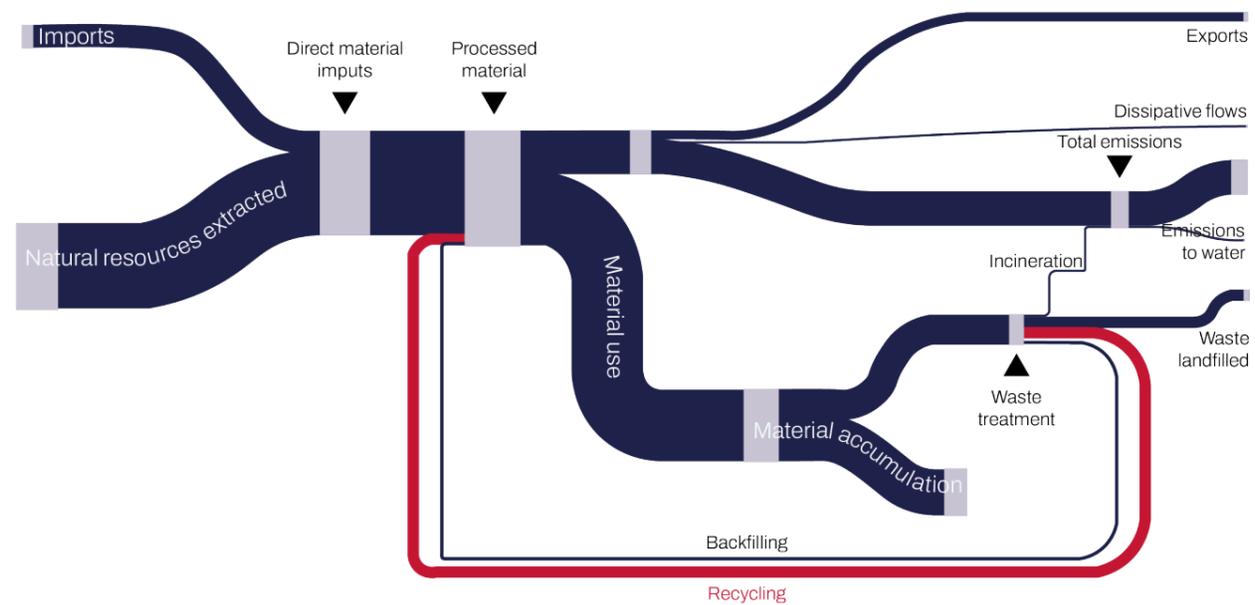


Figure 49: Waste flows Sankey diagram



Figure 50: Waste flows in NW Europe

# How are Portscapes linear today?

## Portscapes currently support linear waste flows

The section in figure 51 depicts that the waste management also releases contaminants. This makes the linear processes in the waste flows a polluting system which can hurt the climate and the surroundings of the Portscape, which are mostly natural areas. This may cause a loss of biodiversity. This leads to the following conclusion that the linear waste flows affect the nature flows.

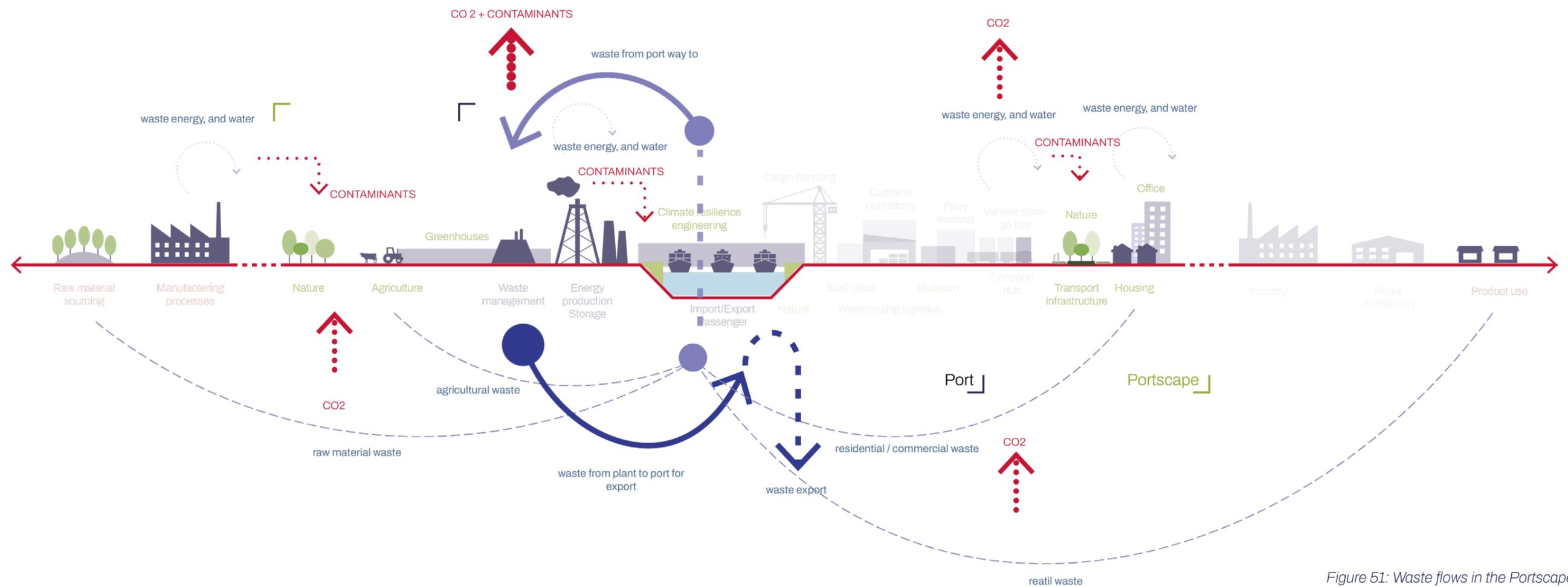
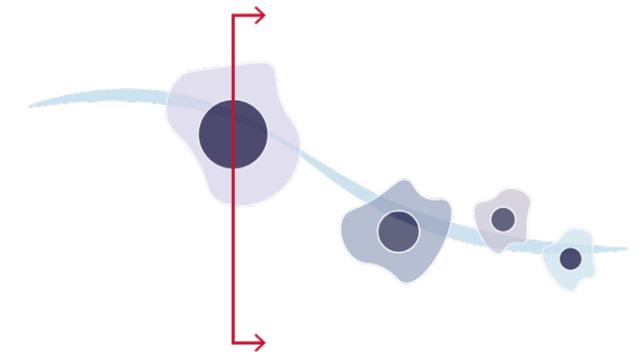


Figure 51: Waste flows in the Portscape

# How are Portscapes linear today?

## Portscapes infringe nature flows

As is shown before, ports are surrounded by nature area's and flora and fauna. Therefore these nature areas are affected by everything that happens in the port. This means air, water and soil pollution that will enter the ecosystems.

On top of that, other forms of pollution will also have a big impact. Port activities provide a lot of noise pollution that for example can affect the surrounding animals, especially those living in or near marine environments.

For example, it can cause disruption of communication, as certain animals rely on sound for communication, navigation and finding their food. They might also be displaced from their habitats due to noise disturbances. Light pollution also impacts wildlife as it causes disruption of natural cycles because of wildlife relying on natural light cues.



Figure 52: Nature flows in NW Europe

# How are Portscapes linear today?

## Portscapes infringe nature flows

Port infrastructure can also directly impact the habitats. For example, when the flood prevention gates in the river will be closed, the migration and movement of water species might be blocked. So not only the port activities with their contaminants, but also the physical structure of the port itself impacts the nature life.

Nature flows are also definitely linear flows. The processes in nature are not circular as there is nothing being regenerated. The nature gets polluted and used for other practical uses, rather than just letting the nature be nature and be biodiverse.

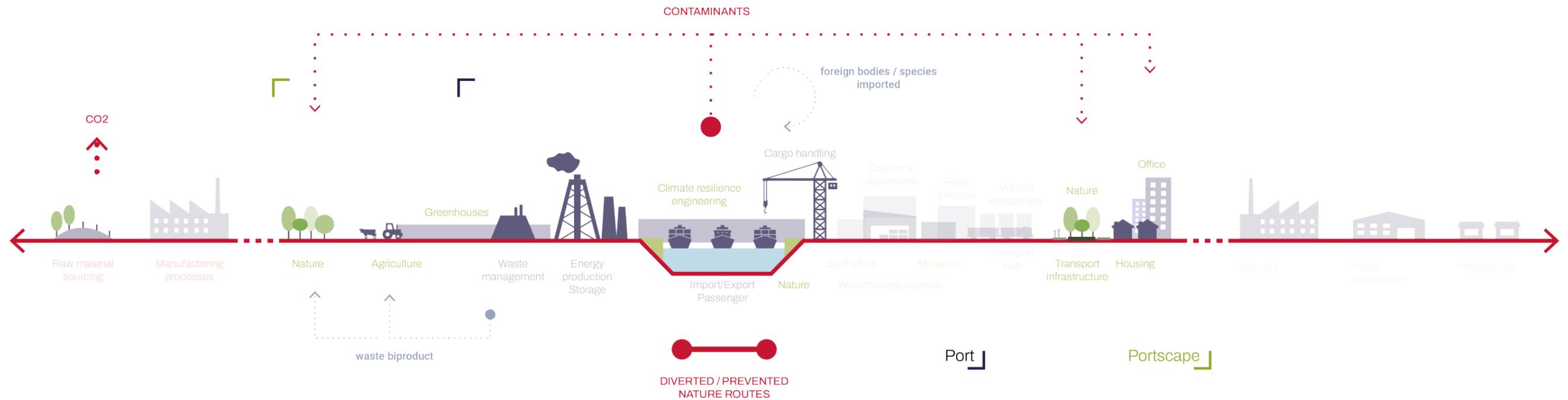
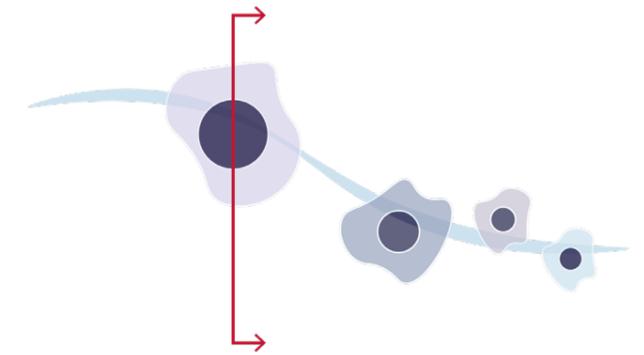


Figure 53: Nature flows in the Portscape

# How are Portscapes linear today?

## Portscapes are central in goods flows

The goods flows are on an international scale in contradiction to the previous flow as the waste flows were on a regional scale. The ports play a major role in importing and exporting goods, as they provide a great infrastructure towards the hinterland, and they contain a lot of space which is used for storing the goods. It is important to acknowledge that goods are not only limited to physical goods, but also immaterial goods like knowledge. The goods flows also have a spatial impact on ports and Portscapes; physical impacts like warehouses, logistic centres, and multimodal transport infrastructure are needed.

To link the goods flows to the linear system, it is important to realise that the use of the goods is mostly single use. Consuming these single uses, causes that the goods flows are embedded in the other linear flows. So actually, people are the enablers of these goods flows. This brings another aspect into the light; the debate of responsibility. It can not be stated that it is the users' fault, or that it is the producers' fault. People don't have the choice of what is available in the grocery stores, but they also have some power as demand equals offer. If people use their group power to reduce the demand of specific linear goods, then those things will be produced less.

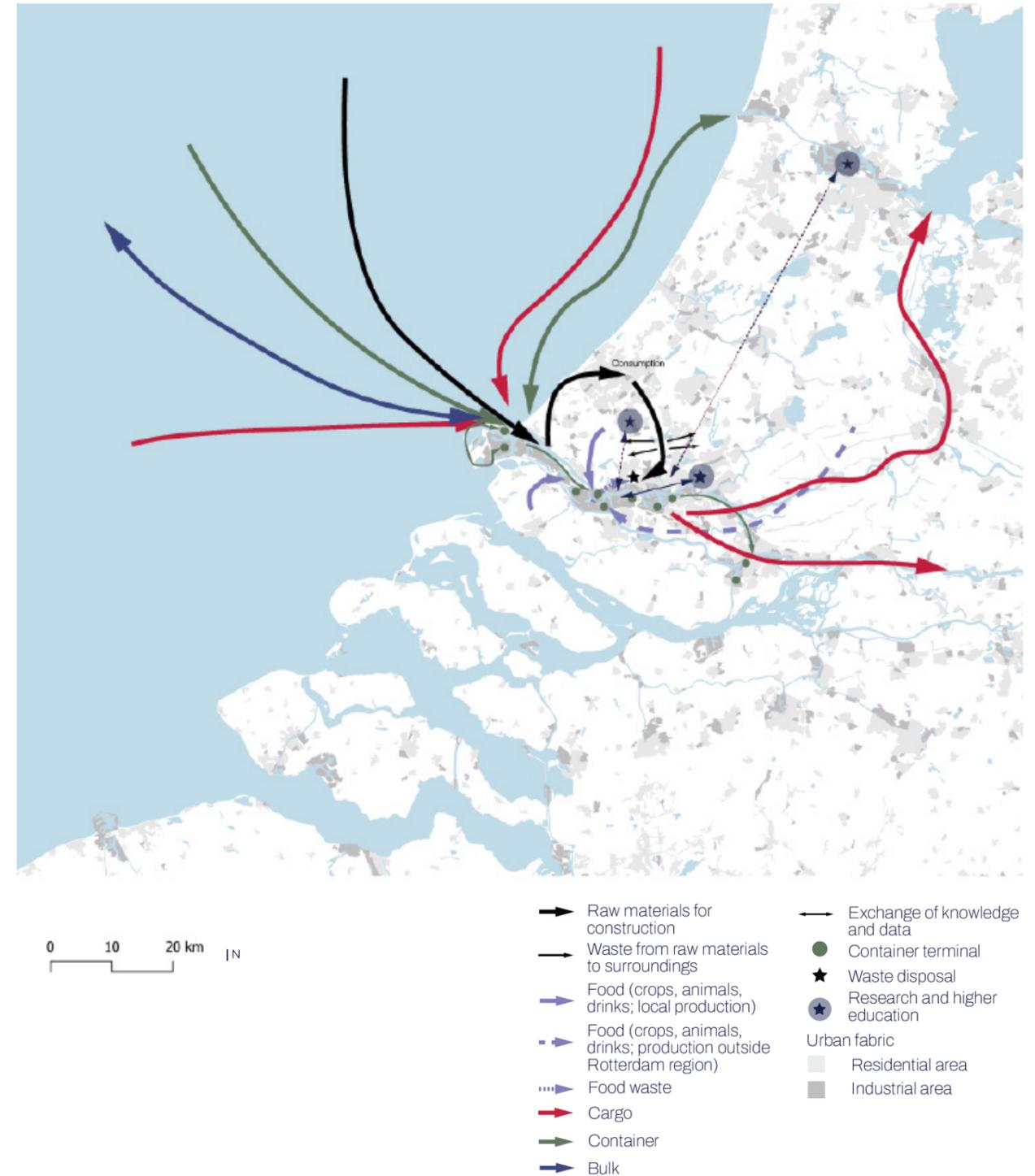


Figure 54: Goods flows in NW Europe

# How are Portscapes linear today?

Portscapes are central in goods flows

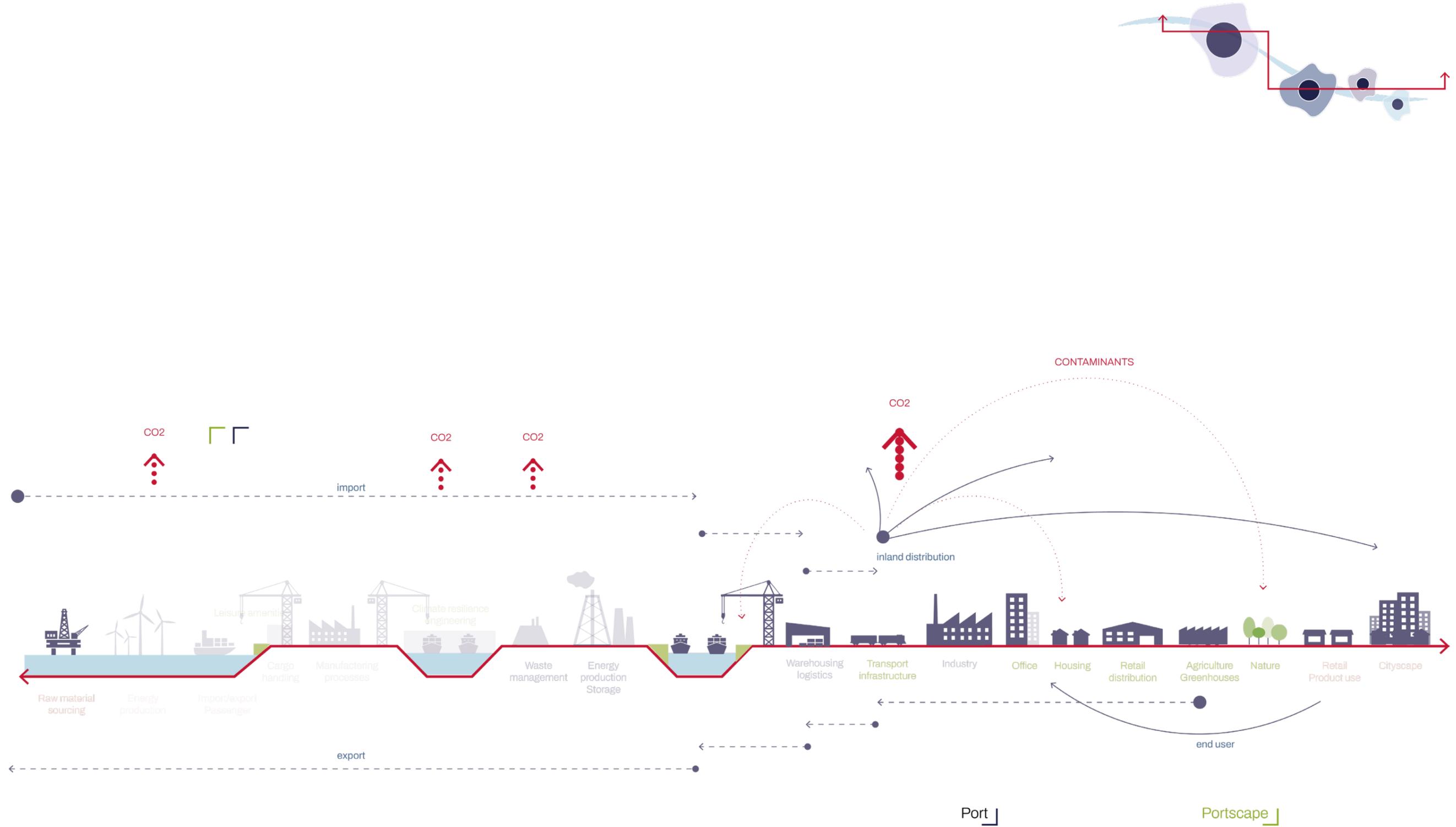


Figure 55: Goods flows in the Portscape

# How are Portscapes linear today?

## Portscapes enable people flows

The people flows have a lot of actors involved on different scales. This includes international passenger flows like tourism, while on a smaller scale, this is more about regional tourism. Inhabitants from the residential area go to the Portscape as well, which could be visiting the recreational sites there. Inhabitants are also going to the Portscape for local jobs, which creates another new type of people flows. Like nature and wildlife, people are directly and indirectly affected by the port activities that are happening. As mentioned before, this is caused by visual, noise and smell pollution.

Another flow would be people using the transport of the Portscape. Portscapes are used a lot as transport hubs for the train, bus, and ferry. But the current public transport is very carbon intensive. This also makes people the enablers of linear energy and waste flows. It can be said that people are embedded in these other flows. Thus, people are part of the linear flows.

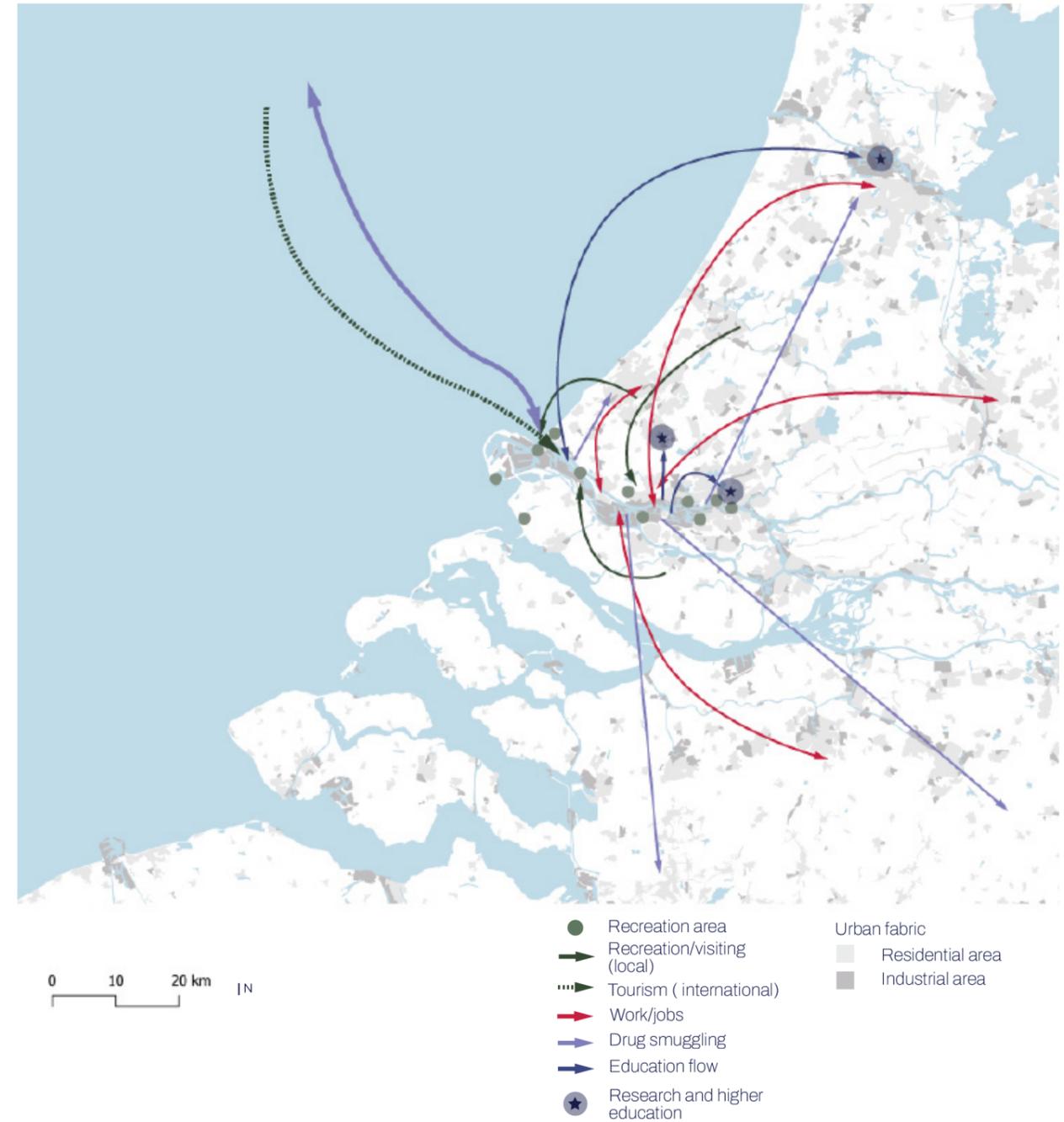


Figure 56: People flows in the NW Europe

# How are Portscapes linear today?

Portscapes enable people flows

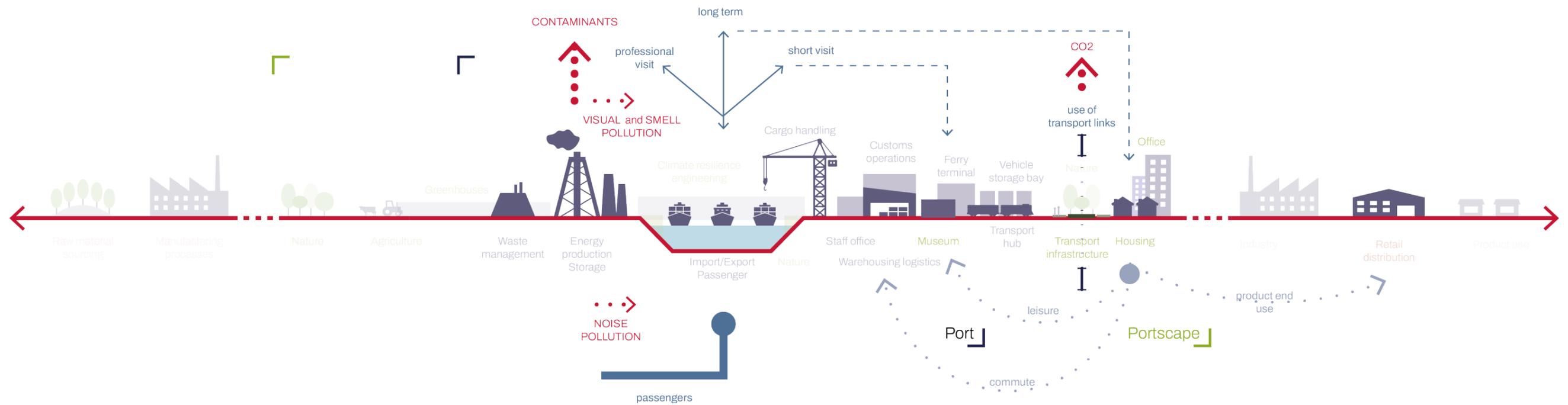
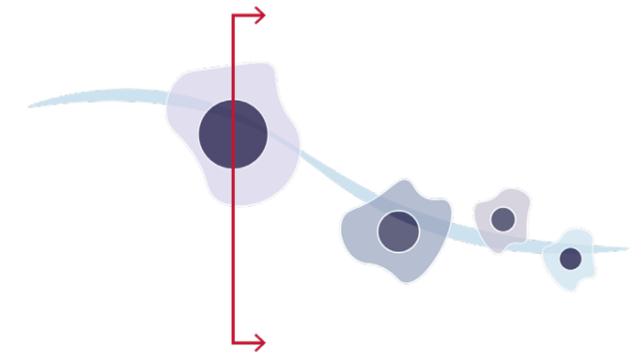


Figure 57: People flows in the Portscape

# What is the Eurodelta Port Landscape?

## Ports are central in international geopolitics

Public actors play an important role in the transition to a sustainable and circular port. They are involved in policy and implementation of measures that affect the port and its surroundings. These public actors could be subdivided into different governmental scales and have different responsibilities: EU, Rijksoverheid (State), Province, Municipality and Port Authority.

The EU plays a role in funding and market regulations and has a relatively high power. They are responsible for the management of Port Landscape across Europe. The state makes sure the policies of the EU are implemented. They mainly look at the national port and spatial planning. The province looks more at regional spatial planning in which it is responsible for the implementation of regional infrastructure. Municipalities are responsible for regulating the port and its services. In here, local infrastructure and accessibility are important through detailed spatial planning. The port authority itself focuses on the overall port development and are accountable for land allocations, internal port infrastructure and nautical safety.

Each Country within the Eurodelta Port Landscape has its own goals in which the public actors are responsible for. Besides that, these public actors could invest in other actions like research funding, knowledge sharing and stakeholder engagement. In here, a proactive multi-governmental approach would speed up the transition to a circular port.

- **Public Services**
- P1 EU
- P2 Rijksoverheid (State)
- P3 Province
- P4 Municipality
- P5 Port Authority
- **Businesses**
- B1 Energy Companies
- B2 Fossil Fuel Companies
- B3 Chemical Companies
- B4 Waste Collection Companies
- B5 Construction Companies
- B6 Cargo Companies
- B7 Shipping Lines / Companies
- **Community**
- C1 Residents
- C2 Employees
- C3 NGO's
- C4 Nature
- C5 Future Generations
- C6 Farmers
- **Knowledge**
- K1 Universities
- K2 Research Institutes
- **Financial Capital**
- F1 Land owners
- F2 Investors
- F3 Housing Corporations

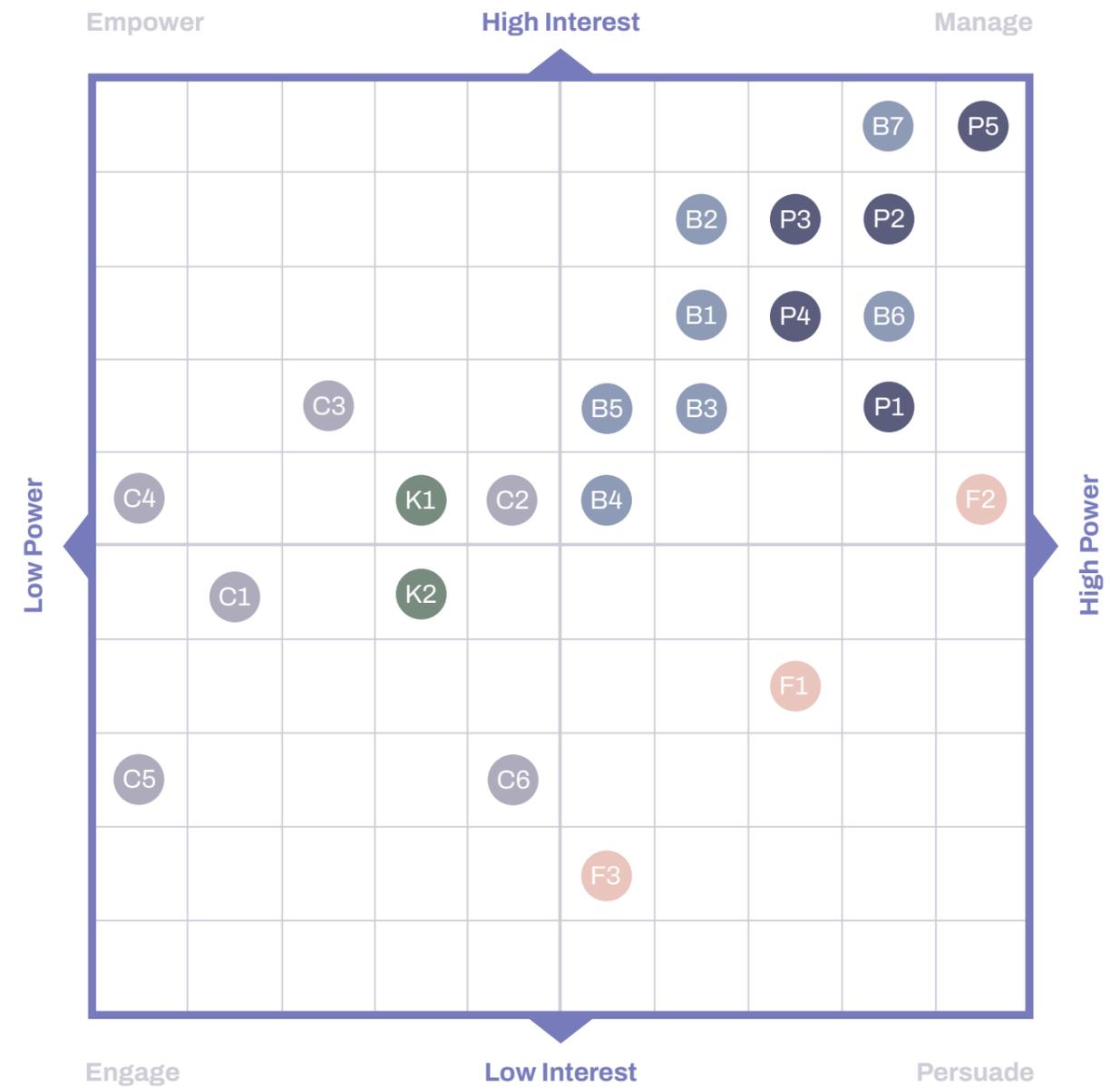


Figure 58: Current Portscape power / influence matrix

# What is the Eurodelta Port Landscape?

## Eurodelta Portscape types

### Introducing the Port Landscape

For centuries, European port cities have been the beating heart of European progress and developments. These Portscares are deeply interconnected, facing similar challenges, and have engaged in continual global and local exchanges with each other (Hein, 2023). The shared characteristics of Portscares begin with their relationship to the city, the sea, and maritime activities, extending into spatial, economic, political, social, and cultural patterns. The stakeholders of each Portscape include a port authority - often highly influential and linked with national authorities - and various local actors and groups of citizens, often less influential. However, each Portscape has developed its own characteristic spatial strategies and relationships with their cities and stakeholders over time.

Collaboration among ports relies on their willingness to engage and the availability of shared resources. However,

currently, only a few institutions actively promote collaboration across port city territories, hindering efforts to address current challenges like sea-level rise and climate-related changes

### Scope of type study

We have chosen to select the Portscape of Antwerp, Hamburg, Duisburg, and Rotterdam for a deeper analysis of different types of Portscares due to their (historical) significance, economic impact, and diverse characteristics. These cities represent a spectrum of Portscares, ranging from traditional maritime hubs like Antwerp and Rotterdam to the largest inland port of Duisburg.

Antwerp and Rotterdam are two of Europe's largest and busiest seaports, serving as vital nodes in global trade networks. They have well-established relationships with their respective cities, deeply ingrained in their economic,

social, and cultural fabric. In contrast, Hamburg boasts a rich maritime heritage but also serves as a vibrant urban centre, showcasing a unique blend of historical port infrastructure and modern city life. Duisburg, although located inland, is a critical logistics hub due to its connectivity to major waterways and rail networks, highlighting a different dimension of port-city relationships.

Analysing these Portscares offers insights into the different dynamics between Ports and their urban surroundings. Understanding the nuances of these Portscares is crucial for developing effective strategies to address contemporary challenges such as sea-level rise and climate change, which will need collaborative efforts across different stakeholders and territories.



Figure 59: Legend for Port type maps

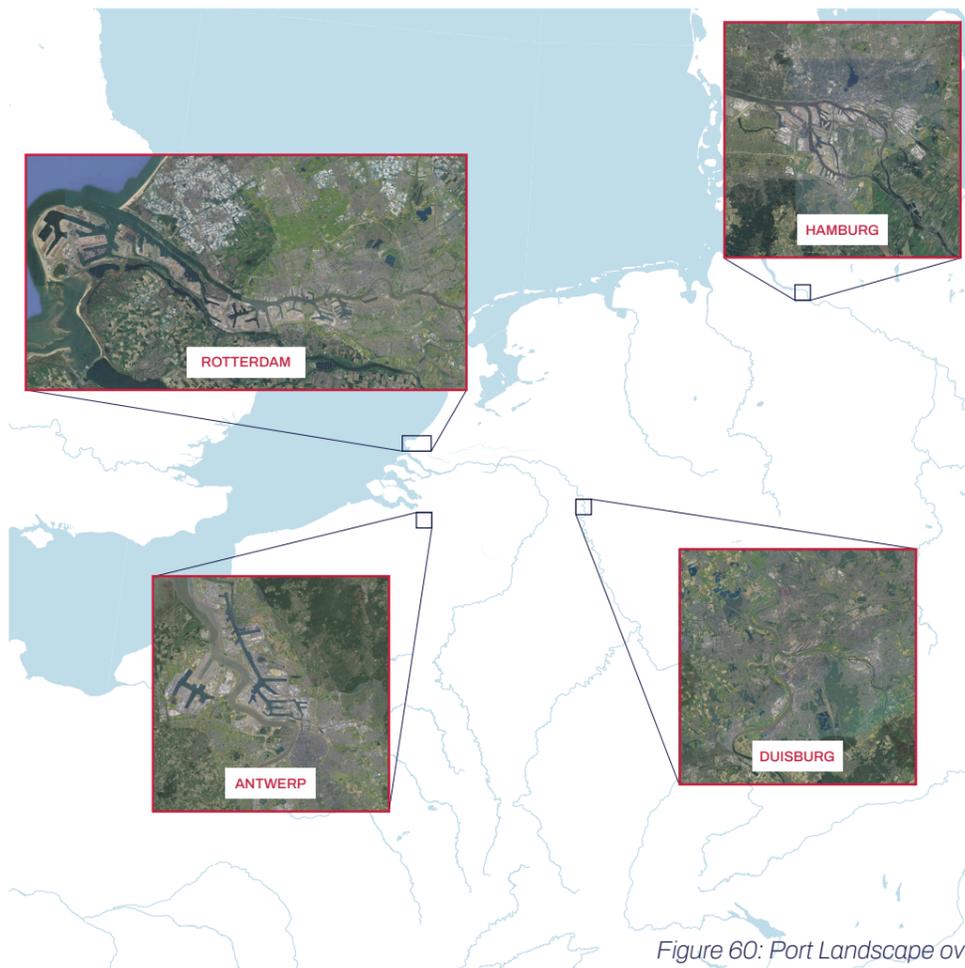


Figure 60: Port Landscape overview - aerial

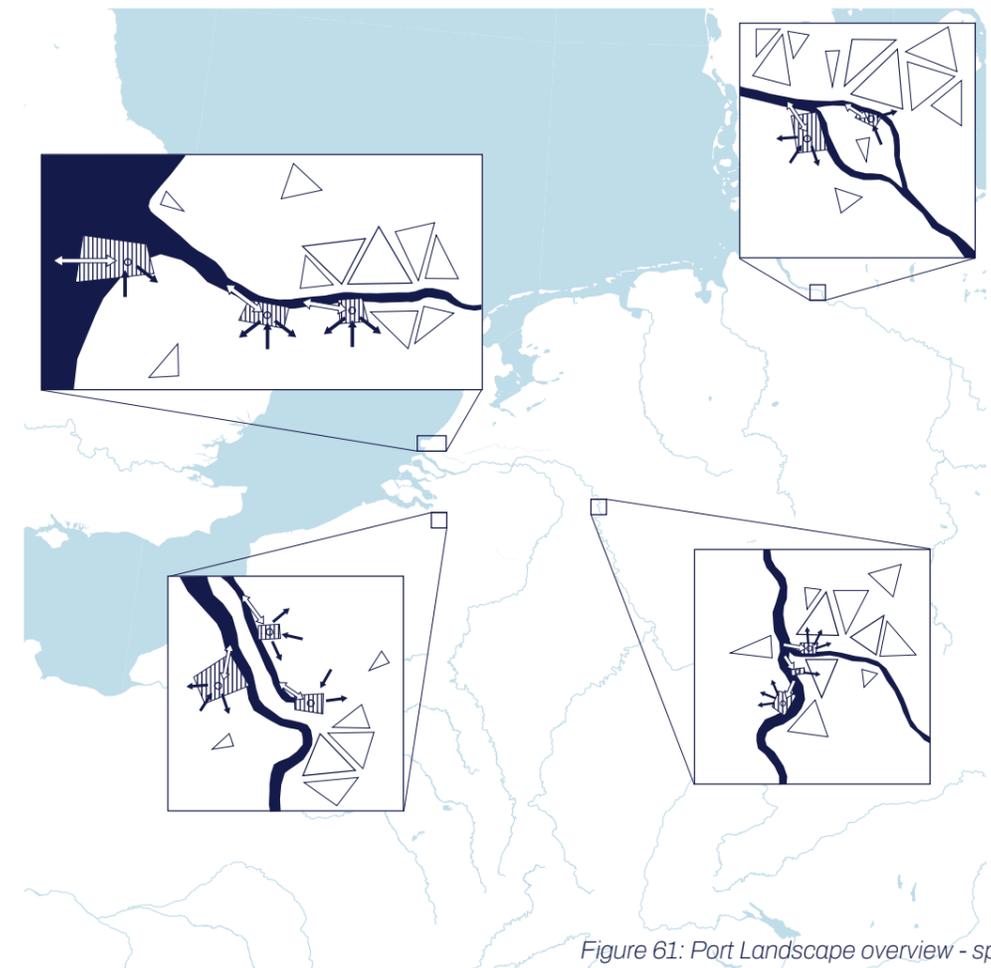


Figure 61: Port Landscape overview - spatial relation



Figure 62: Portscape of Antwerp

### Antwerp

The Portscape of Antwerp presents the second largest port in Europe with its interconnected city and other surrounding areas. Stretching beyond the harbour, there are numerous nature reserves in the Portscape area, lively waterfront promenades along the banks of the Scheldt River, education clusters, and cultural landmarks connecting port, people, and city.

In the port, containers and liquid bulk make up the largest share of total throughput (Port of Antwerp, 2023). The port is located on the Scheldt and has a maximum depth of 15.5 metres during high tide. The port area covers approximately 12,000 hectares (Port of Antwerp, 2023). The pie charts show the modal distribution of further transport into the hinterland of maritime freight. The port is also home to the largest integrated chemical cluster in Europe; various global players in the chemical production sector are based in Antwerp, either logistically or with a production unit (Port of Antwerp Bruges, 2024). The four biggest refineries (Total, ExxonMobil, Gunvor Petroleum Antwerp, ATPC) and the three steam crackers in the port ensure a stable local availability of fossil resources.

To ensure an active port in the future, the port needs to attract other sectors to offset the reduction of petroleum in the future. The port currently places great emphasis on recycling opportunities (Port of Antwerp Bruges, 2024). Central to these current strategies are the recycling hubs that fill the missing link for closing loops. These hubs organise reverse logistics of end-of-life products and process sorted and pre-treated waste streams with high-tech (chemical) recycling into circular raw materials (Port of Antwerp, 2021). The port of Antwerp now has many recycling opportunities, more than most other ports, and therefore aims to build on and enhance this extensively.

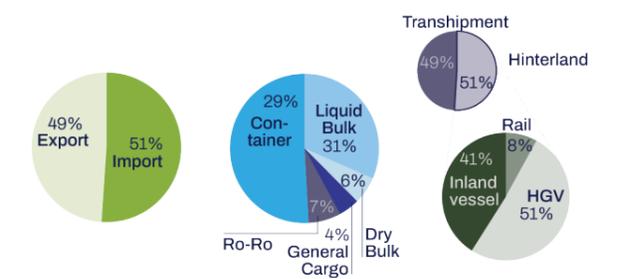


Figure 63: Portscape of Antwerp - cargo



Figure 64: Portscape of Hamburg

### Hamburg

The port of Hamburg, the fourth largest in Europe, predominantly handles containers in its operations (Port of Hamburg, 2023). Containers dominate its throughput. Wet and dry bulk constitute a minor proportion of its remaining activities. Situated on the Elbe, the port has a maximum depth of 15.10 metres at high tide, comparable to Antwerp. What stands out is a difference in transport modes compared to other ports: a significant portion of goods is transported by rail, approximately 41%, while pipelines and inland waterways are rarely used for hinterland transport.

Due to its current functions, it is currently not expected that the port of Hamburg will undergo as significant a transformation in the near future as other ports might (Studio Marco Vermeulen, 2021). Nevertheless, the port serves as a significant hub for scrap, where steel and other metals are recycled. This includes metal waste originating from port activities, households, and businesses in the city, contributing to a circular economy by upgrading (residual) streams from the city in the port.

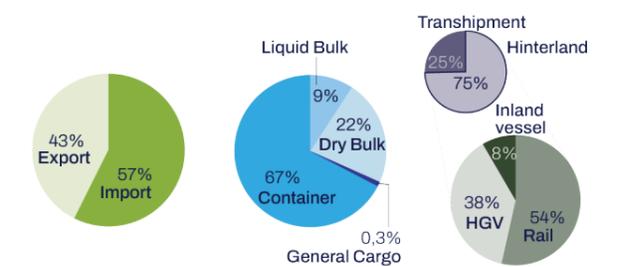


Figure 65: Portscape of Hamburg - cargo



0 2.5 5 km | N

Figure 66: Portscape of Duisburg

### Duisburg

The port of Duisburg is the world's largest inland port and leading logistics hub in Central Europe (Duisport, 2023). The port is located in the Ruhr area, in the heart of Europe's largest consumer market with more than 30 million consumers. The Rhine, Europe's most important waterway, links the port of Duisburg directly with the sea ports of Rotterdam, Antwerp and Amsterdam as well as the European inland waterway and canal system. Noticeable is a large quantity of goods, immense amounts of coal among other things, coming in from Rotterdam.

Duisburg produces more steel than any other city in Europe. Disused production facilities now bring a new quality to the Portscape of Duisburg and have been imaginatively transformed (Duisburg am Rhein, 2024). They are now among the world's most unique monuments to industrial heritage: former factory sites now offer culture, sport and other leisure activities in an exciting setting.

Current strategies show that Duisburg's ultimate goal is to stimulate cargo handling in the Mediterranean region (Duisport, 2018). This will then reduce maritime transport flows towards the North Sea ports. This means that new, stable train connections in the south-north direction are in demand for the Portscape of Duisburg.



Figure 67: Portscape of Rotterdam

### Rotterdam

The Portscape of Rotterdam is vast and expansive, with the largest port in Europe, alongside numerous headquarters and offices in the surrounding cities, and important education clusters focused on technological innovations. The magnitude of this port is partly due to its maximum depth of 24 metres and its strategic position on the Rhine and the North Sea, making it particularly suitable for vessels such as oil tankers. Goods are transported from the port to the hinterland, which encompasses around 460 million inhabitants, including destinations like Duisburg in the Ruhr area.

A big range of activities takes place within the port of Rotterdam, hence it is usually referred to as a multipurpose port, although there is a primary focus on the energy sector (Port of Rotterdam, 2023). The pie charts showcase that liquid bulk constitutes the largest share of total throughput. Goods are further transported by road, inland waterways, and railways, with a notable proportion of raw materials (20%) transported via pipelines (not depicted in the pie charts). The qualitative and quantitative transport via pipelines is a distinctive feature of the port of Rotterdam.

Given the important role of the Portscape of Rotterdam in the current fossil fuel energy sector, numerous strategies and pilots are already in place to switch to a more circular and sustainable environment; for instance, extensive experimentation with bio-refining has already started (Studio Marco Vermeulen, 2021). The port's location and size is ideal for the import of resources from all over the world, with lots of possibilities to transport these into the hinterland via the extensive pipeline network and inland shipping. Furthermore, the transition away from fossil fuel facilities will create new space for future and other developments.

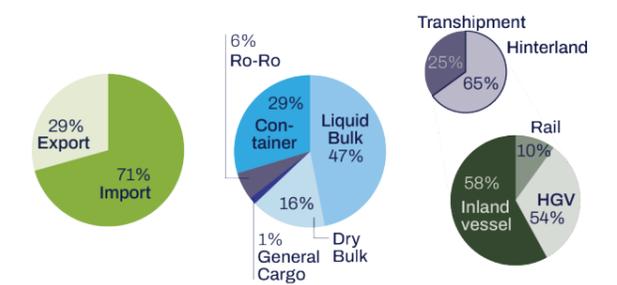


Figure 68: Portscape of Rotterdam - cargo

# What is the Eurodelta Port Landscape?

## Defining the Port Landscape

As a result of the above analysis, we can now characterise Port Landscapes. Indeed, Ports and Port Landscapes don't just affect each other but they also affect the surrounding areas, part of the Port Landscape. This is in terms of pollution, economic impact and geopolitical relations. However, despite their similar base characteristics, we found that each Portscape has its specific relation to the city and, in broader terms, the Port Landscape network, in terms of industrial specialties and interdependent processes. Indeed, Portsapes vary in type, such as Antwerp's emphasis on recycling, Hamburg's role as a container hub, Duisburg's focus on logistics, and Rotterdam's multipurpose port with extensive energy sector involvement. These types all together form a web that we have identified as the Port Landscape, defined below.

Figure 69 illustrates those relations, hinting at not only spatial but also political, cultural and knowledge links and separations throughout the Port Landscape.

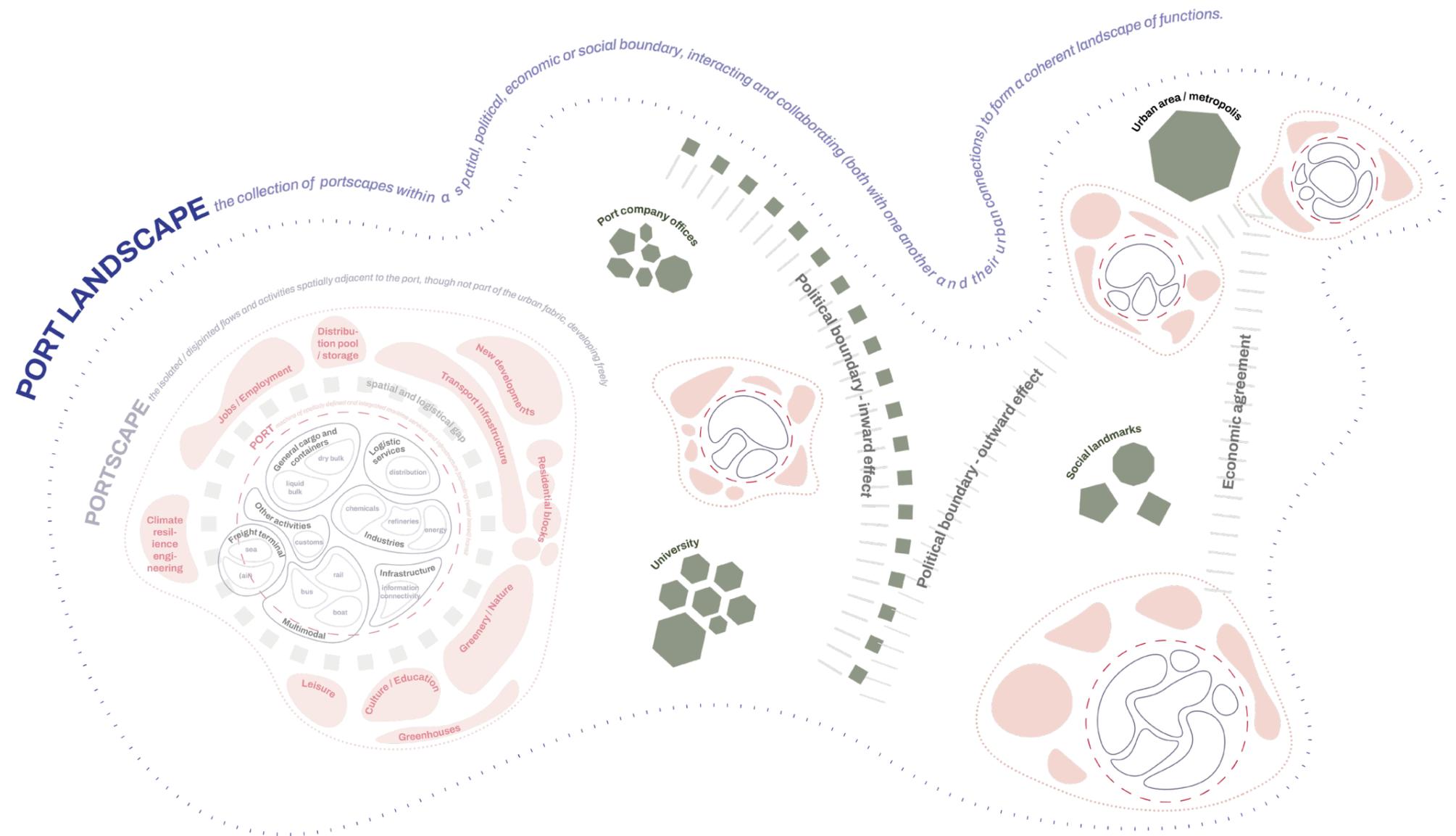


Figure 69: What is a Port Landscape?

# Port Landscape

noun  
/pɔ:t-lænd.skeɪp/

the collection of multiple Portsapes within a spatial, political, economic or social boundary, interacting and collaborating (both with one another and their urban connections) to form a coherent landscape of functions.

# What are the key takeaways?

## Strength and Weaknesses to Opportunities and Threats

### SWOT of Portscapes

The SWOT analysis highlights several key factors regarding Portscapes in the Eurodelta region, with the one of Rotterdam being used as an example for the illustration of the most prominent issues that happen across the Port Landscape. Strengths include their significant economic influence, role as a hub for the local economy, and central position in the infrastructure network. Additionally, the diverse landscape and openness to mindset change are noted as strengths. However, weaknesses such as carbon-intensive operations, negative environmental impacts, and power struggles create challenges. Opportunities lie in creating space for people and nature, leveraging new digital tools, and developing a regional strategy for sustainable port development. Addressing threats such as the expansion of undesirable living environments, socio-spatial segregation, and climate change consequences will require concerted efforts and collaboration.

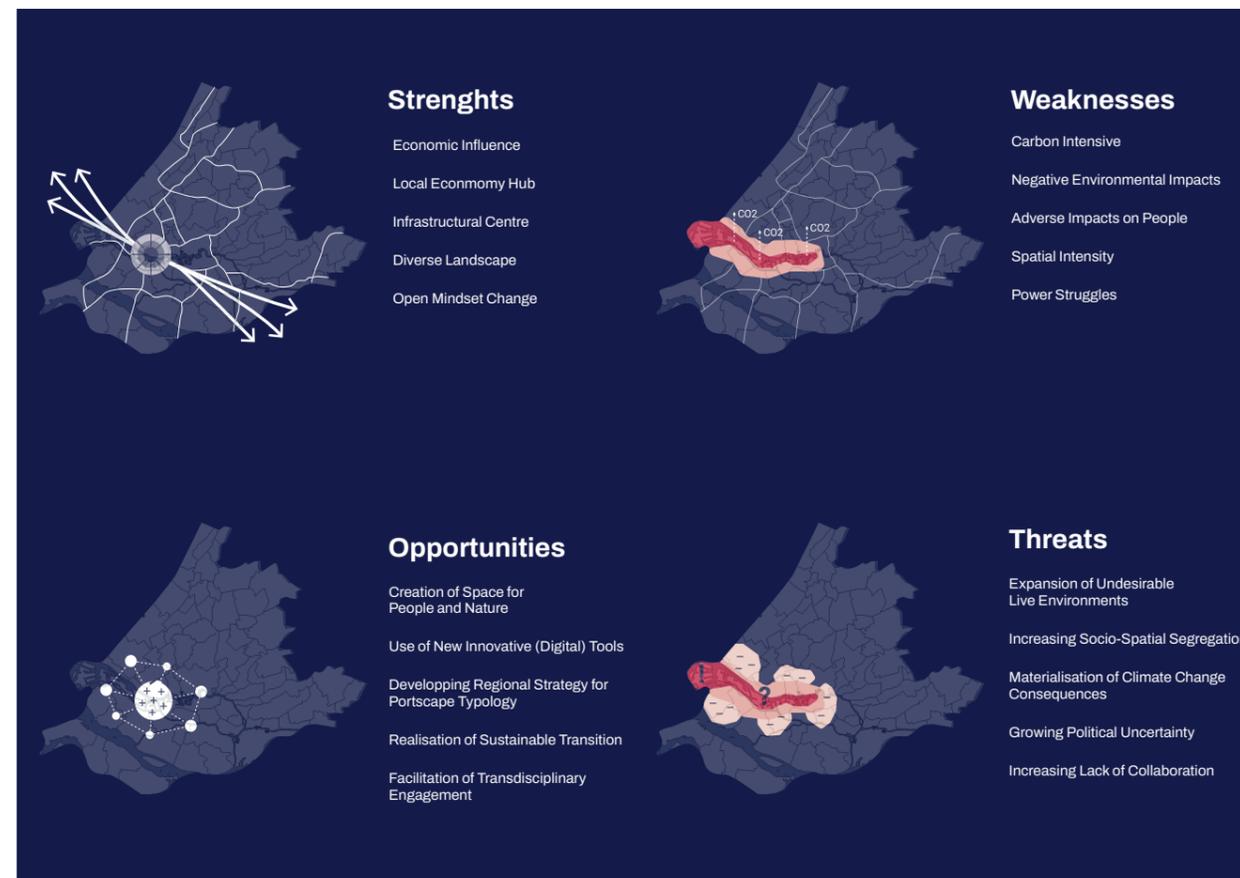


Figure 70: SWOT analysis - visuals based on Rotterdam for illustration purposes

### A combined approach

Combining the elements of the SWOT-analysis allows for specific actions that may later form the basis for objectives. Utilising strengths and opportunities involves enhancing connectivity and accessibility, meeting sustainability goals, and steering economic power through collaborative strategies. Strengths must also be used to counter threats, such as the ongoing Portscape competition and safeguarding strategies aimed to protect people's safety and well-being. Similarly, weaknesses and opportunities call for actions like regenerating port surroundings, transitioning to efficient and smart Portscapes and embracing the circular economy. Addressing weaknesses and threats thus requires avoiding governance aimed at singular issues and moving towards eliminating one-dimensional thinking.



Figure 71: Combined SWOT

# What are the key takeaways?

## Problem statement: Ports of yesterday

Looking at the analysis, we learned about many aspects, but also challenges regarding, ports, Portscapes and Port Landscapes today. We can derive the following problem statement from it:

Ports have been central in the economic development of cities via global trade, job creation and transportation. They are “funnels” and act as catalysts the development of economic sectors and locations near ports. They are also important job generators. Shipping, cargo, and industrial activities and services in port areas generate direct employment effects (Rodrigue and Notteboom).

However they are a typical model of the linear economy and impact their surrounding landscape (the “Portscape”) negatively. They contribute to pollute air, soil and water (on top of noise and visual pollution).

This is relevant because ports operations are carbon intensive and contribute to climate change. They also reduce biodiversity in the adjacent spaces. These go against current efforts for a more environmentally sustainable future in the current climate crisis.

In light of the current climate crisis and global efforts towards environmental sustainability, addressing the people aspect in the context of port operations is also crucial. Balancing economic development with the well-being of the surrounding communities, but also communities further down the flows connected to the Portscape, is really relevant for achieving a transition in a just manner.

### Link to the research questions

We have answered the first two steps of the research questions already in this chapter. Shifting to looking into the future in the following chapters of this report, we are now focusing on the third – and final – step:

- 1. Definition  
**How can Ports, Portscapes and Port Landscapes be defined?**
- 2. Spatial relations  
**What is the impact of Portscapes on surrounding environments and communities?  
What is the Portscape of the linear economy?**
- 3. Envisioning the future  
**What is the Portscape of the future?  
How can Portscapes be key in the transition to a Circular Economy?  
What role do they play in ensuring a just transition?**

We will focus on two key scale: the Eurodelta Port Landscape and the Port of Rotterdam Portscape.

# 03

## Looking into the future

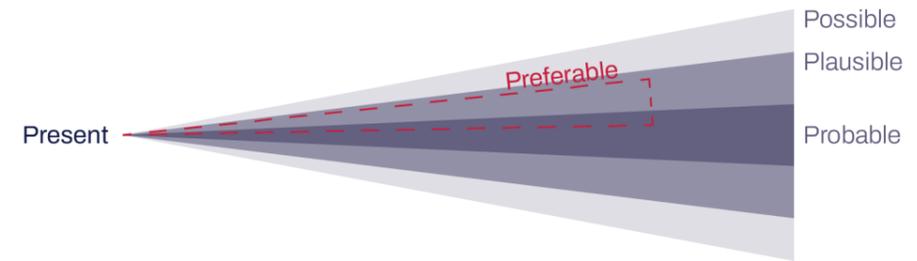


Figure 72: Cone of the future

### Imagine that...

... in the coming decades, Portscapes will be completely sustainable and a model for circularity. The Portscapes will be well-integrated with their direct surroundings and the hinterlands, but also foster connections across European Port Landscapes, strengthening each other in a synergistic network. Beyond their traditional role, Portscapes will serve as spaces for humans, flora and fauna, incorporating recreational areas in a spatially just manner. Fueled by embracing new technologies and innovations, Portscapes will be a dynamic landscape, creating a resilient and regenerative environment for generations to come.

The Portscapes' shift towards complete sustainability and circularity involves an energy transition, where offshore wind energy, sun energy and hydrogen will play a main role. But it also involves a switch from the carbon intensity to secondary raw material systems, to enable recyclables to re-enter the production value chain to reduce dependency on primary resources as a result.

Resource efficiency will be elevated by closing loops, minimising waste, and maximising the utility of materials. Facilitating this big transition for Portscapes requires embracing new technologies and innovations through research initiatives.

Integrating ports, Portscapes and Port Landscapes will be facilitated by increased communication channels, redefined purpose of each port and clarified governance of Port Landscapes, in order to foster collaboration rather than competition.

At the Portscape scale, the uncomfortable adjacent yet separated functions will be no more and developments will be considered both spatially and logistically, ensuring a multidimensionality in all strategies implemented. Alongside this comes the regeneration of spaces for humans, flora and fauna. We cannot act on what we do not know and as such water, air and soil quality will be monitored and reported as part of the Port Landscape strategy. Filtration and regeneration systems will be implemented, with consideration for the local Portscape habitats and inhabitants. This will be achieved in collaboration with knowledge sources such as research centres and universities. Finally, our circular ports, Portscapes and Port Landscapes will consider socio-spatial justice: Portscapes are currently an example of inconsiderate planning in terms of social justice. We will avoid ripple effects and promote a more just planning by adopting collaborative, transparent and engaged / engaging planning processes.

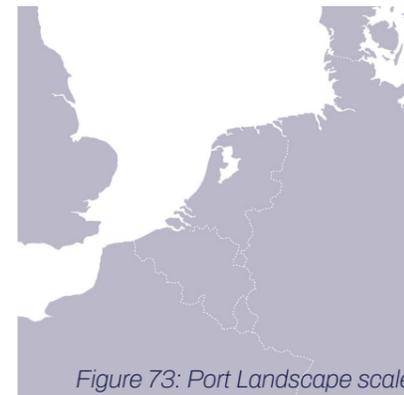


Figure 73: Port Landscape scale

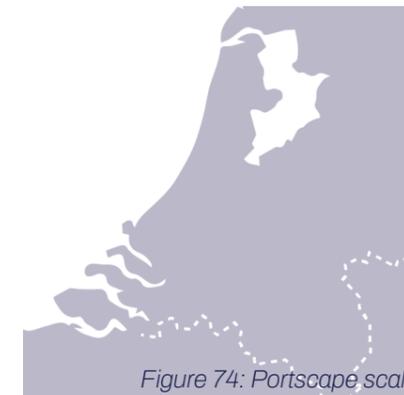


Figure 74: Portscape scale

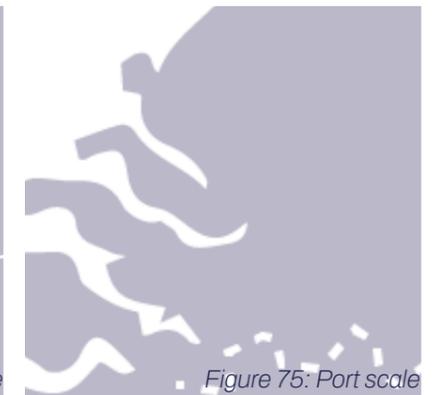


Figure 75: Port scale

# What are our key objectives?

## A sustainable Eurodelta

### Our objectives

The process of development of our vision is depicted in the graph on the right: Our vision for the future of the Eurodelta is informed by several external drivers. Against this backdrop, our overarching goal of a sustainable Eurodelta emerged. This ambition then translates into the specific goal of our vision: the transition to sustainable and circular Portscapes across both the coast and hinterland.

We refined this vision into five actionable objectives: Better integration among ports, enhancing resource efficiency by closing loops, improved conditions for both human inhabitants and local flora and fauna, embracing technological innovation and last but not least facilitating a transition that is not only environmentally sustainable but also socially just, ensuring equitable outcomes for all stakeholders involved.

Our vision objectives are woven into the (theoretical) fabric of the seven cycles of care, aligning with the bio-geochemical, ecosystem, resource, political, economic, knowledge, and social cycles that underpin sustainable development. Through this, we aim to achieve a future where the Eurodelta thrives as an example of sustainability and resilience, setting a precedent for coastal regions worldwide.

On the following pages, we are explaining the vision further by presenting each objective in detail, both for the Eurodelta as a whole, as well as for our exemplary zoom-in, which is the Portscape of Rotterdam.

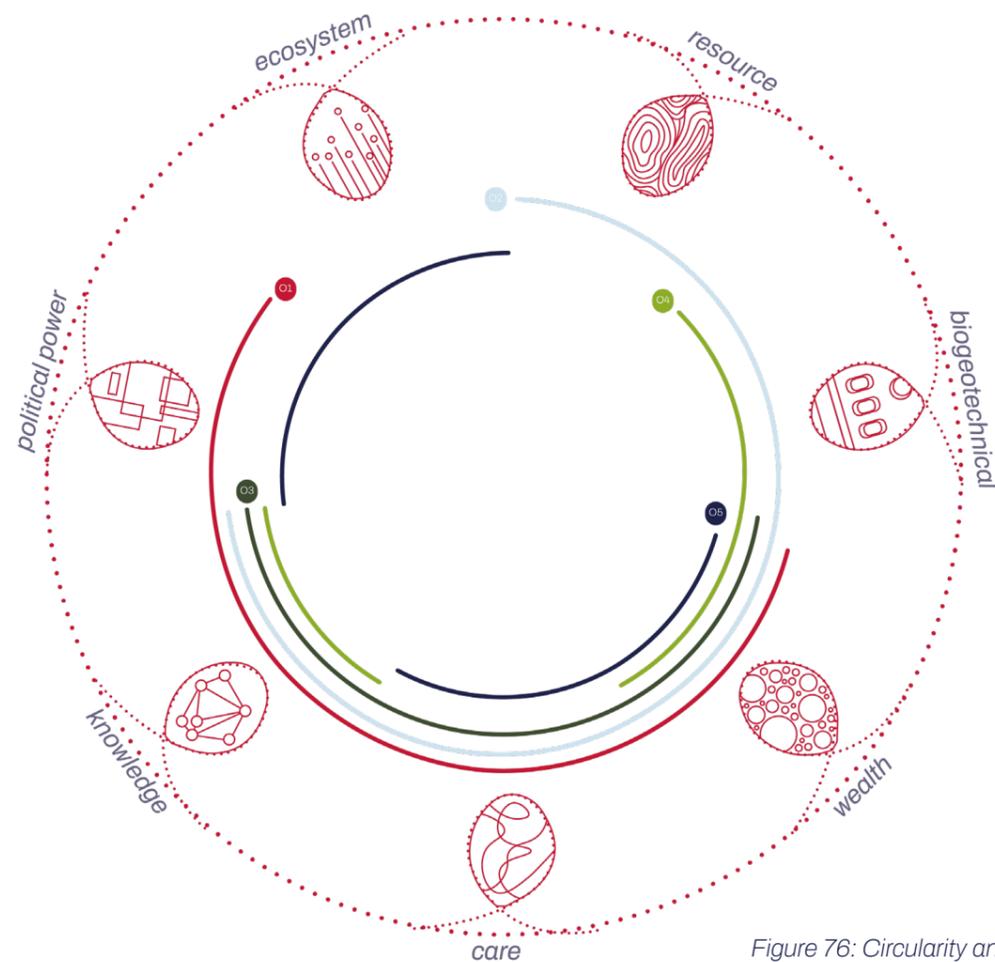


Figure 76: Circularity and objectives

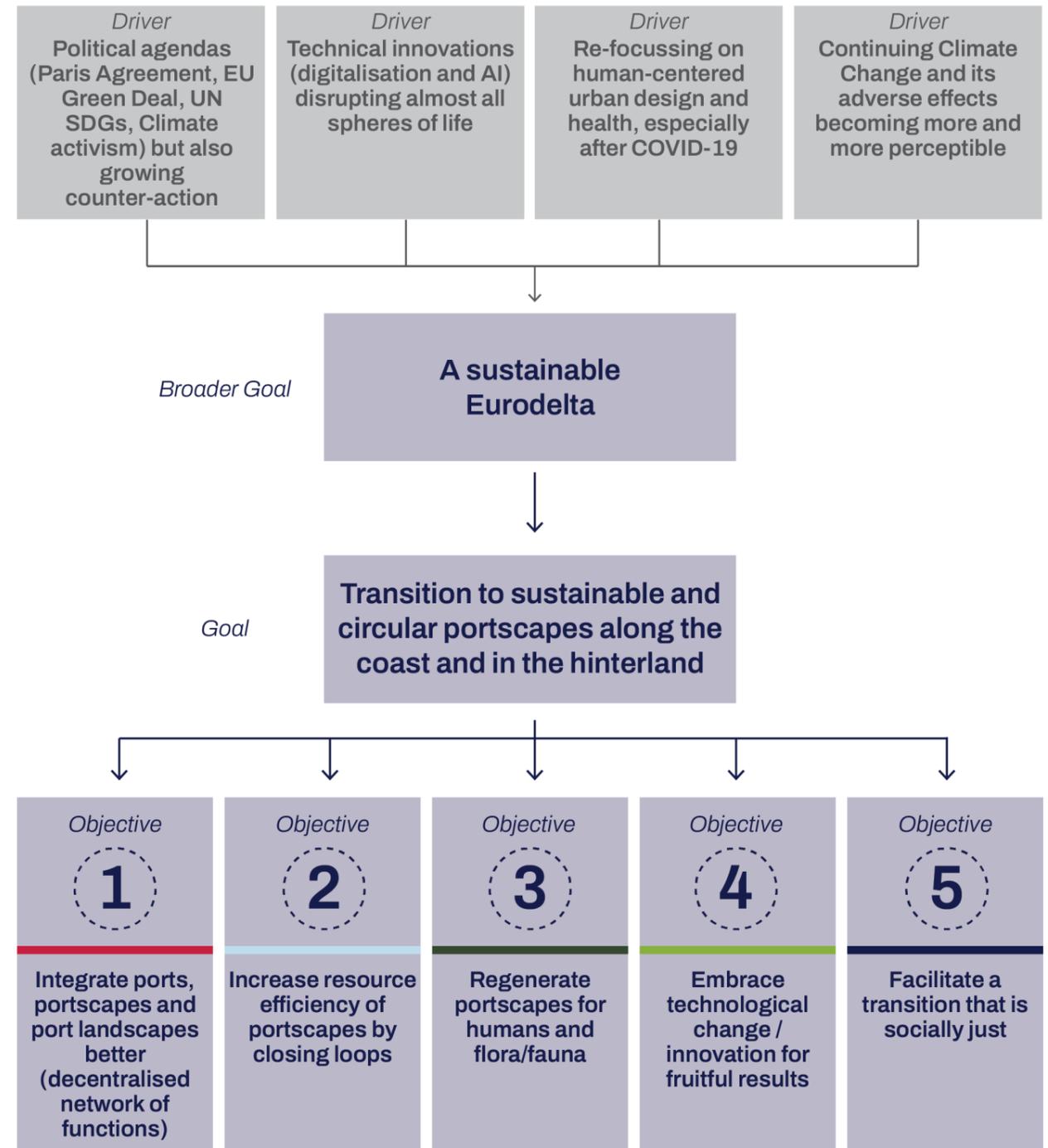


Figure 77: External drivers and objectives

# What is the future Portscape?

## OBJ 1 - Integration

### North-Western Europe

This objective aims at integrating ports with their surrounding landscapes to reduce physical and perceptual barriers. In doing so, we are recognising both the issues of peri-urban areas in future Portscape development and also the intermingling of urban and rural elements in this type of space, which we want to embrace and develop further in a positive way. On a larger scale, we shift from competitive strategies towards collaborative approaches, promoting a smart division of functions within the Eurodelta Port Landscape. Therefore, we develop a decentralised network of port functions, allowing for efficient resource allocation and minimising duplication of infrastructure. This approach focuses not only on the ports, but also along the transport chains into hinterland.



*“I am happy that we were successful in creating new areas that intermingle the port and neighbouring areas a lot more!”*

Jan, the Urban Planner (Rotterdam)

### South-Holland

On the South-Holland scale we want the port to be better integrated with the hinterland. This should improve the efficiency of the transportation and logistics network. With a better integration, the Portscape contributes to the resilience of supply chains. The well-connected network lets businesses better respond to disruptions and makes . The improved connectivity between ports and hinterland will stimulate economic development as well. It should encourage investment, industrial growth and job creation in both port cities and inland areas. This efficient integration will also contribute to environmental sustainability.

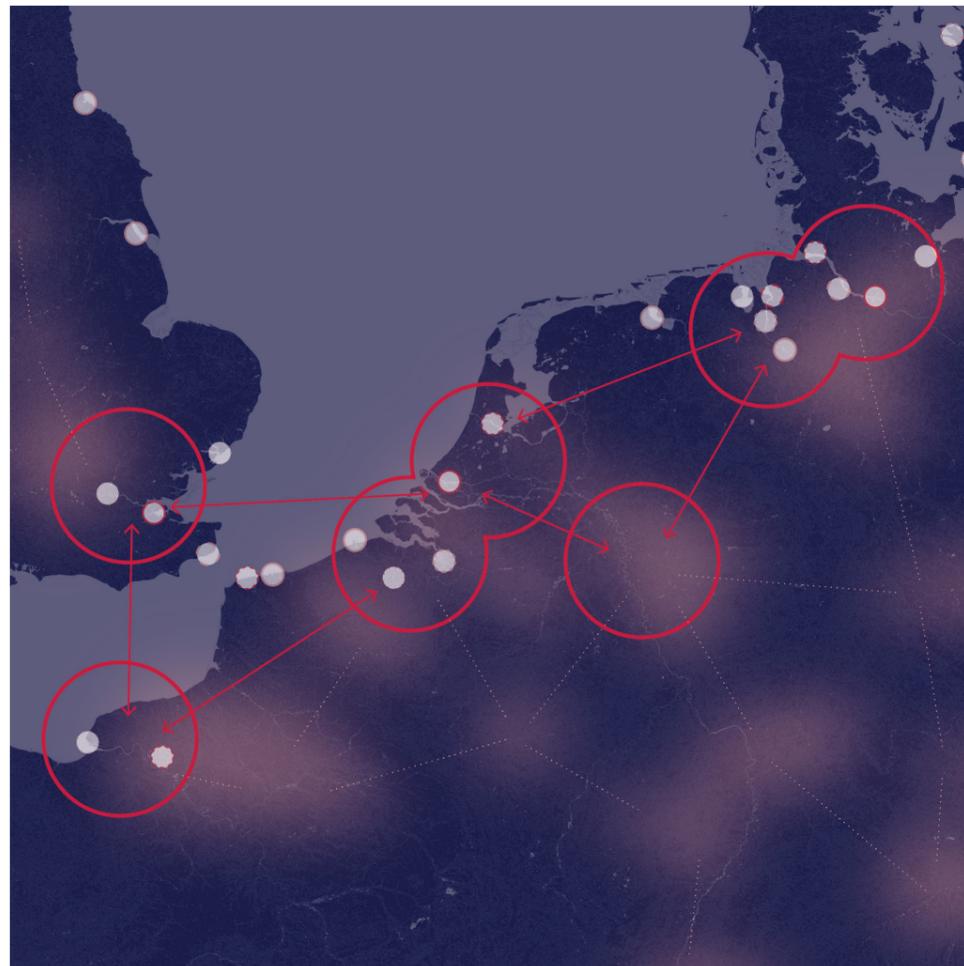


Figure 78: OBJ1 Port Landscape



Figure 79: OBJ1 Portscape

# What is the future Portscape?

OBJ 1 - Integration

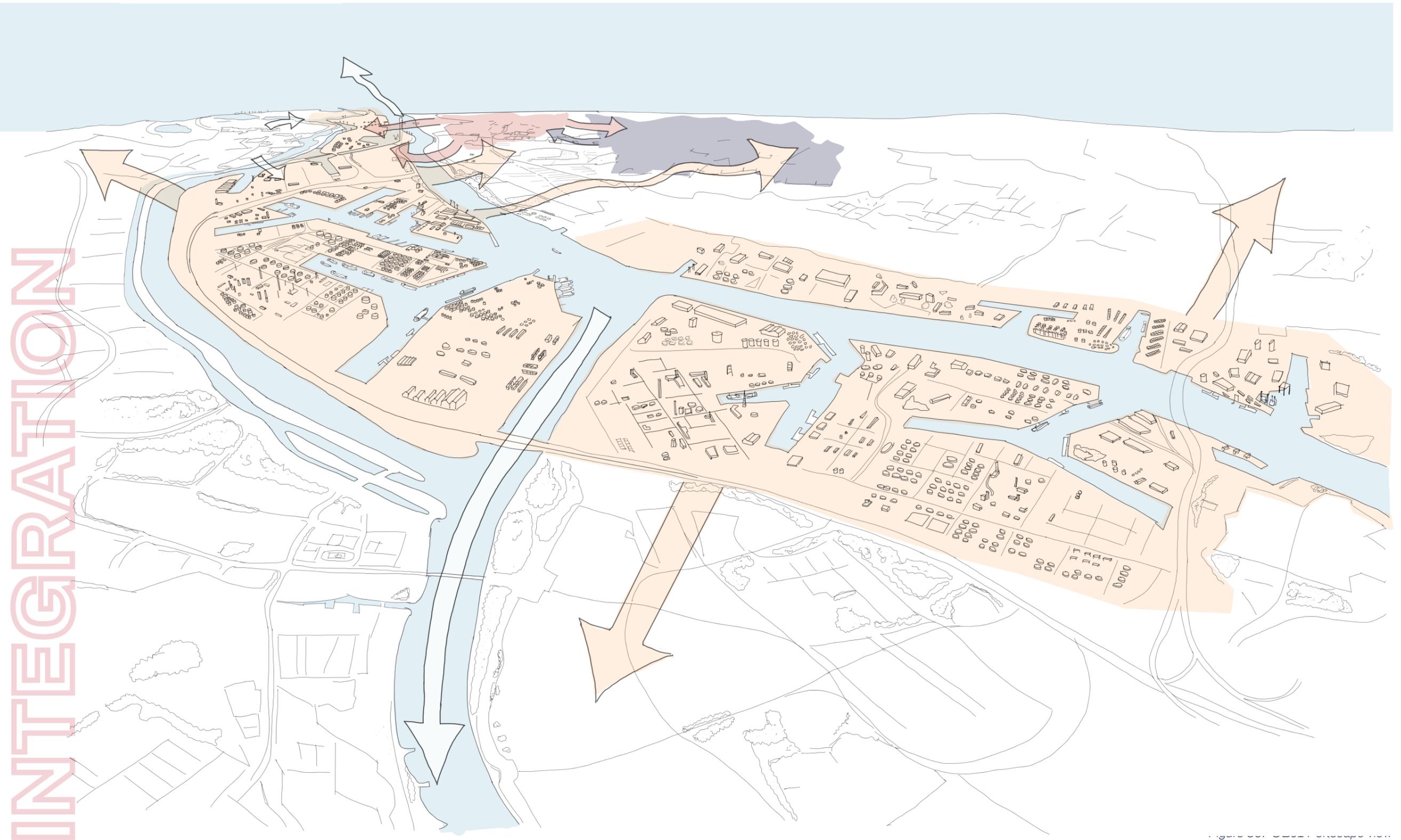


Figure 100: Future Portscape Plan

# What is the future Portscape?

## OBJ 2 - Resource efficiency

### North-Western Europe

We embrace circularity in and across Portscares to both minimise resource consumption and maximise resource efficiency, aligning with the cycles of resources, bio-geo-chemical matter, wealth. This means a shifting role for the Portscape: from a place through which materials flow in a mostly linear manner, we move increasingly towards a place of making, in a circular way. Here, we implement closed-loop systems for critical material flows such as critical raw materials and construction materials, reducing dependency on finite resources and promoting sustainable production practices, on local, regional and the European scale. Using Portscares as a catalyst to foster the transition from linear to circular economy models, as many streams and flows come together here. Scaling up from pilots, they become beacons for the European circular

transition. This way, we promote the adoption of bio-based materials as alternatives to fossil-based ones, contributing to the reduction of greenhouse gas emissions.



*“I used to carry polluting oil on my ship – today, it’s bio-based plastics. It is great to be at the forefront of innovation.”*

Pierre, the Ship Captain (Le Havre, France)

### South-Holland

The energy transition will be achieved by closing the loops in order to switch to resource efficiency. Waste should be minimised and utility of materials should be maximised. Implementing waste reduction by realising recycling programs and centres within the Portscape can help minimise the generation of the waste. In order to close the loops, the Portscape will transition to renewable energy sources, including solar, wind and tidal energy to meet the energy needs. We will realise this by installing solar panels on port buildings, placing more wind turbines in Portscape areas.

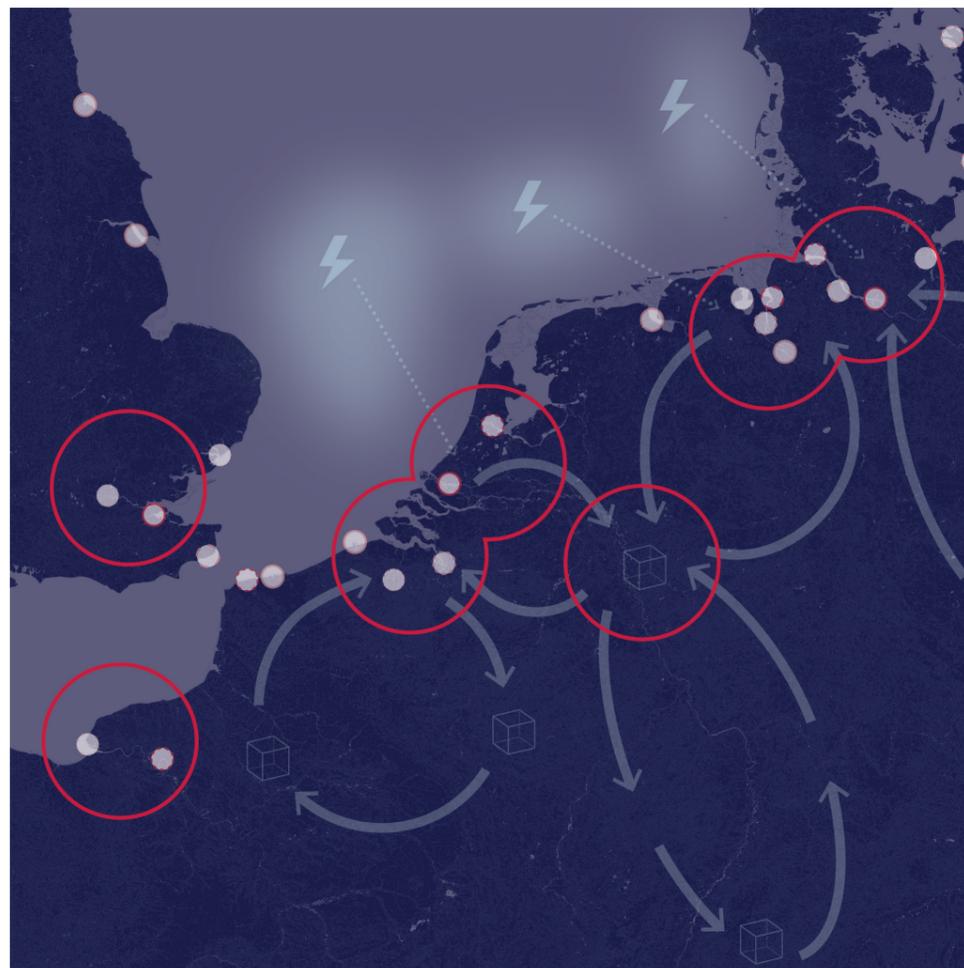


Figure 81: OBJ2 Port Landscape

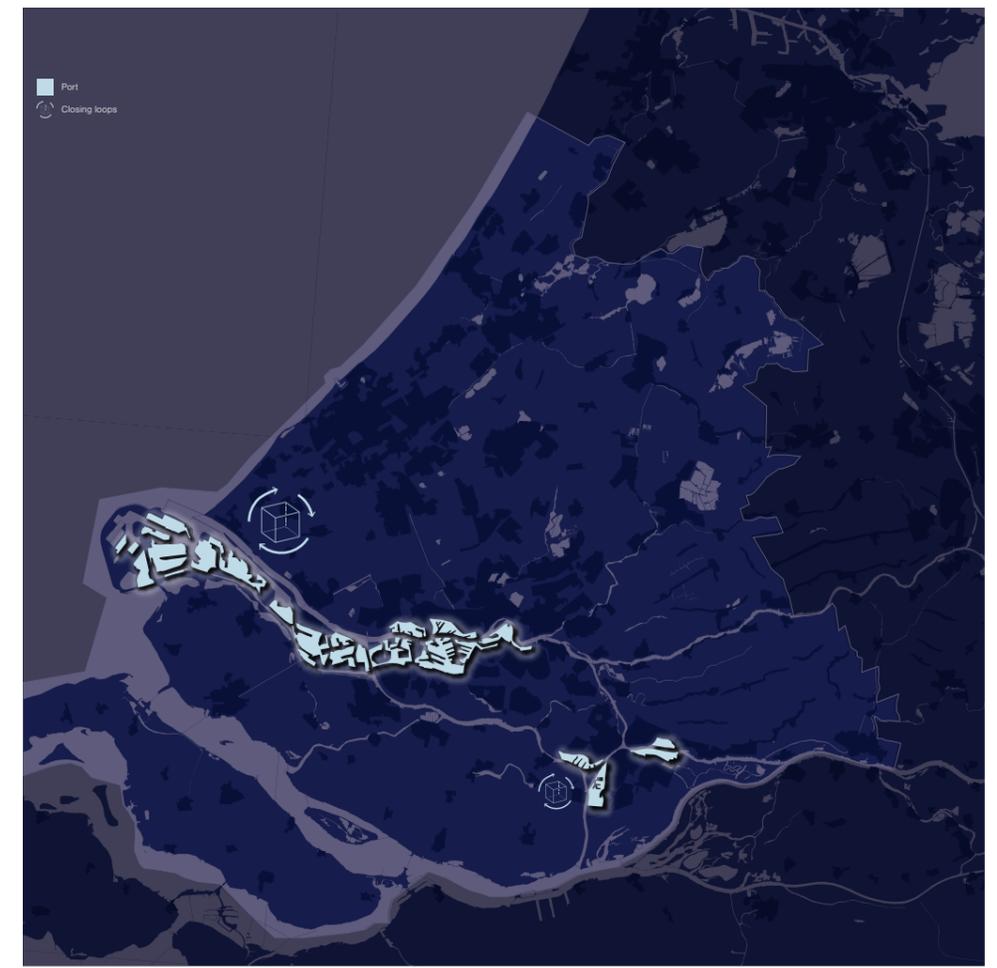


Figure 82: O2 Portscape

# What is the future Portscape?

OBJ 2 - Resource efficiency

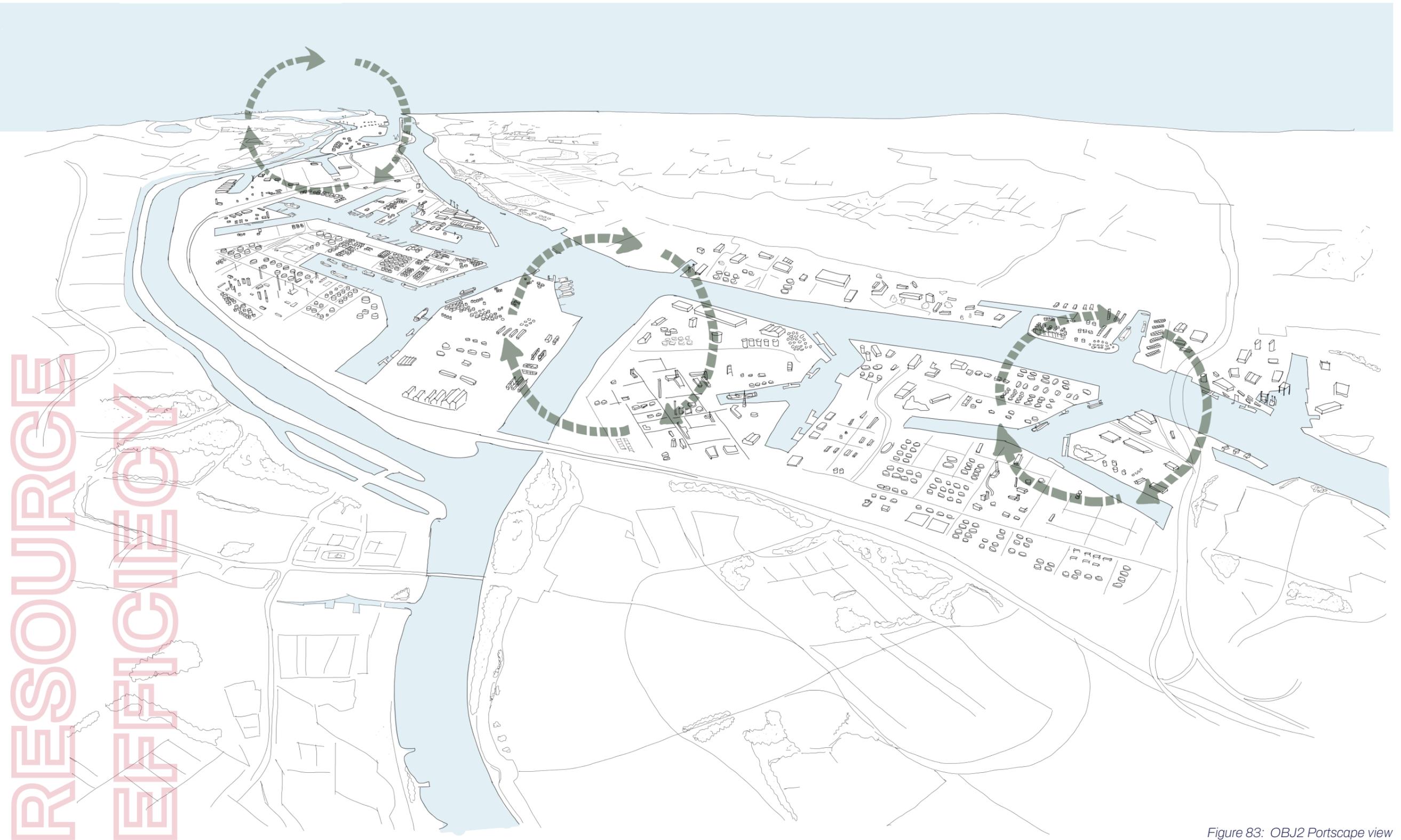


Figure 83: OBJ2 Portscape view

# What is the future Portscape?

## OBJ 3 - Regeneration

### North-Western Europe

The changes we envision bring about the regeneration of Portscares to enhance human well-being and biodiversity, aligning with the cycles of care for ecosystems and social well-being. Our goal according to this objective is to restore and enhance green and blue spaces within port areas and Portscares to improve air quality, mitigate urban heat island effects and provide more and better habitats for flora and fauna. This also to make up for past damages that harmed natural spaces due to ever-expanding linear port activities. We implement nature-based solutions, such as green infrastructure that provides ecosystem services or wetland restoration, to promote ecological resilience and support the ecosystem cycle, also in light of increased resilience in the face of climate change. Alongside, this generates the chance to create opportunities for recreational and cultural activities within Portscares, contributing to

community engagement and cohesion. This way, we are adding a chapter to the historical role of ports and the rich industrial heritage which is also manifested in the physical structures of ports and their presence in the Portscape.



*“Years of activism were worth the effort! Finally, nature is healing and thriving again in and around our ports.”*

Marie, the Environmental Activist (Antwerp)

### South-Holland scale

The Portscape will function as spaces for humans, flora and fauna. In the Portscape of South-Holland, a new green backbone will be introduced. This new green backbone will enhance biodiversity and provide possibilities for more recreational areas. This way, the Portscape will be an attractive place for not only residents, but also for wildlife. Industry and nature will go hand in hand. In addition, new green routes will create connections for better integration. The green backbone contributes to this because its green corridors along the port can serve as wildlife corridors. This connects fragmented habitats and enables the movement of species. We want to incorporate features like wetlands, so that the Portscape can create diverse habitats for plants and animals.



Figure 84: OBJ3 Port Landscape

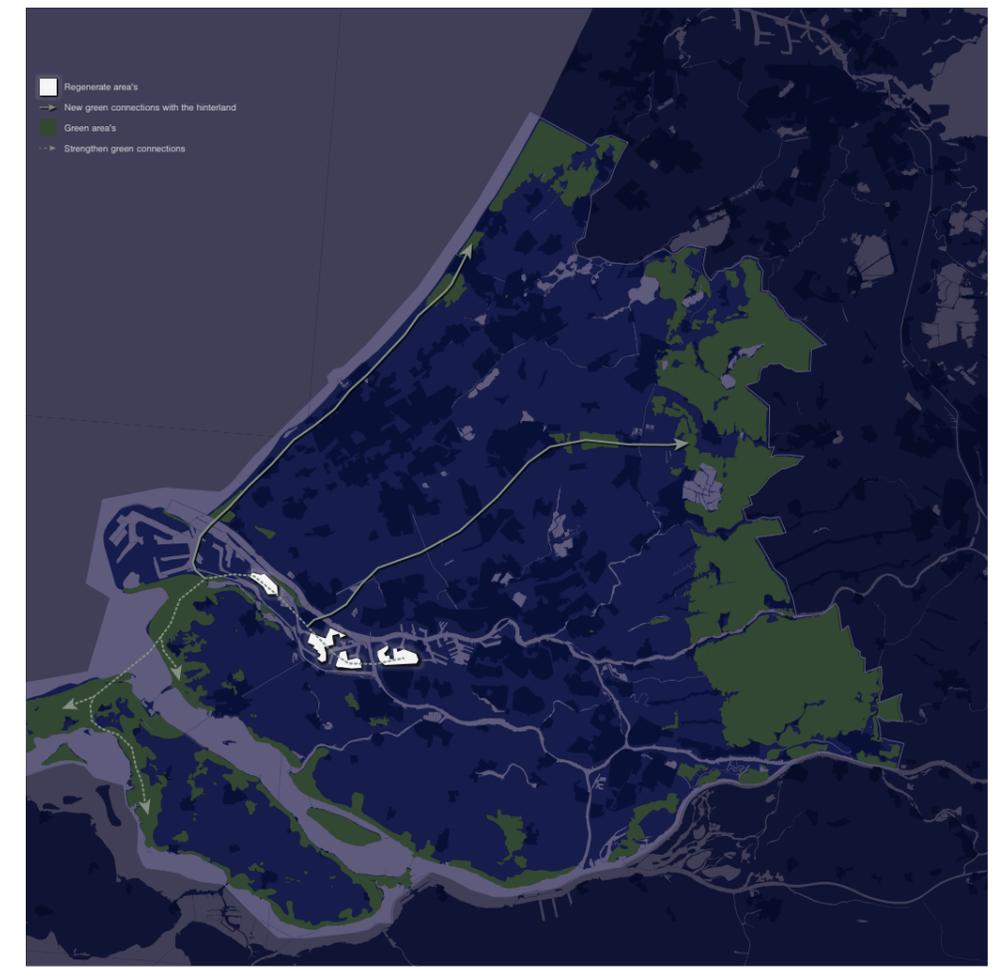


Figure 85: OBJ3 Portscape

# What is the future Portscape?

OBJ 3 - Regeneration

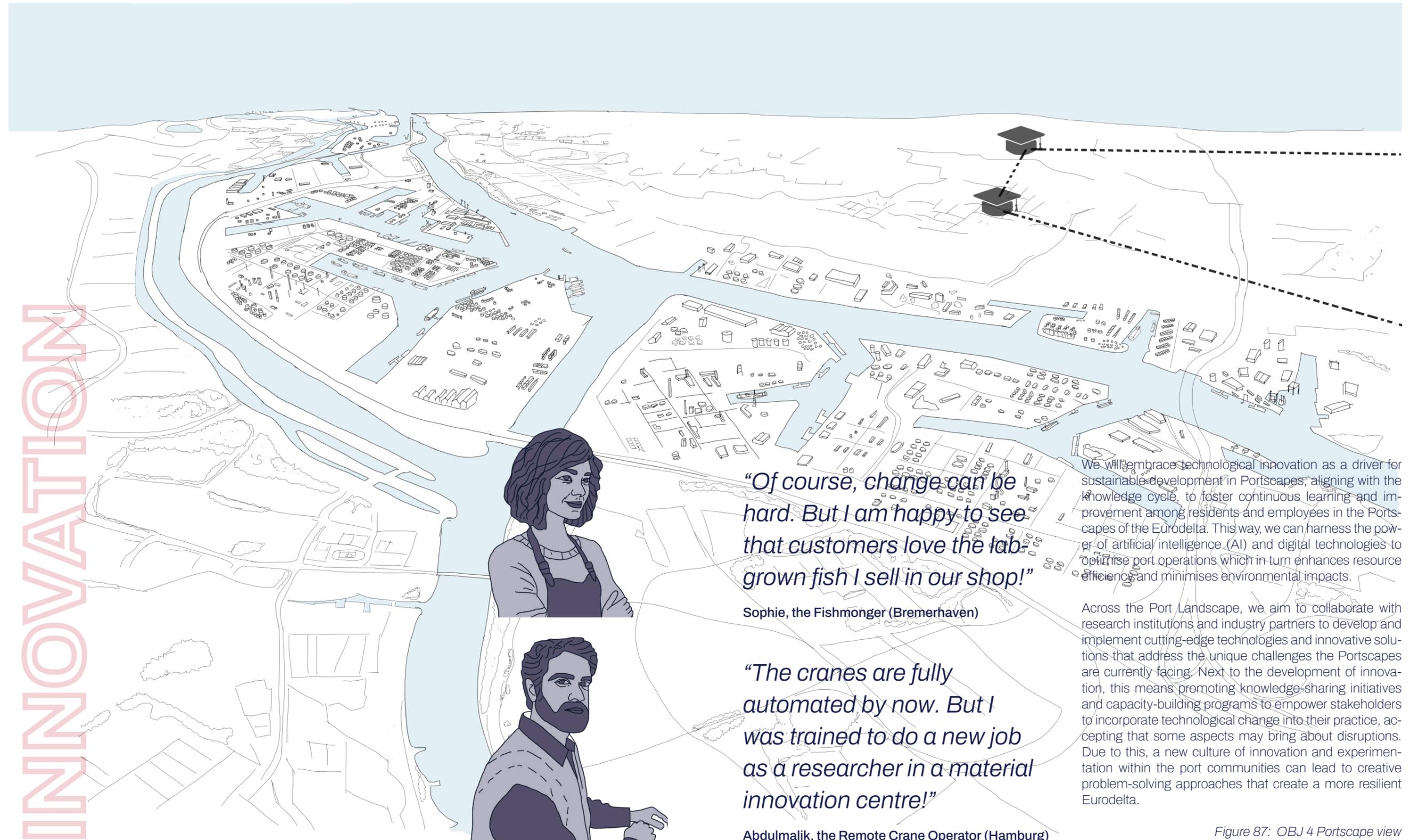


Figure 86: OBJ3 Portscape view

# What is the future Portscape?

## OBJ 4 - Innovation

INNOVATION



*“Of course, change can be hard. But I am happy to see that customers love the lab-grown fish I sell in our shop!”*

Sophie, the Fishmonger (Bremerhaven)

*“The cranes are fully automated by now. But I was trained to do a new job as a researcher in a material innovation centre!”*

Abdulmalik, the Remote Crane Operator (Hamburg)

We will embrace technological innovation as a driver for sustainable development in Portsapes, aligning with the knowledge cycle, to foster continuous learning and improvement among residents and employees in the Portsapes of the Eurodelta. This way, we can harness the power of artificial intelligence (AI) and digital technologies to optimise port operations which in turn enhances resource efficiency and minimises environmental impacts.

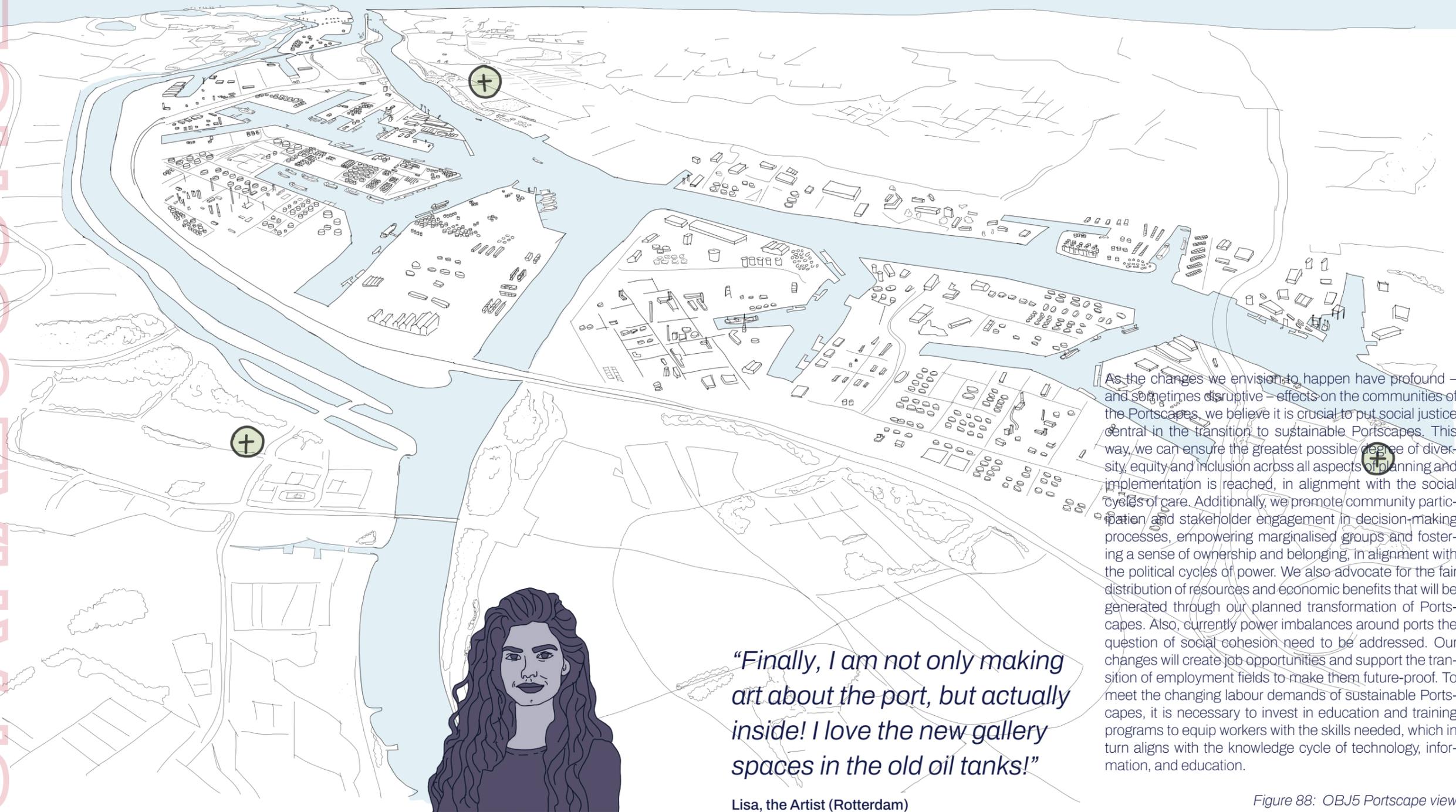
Across the Port Landscape, we aim to collaborate with research institutions and industry partners to develop and implement cutting-edge technologies and innovative solutions that address the unique challenges the Portsapes are currently facing. Next to the development of innovation, this means promoting knowledge-sharing initiatives and capacity-building programs to empower stakeholders to incorporate technological change into their practice, accepting that some aspects may bring about disruptions. Due to this, a new culture of innovation and experimentation within the port communities can lead to creative problem-solving approaches that create a more resilient Eurodelta.

Figure 87: OBJ 4 Portscape view

# What is the future Portscape?

OBJ 5 - Spatial Justice

SPATIAL JUSTICE



As the changes we envision to happen have profound – and sometimes disruptive – effects on the communities of the Portscape, we believe it is crucial to put social justice central in the transition to sustainable Portscape. This way, we can ensure the greatest possible degree of diversity, equity and inclusion across all aspects of planning and implementation is reached, in alignment with the social cycles of care. Additionally, we promote community participation and stakeholder engagement in decision-making processes, empowering marginalised groups and fostering a sense of ownership and belonging, in alignment with the political cycles of power. We also advocate for the fair distribution of resources and economic benefits that will be generated through our planned transformation of Portscape. Also, currently power imbalances around ports the question of social cohesion need to be addressed. Our changes will create job opportunities and support the transition of employment fields to make them future-proof. To meet the changing labour demands of sustainable Portscape, it is necessary to invest in education and training programs to equip workers with the skills needed, which in turn aligns with the knowledge cycle of technology, information, and education.

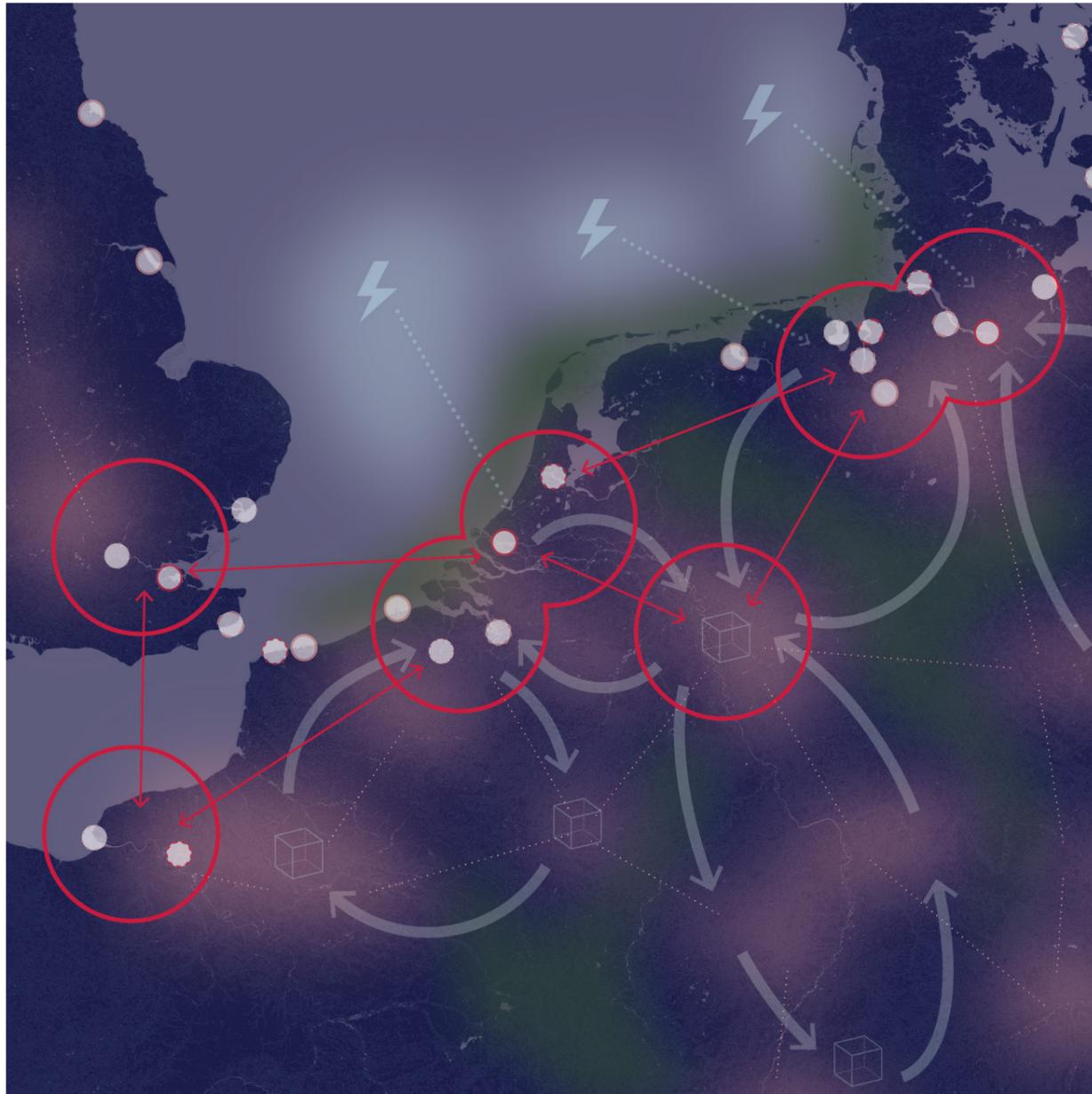
*“Finally, I am not only making art about the port, but actually inside! I love the new gallery spaces in the old oil tanks!”*

Lisa, the Artist (Rotterdam)

Figure 88: OBJ5 Portscape view

# What is the future Portscape?

Overall vision



## Port Landscape

*Eurodelta of the future*



Figure 89: Vision Map - Port Landscape



## Portscape

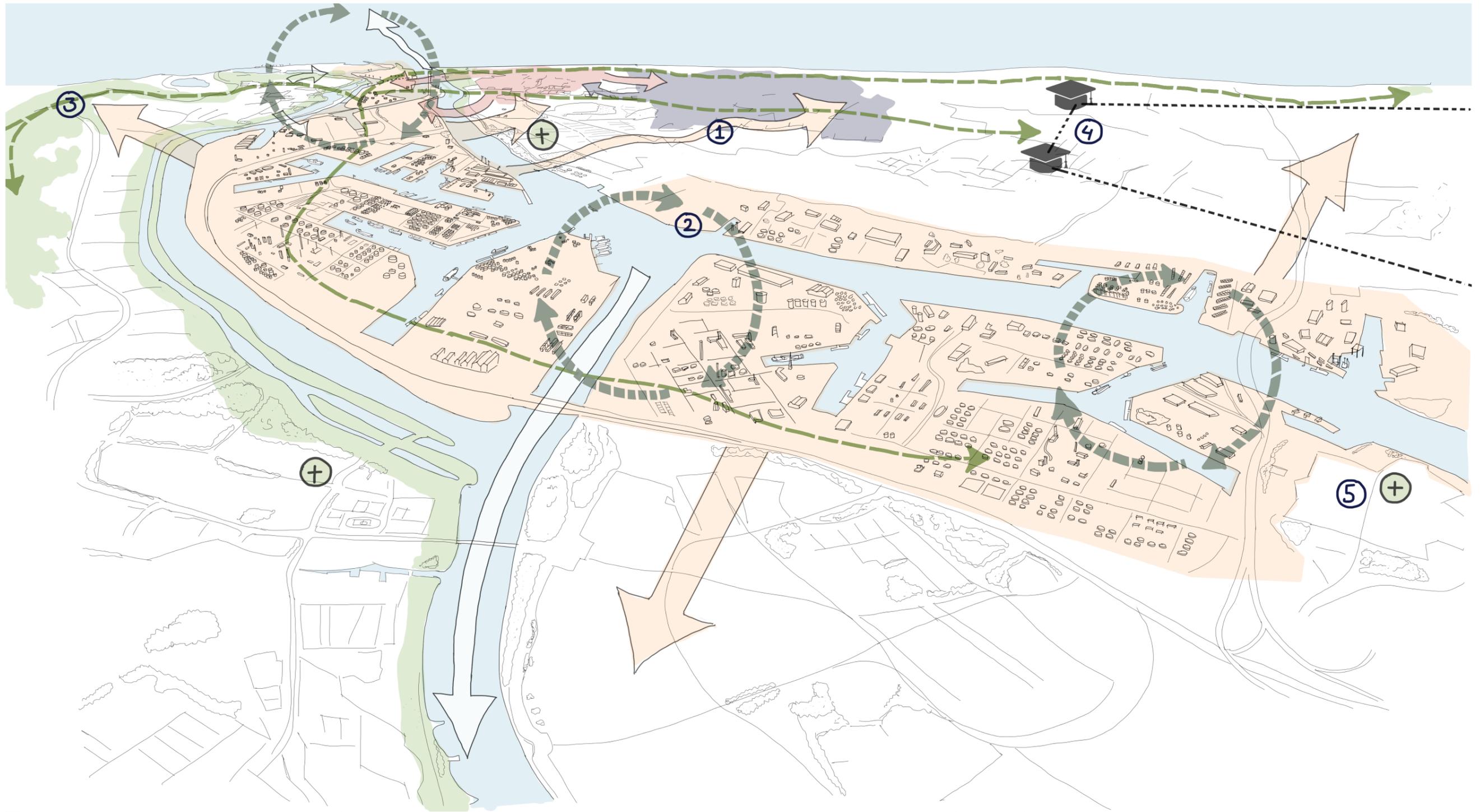
*South Holland of the future*



Figure 90: Vision Map - Portscape

# What is the future Portscape?

Overall vision



- ① Integrating port, portscapes and port landscapes
- ② Increase resource efficiency by closing loops
- ③ Regenerating for humans and flora/fauna
- ④ Embrace innovation and technological change
- ⑤ Socially just transition

Figure 91: Vision Portscape view

# What is the future Portscape?

Envisioning the Portscape

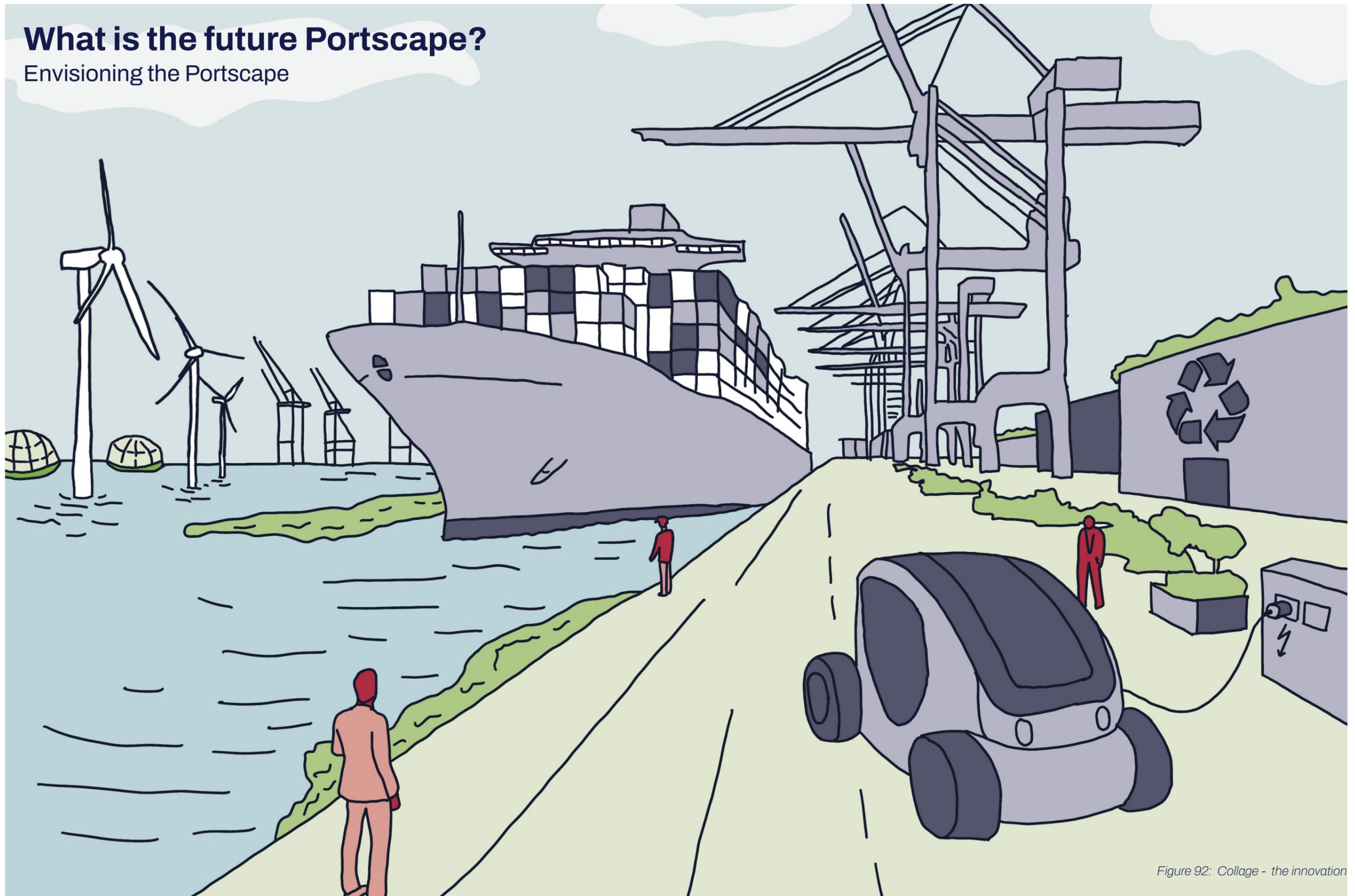


Figure 92: Collage - the innovation

# What is the future Portscape?

Envisioning the Portscape

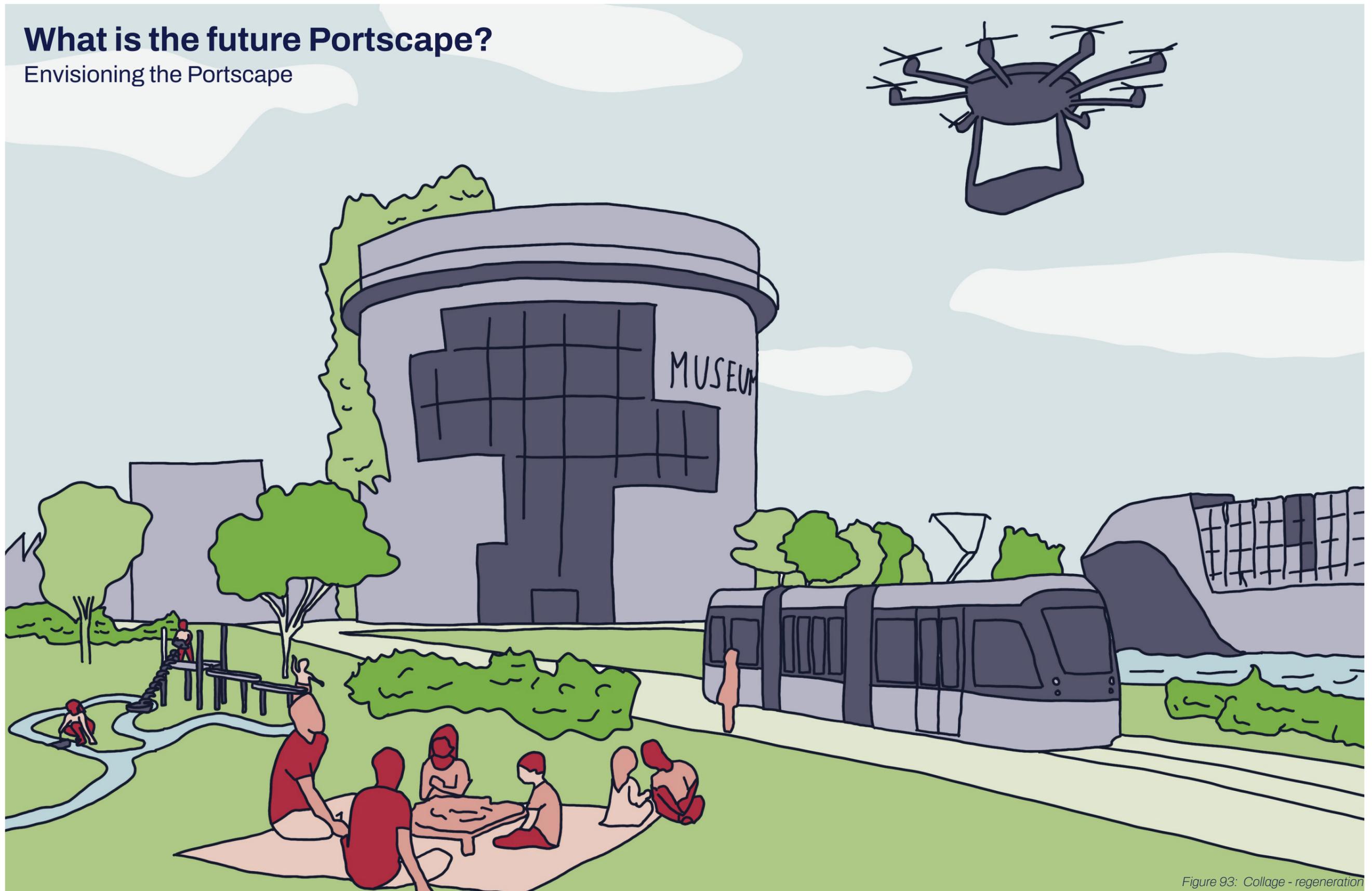


Figure 93: Collage - regeneration

# What is the future Portscape?

## Rethinking flows and spatial relations



Figure 94: Current Portscape section

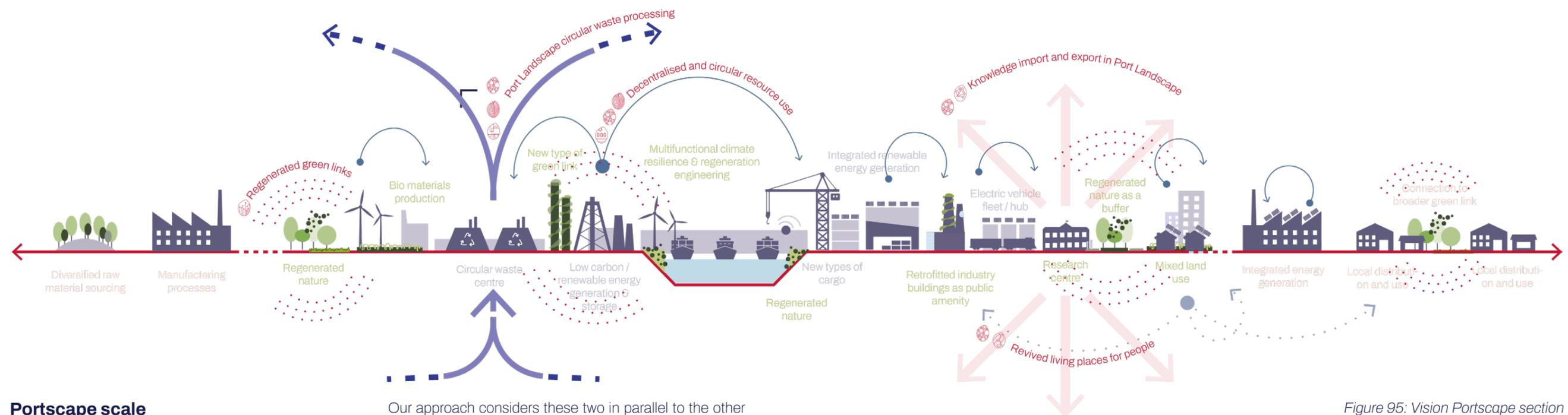


Figure 95: Vision Portscape section

### Portscape scale

As a shift from the observed linear processes, and in line with our conceptual framework and objectives, it is clear that the key shift in Portscape flows will be the introduction of circular elements. Existing port strategies and literature mention two main components for the transition to Circular Economy:

- Energy - from fossil to renewable sources
- Material - from single use and waste to reuse (Bergqvist et al, 2019, p.87) (DRIFT, 2024)

Our approach considers these two in parallel to the other cycles of sustainability. Indeed, our circular flows consider the co-benefits and interrelated impacts of the well documented energy and material transitions, as well as cycles of care, knowledge and ecosystems to name a few.

By adopting an integrated design approach and overlaying objectives, we can create truly holistic circular flows for the future of the Portscape.

# What is the future Portscape?

## Rethinking flows and spatial relations



Figure 96: Current Port Landscape section

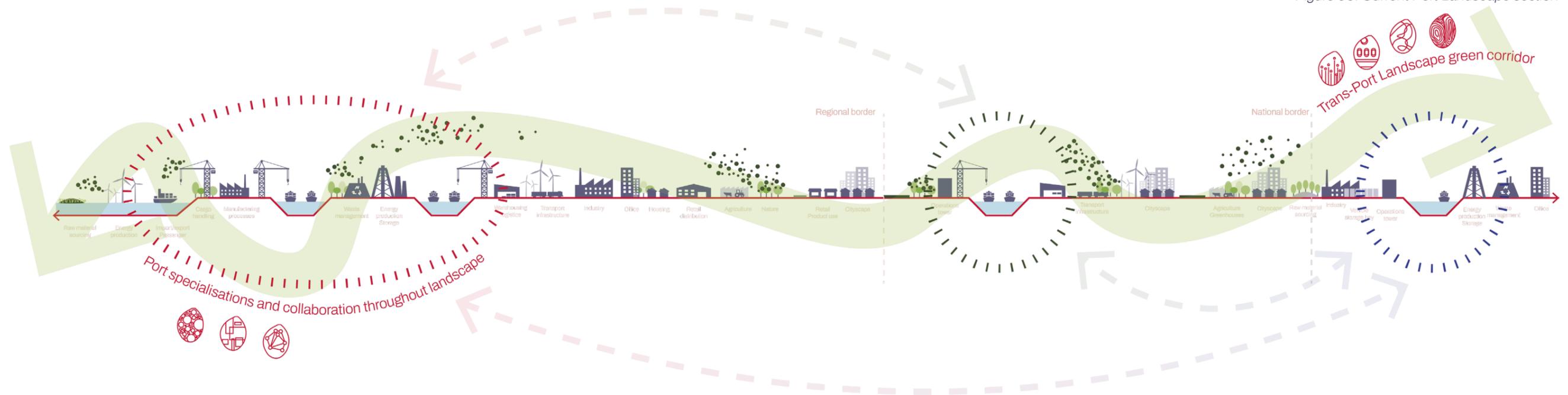


Figure 97: Vision Port Landscape section

### Port Landscape scale

Similarly, currently each government's strategy for their own Port Landscapes, typically concerned by political borders rather than spatial proximities, with the aim of increasing national influence and wealth. This harmonious approach to planning can be applied throughout the Euro-delta Port Landscape as well.

Applying our objectives and values, our vision for the Port Landscape of North-West Europe's flows is to emphasise

collaborative links, via virtual and physical routes for communication, knowledge exchange and a determined role specialty for different ports, which will help in decentralisation processes as well. For a truly circular approach, we envision a connected network of green links and corridors, transcending the Port, Portscape and political boundaries to consider not the invisible border lines but the actual spatial natural processes and movements.

# What is the future Portscape?

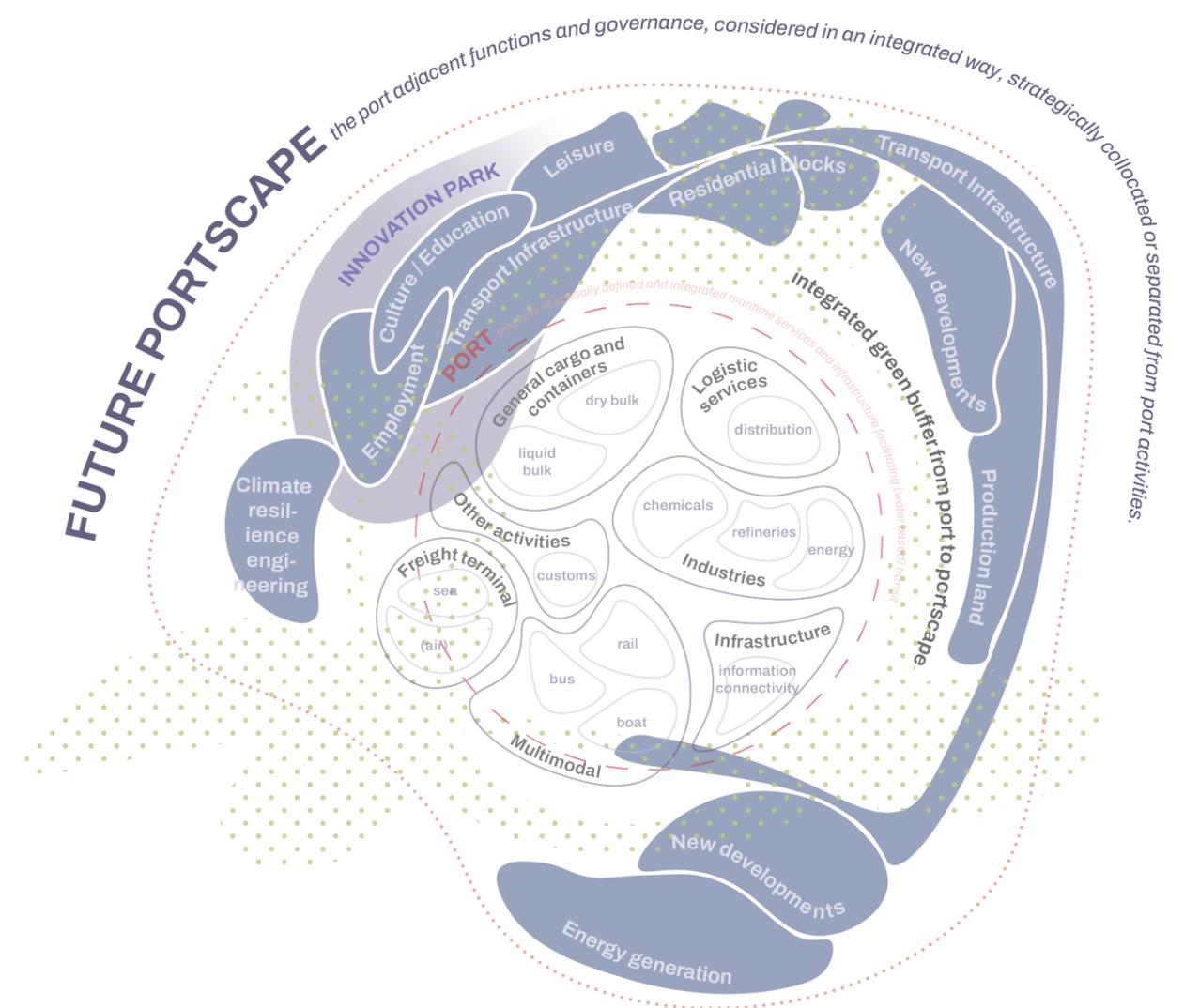
## Rethinking flows and spatial relations

The Future Portscape envisions a transformation towards complete sustainability and circularity, fostering integration with surroundings and hinterlands while prioritising human, flora, and fauna well-being. Key objectives include better integration among ports, enhanced resource efficiency, improved conditions for inhabitants and biodiversity, embracing technological innovation, and ensuring social justice. Objectives are aligned with cycles of care, aiming for a thriving Eurodelta as a global sustainability model. Specific actions include decentralising port functions, implementing closed-loop systems, regenerating green and blue spaces, embracing technological change, and facilitating a socially just transition.

The vision emphasises collaboration, knowledge-sharing, and equitable distribution of benefits and risks, aiming to create resilient, inclusive, and environmentally sustainable Portscares. Additionally, a shift towards circular flows involves transitioning from fossil to renewable energy sources and promoting material reuse, while harmonising planning across political borders to prioritise spatial natural processes and movements.

Achieving this will have not only a notable spatial impact, but also a profound shift in policy, where we go from unidimensional to integrated solutions.

All of this leads to the below definition of the Future Portscape, conceptualised in Figure 97. This shows the renewed spatial links which transcend from Port through to Portscape and beyond, connecting to existing Port Landscape links and building new ones (here, the nature link specifically is shown). In contrast to the current Portscares, the Future Portscape adopts an integrated approach to planning, understanding when spaces should be related and when they should be separated, creating a harmonious spatial and relational setting.



# Future Portscape

noun  
/ˈfjuː.tʃər.pɔːt.skeɪp/

the port adjacent functions and governance, considered in an integrated way, strategically co-located or separated from port activities.

Figure 97: What is the Future Portscape?

# 04

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## Making it happen

### **Introducing our strategy**

Realising our vision for sustainable and circular Ports, Portscapes and Port Landscapes of the future requires a deeper dive into the political, temporal and above all, spatial elements. Indeed, a good strategy is defined not only by clear planning and purpose but also by understanding of the real implications of our actions. For example, planting a tree on paper takes one second, while in reality there are intricate political (who owns the tree, who pays for it?), temporal (when do we plant it for it to be grown when we need it? What happens while we wait for it to grow?) and spatial (is the land adequate for the tree to be planted? How much space does it need to grow? Will it overshadow and block the views of surrounding spaces? Is there space to plant the tree?) requirements and relationships to consider.

In this chapter, we detail out how we can make our vision happen on the ground, by considering current trends and plans for change, detailed infrastructure needed and zoning and phasing of the different elements, both spatial and regulatory. With these tools in hand, we can enable change.

While our vision was considering both the Portscape of Rotterdam and the Eurodelta Port Landscape, our strategy focuses on the Port of Rotterdam Portscape scale, with understanding and actions relating to its connection to the broader future Port Landscape. They may also serve as a blueprint for other parts of the Port Landscape to adopt similar measures.

# What is changing?

## Current plans for Rotterdam

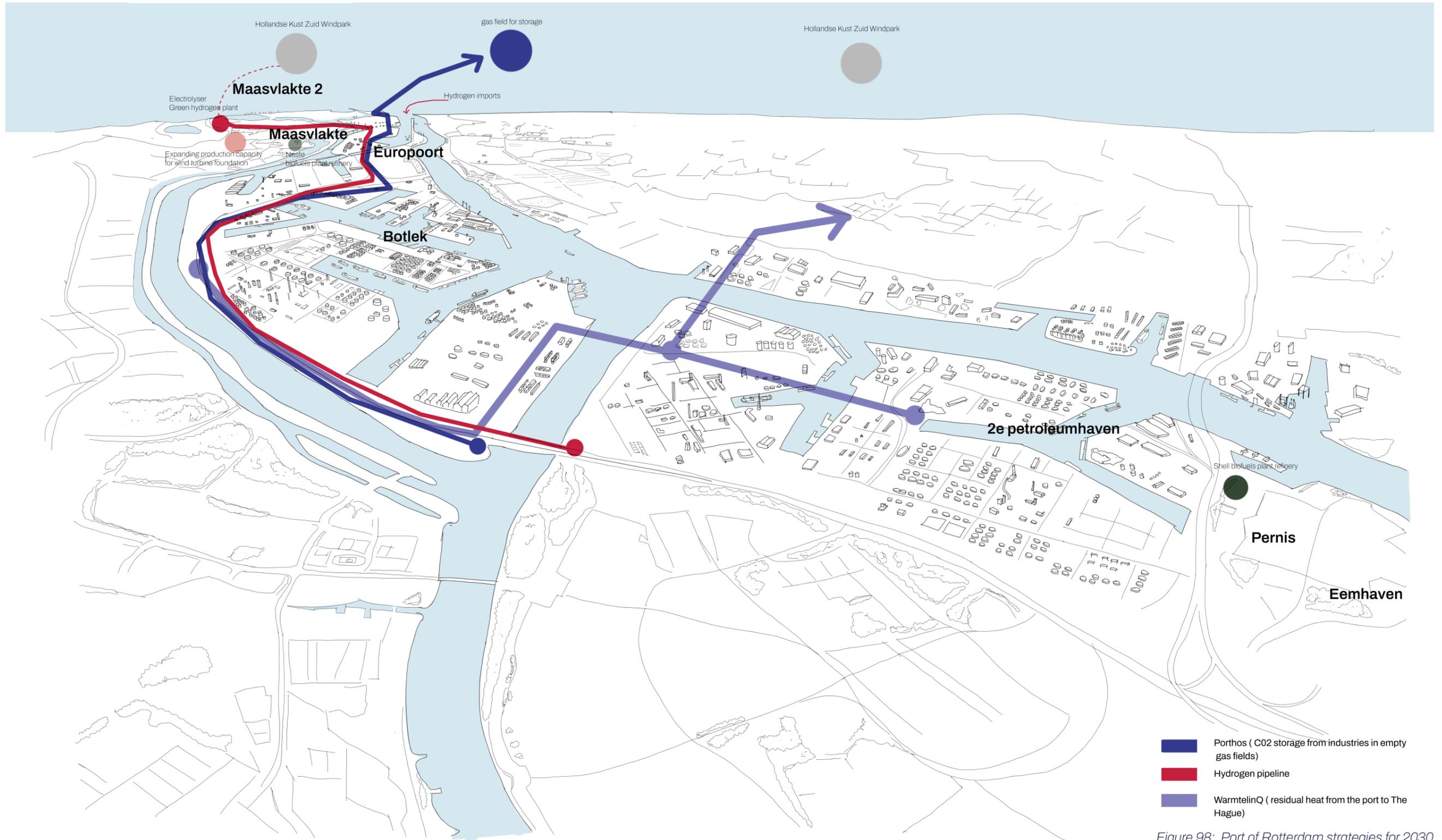


Figure 98: Port of Rotterdam strategies for 2030

# What is changing?

## From linear to circular - key milestones

In order to accurately plan future strategies for the Port of Rotterdam, it is essential to understand the current motions in place. For this, we have visualised the currently published 2030 strategies for the Port of Rotterdam (Figure 98) as well as the key trends and expectations for the transition from circular to linear economy, again for the Rotterdam Portscape, using the X Curve tool (Figure 99). Doing so helps create a richer understanding of the transition dynamics, to facilitate co-creation in multi-stakeholder settings, like that of the Rotterdam Portscape (Silvestri et al, 2022, p. 1).

With the X Curve, we can set priorities and start thinking about the sustainability transition for the Portscape of Rotterdam in phases through time, considering what becomes redundant and what emerges. Currently, the Portscape of Rotterdam is in the Destabilisation // Acceleration phase for linear and circular processes respectively.

Indeed, while there are more and more considerations for the transition, we are still in the early stages of change, with linear economy predominating the Portscape.

Our strategy builds on this and looks at the next steps, how to go through the chaos phase and stabilise.

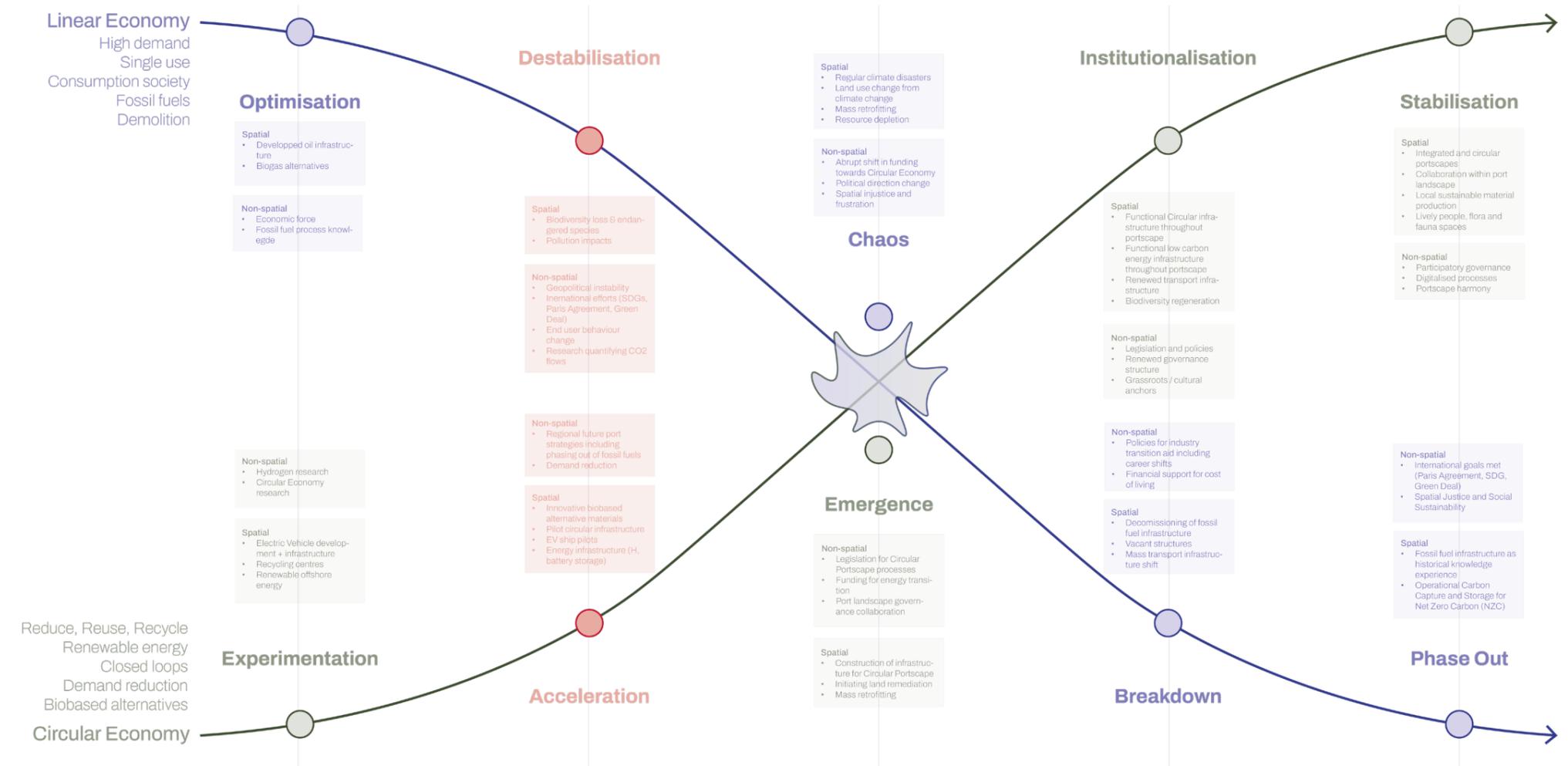


Figure 99: X Curve - from linear to circular Portscales

# What is changing?

## Spatial interventions

### Rotterdam Portscape

The Portscape of Rotterdam is the main transit hub of the Netherlands, as well as the entirety of Europe. More than four times the national Dutch energy consumption is further transported into Europe through the Portscape of Rotterdam (IEA, 2018), and most of Europe's raw materials and goods enter Europe via maritime transport through this Portscape. From the port type analysis we know that wet bulk constitutes the largest share of total throughput, followed by containers. Noteworthy is the transportation inland via pipelines, which is of high quality due to the excellent infrastructure and the nature of the product being transported, namely liquid oil products.

As mentioned earlier, the main focus of the port of Rotterdam is on the energy sector. Given the significance of the port of Rotterdam in the current fossil fuel energy sector, it will take some time before these activities completely disappear. However, it is clear that the start of the energy transition must begin in Rotterdam. Currently, there is already large-scale experimentation with bio-refining; the processing of biomass into valuable renewable raw materials (Port of Rotterdam, 2023).

The location of the port is ideal for the import of raw materials from around the world. The same applies to the distribution of bio-fuels, presenting opportunities for pipeline and inland waterway transport. Additionally, a significant amount of space will become available where current fossil fuel facilities will disappear with the coming trends and transitions. With these vast facilities and the space becoming available, the Portscape of Rotterdam offers the best opportunities for the production of bulk chemicals in the bio-based economy and the start of the energy transition.

On the following pages, a (spatial) exploration can be found for a possible future scenario of a robust and efficient energy and material system for as far as 2100, developed from spatial considerations and system logic. This offers inspiration for the attractive Portscape of Rotterdam of the future.

The exploration attempts to provide an overview and insight into the complex world of networks and systems. The tiles are designed to gain a better understanding of the 'metabolism' of the Portscape of the future and possible focal points in the various networks.

First, all tiles needed per system flow are systematically analysed to explain their stakeholders, spatial implications, conflicts, and current possibilities, corresponding to the timeline. Subsequently, the tiles are organised within a grid to illustrate their interrelationships and networks.

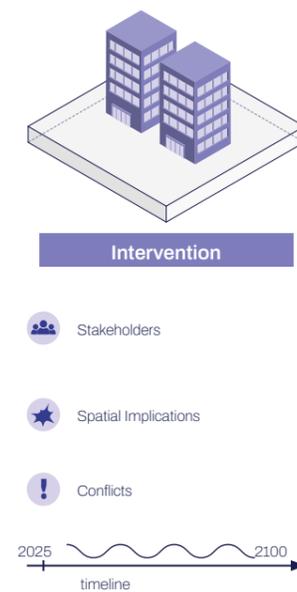


Figure 100: Tiles layout

# What is changing?

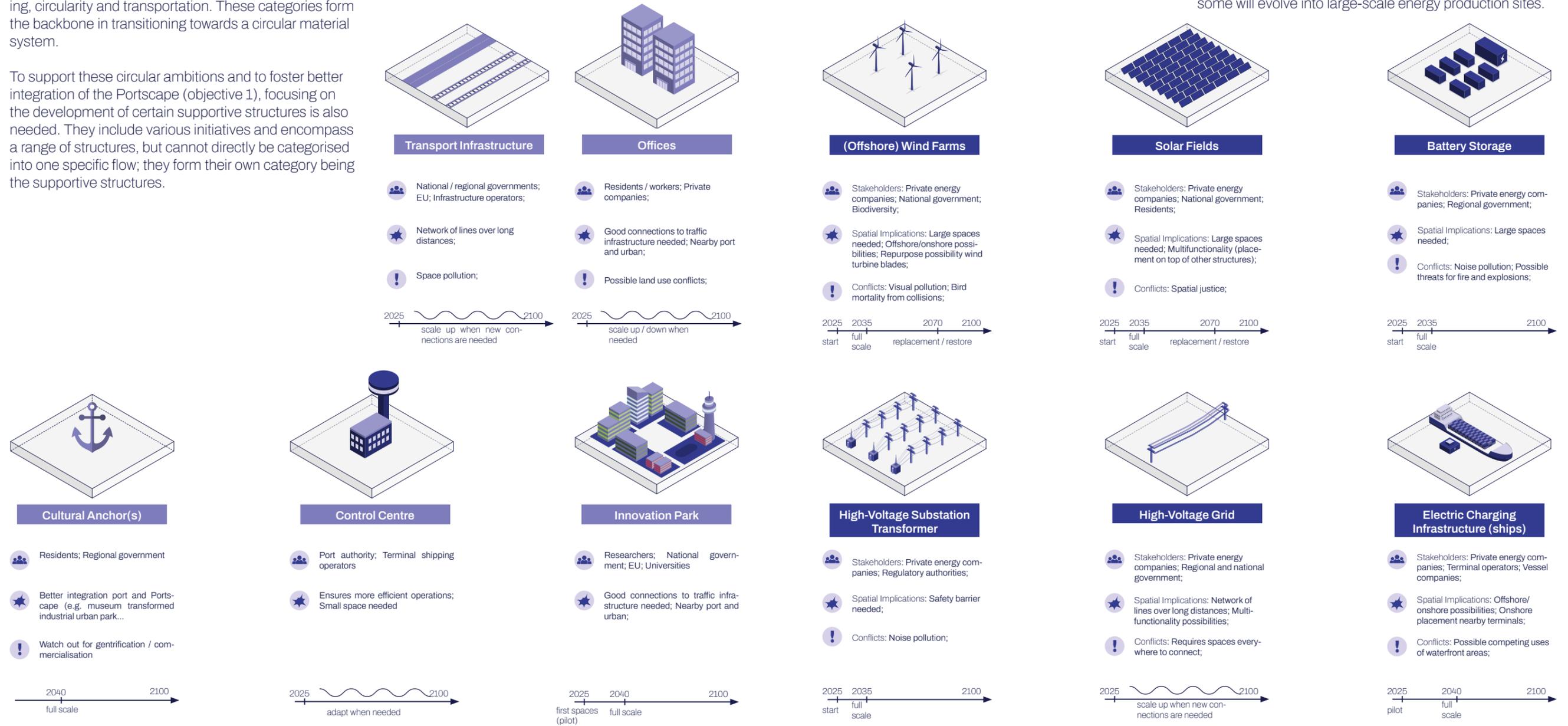
## Spatial interventions

### Supporting structures

In envisioning the future Portscape of Rotterdam, the energy flow has been subdivided into three distinct categories: CO2, electricity, and hydrogen. These categories together form the backbone in transitioning towards a more sustainable and circular energy system.

Material flows are subdivided into production/manufacturing, circularity and transportation. These categories form the backbone in transitioning towards a circular material system.

To support these circular ambitions and to foster better integration of the Portscape (objective 1), focusing on the development of certain supportive structures is also needed. They include various initiatives and encompass a range of structures, but cannot directly be categorised into one specific flow; they form their own category being the supportive structures.



### Electricity

Over the coming decades, there is set to be a significant increase in demand for renewable and electric power, also within Rotterdam's industrial sector. Companies will need extra power to facilitate the electrification of industrial processes, the production of green hydrogen, and to power electric transportation. The demand for electricity here is expected to at least double – and potentially quadruple – necessitating Rotterdam to strengthen its power grid.

The vast majority of our electricity needs will be met by wind energy. Wind turbines at sea, in particular, will make a big contribution to the sustainable energy mix, with more than 70% of the required electricity capable of being generated offshore (Studio Marco Vermeulen, 2021). The remaining part will mostly be met by solar energy. Most solar energy will be produced from rooftops and facades of different structures in the built environment. Ongoing pilot projects for solar energy along dams, railways, and highways have already started, and it is expected that some will evolve into large-scale energy production sites.

# What is changing?

## Spatial interventions

### Hydrogen

For a fully sustainable energy system, in addition to sustainable electricity and heat, another emission-free energy carrier is needed, especially for energy-intensive applications that require 'molecules'. Hydrogen will therefore be essential; it plays a key role in the sustainability of industrial processes, transportation, and as a building block for green chemistry (Port of Rotterdam, 2023). To meet the significant future demand for hydrogen, additional electricity production is also needed.

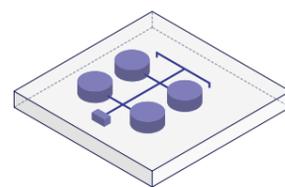
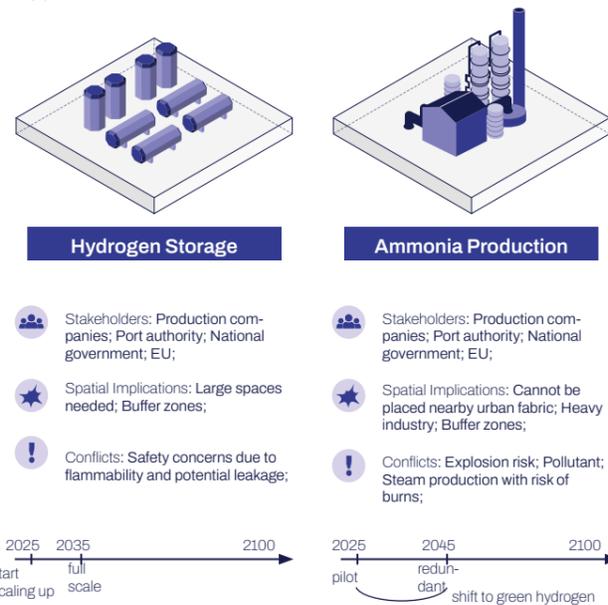
The Port of Rotterdam must fully embrace hydrogen, which will play a crucial role in a new, sustainable economy. This will make the Portscape of Rotterdam, with improved collaboration between various ports, an international hub for the production, import, application, and transit of hydrogen to other countries in North-West Europe.

Hydrogen has to be produced as it is not readily available. There are various options for hydrogen production (Port of Rotterdam, 2022). We see potential in two options for the future of the Portscape of Rotterdam:

1. Currently hydrogen production is already being done based on natural gas. However, CO2 is released during production. Low-carbon production can be achieved by capturing and storing the CO2. This is known as blue hydrogen. Blue hydrogen serves as a practical solution in the short term and it is seen as leading the way for green hydrogen.
2. Another option is carbon-free green hydrogen, which is produced by electrolysing water using green power, for example from (offshore) wind farms or solar fields. No CO2 is released during production. It is expected that the

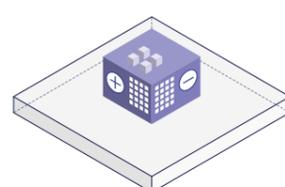
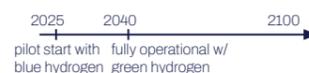
production of green hydrogen will be able to expand to a commercial/industrial scale.

In the port, there's a temporary need to import blue hydrogen to kick-start hydrogen pilot projects. Also, there is an interim significance of converting hydrogen to ammonia as current hydrogen transportation techniques are still too inefficient. Looking ahead, green hydrogen production will take over in the port, supported by large-scale imports of green hydrogen. We expect new advancements and innovations in technology will make the hydrogen conversion to ammonia unnecessary, facilitating the gradual elimination of its somewhat pollutant production processes.



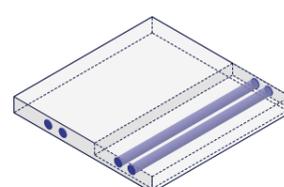
### Import Terminal Hydrogen Carrier

- Stakeholders: Terminal operators; EU; Hydrogen suppliers; National government;
- Spatial Implications: Placement on waterfront areas; Buffer zones;
- Conflicts: High cost, who is responsible?; Safety concerns;



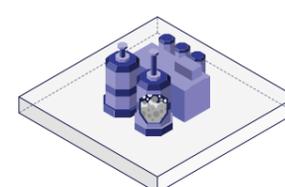
### Hydrogen Electrolyser

- Stakeholders: Production companies; Port authority; National government; EU;
- Spatial Implications: Offshore / onshore possibilities; Needs connections to green energy;
- Conflicts: High costs of producing; Energy intensive (currently);



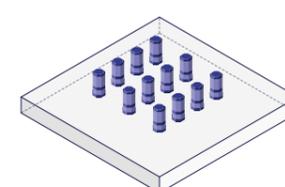
### Hydrogen Pipelines

- Stakeholders: EU; Production and supplier companies; European ports;
- Spatial Implications: Network of pipelines over long distances; Repurpose possibilities of oil / gas pipelines;
- Conflicts: Requires spaces everywhere to connect;



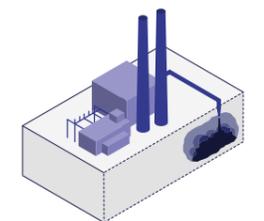
### CO2 Compressor Station

- Private energy companies; Industrial facilities;
- Buffer zones; Cannot be placed nearby urban fabric; Heavy industry;
- Spatial claims; Safety concerns;



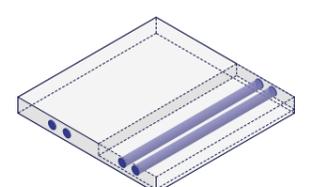
### Small Scale CO2 Tanks

- Private energy companies; Industrial facilities;
- CO2 stored in tanks for transportation;
- Concerns related to leakage



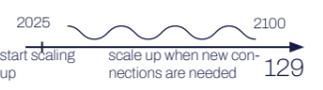
### CCS (Carbon Capture + Storage)

- Private energy companies; Industrial facilities; CCS technology providers
- Offshore storage possibilities in empty gas and oil fields;
- Spatial claims; Energy intensive; Safety concerns



### CO2 pipelines

- Private energy companies;
- Network of pipelines over long distances; Repurpose possibilities of oil / gas pipelines;
- Requires spaces everywhere to connect;



### CO2

Envisioning the spatial components of the circular CO2 flows of the future represents a shift, where carbon dioxide, once deemed a pollutant, is re-purposed as a valuable resource integral to a circular economy. This system entails capturing CO2 emissions from various sources, such as industrial processes and transportation, and re-directing them via pipelines for underground storage and use of renewable fuels and materials (IEA, 2019).

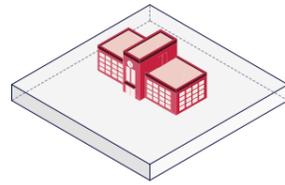
Strategic and spatial planning become essential to optimise the CO2 flows of the future and minimise environmental impact. This involves the strategic placement of carbon capture facilities in proximity to emission sources, as well as the repurposing of oil and gas pipelines for CO2 transportation and distribution. Spatial planning must also account for the integration of carbon utilisation technologies into existing industrial landscapes and keep them further away from urban environments.

Through aligning spatial configurations, policy frameworks, embracing technological innovations, and considering socioeconomic dynamics, we have the potential to create a resilient and sustainable circular CO2 system for the future.

# What is changing?

## Spatial interventions

### Supporting structures Production / Manufacturing

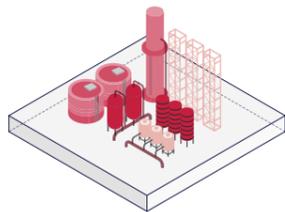


#### Educational Facilities

- Schools; Universities; Research Institutions; Employees; Residents / Community;
- ★ Strategic location adjacent to research institutes and facilities; (Public) Transport opportunities;

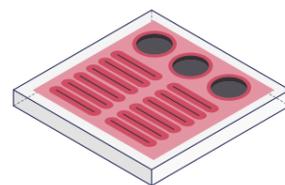


### Circularity



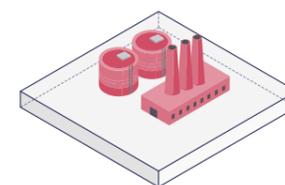
#### Organic Chemicals Biorefinery

- Biotechnology companies; Energy Companies; Municipality;
- Storage Tanks; Accessible location for transport;
- Odor and emissions; Environmental concerns waste;



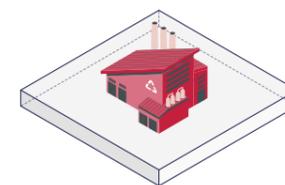
#### Plantation Bio Based Raw Materials

- Biotechnology companies; Agricultural producers; Municipality;
- ★ Large amount of space for production; Transport facilities;
- ! Competition for land with other land uses;



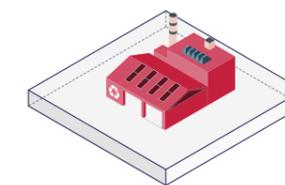
#### Production Facility Bio Based Raw Materials

- Biotechnology companies; Agricultural producers; Manufacturers; Municipality;
- ★ Storage tanks for raw materials and finished products; Accessible location for transport;
- ! Environmental concerns regarding water usage, waste and pollution;



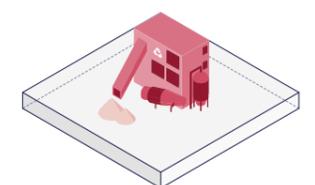
#### CRM Recovery Recycling Facilities

- Recycling companies; Electronics manufacturers; Province
- (Storage) space needed; Accessible location for e-waste transport;
- Risks health hazards; Pollution;



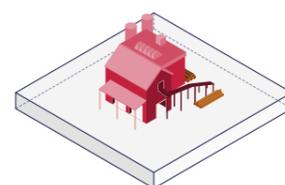
#### Construction Material Recycling Facility

- Recycling companies; Waste management firms; Municipality;
- ★ (Storage) space needed; Accessible location for waste collection and transport;
- ! Noise pollution; Emissions;



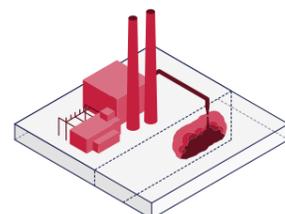
#### Concrete Recycle Facilities

- Construction companies; Recycling companies; Municipality;
- ★ Storage areas; Accessible location for transportation
- ! Noise and dust emissions; Environmental concerns;



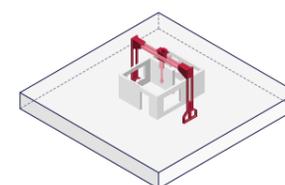
#### Mass Customization Wood Facility

- Wood industry companies; Manufacturers; Municipality
- Storage areas for raw materials and products; Accessible location for transport;
- Noise Pollution; Emissions



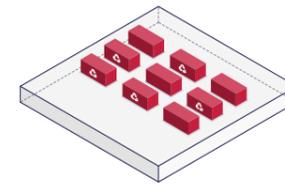
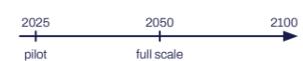
#### Carbon Capture Facilities Production + Storage

- Energy companies; Environmental Agencies; Province;
- ★ Infrastructure for capturing and compressing carbon emissions; Space for storing captured CO2;
- ! Spatial claims; Energy intensive, Safety concerns;



#### 3D Printing

- Production companies; Technology & innovation firms;
- ★ Space needed for materials and end-products;
- ! Noise pollution; Emissions;



#### Storage Space Recycling

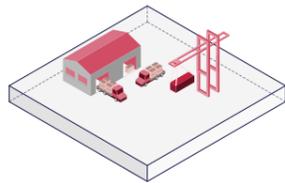
- Waste management companies; Recycle companies; Environmental agencies; Municipality
- Large storage areas; Accessible location for waste transport
- Competition for space; Odor and noise pollutions;



# What is changing?

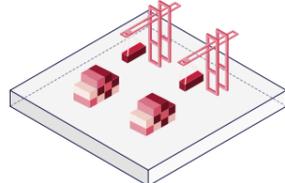
## Spatial interventions

### Transportation



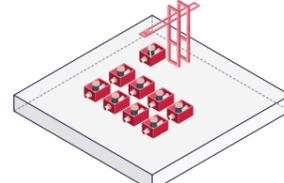
#### General Cargo Terminal

- Cargo handlers; Shipping companies; Port Authority
- Storage area for various types of cargo; Accessible location to various transport links;
- Possible competition for space; Possible Traffic congestion with other land uses;



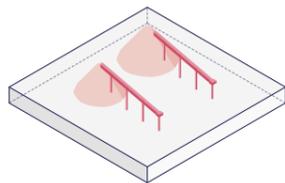
#### Container Terminal

- Logistic firms; Shipping companies; Port authority;
- Space for container storage; High capacity cranes along dock;
- Possible competition for space;



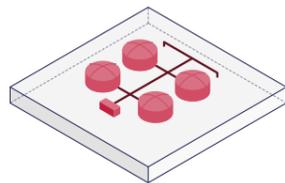
#### (Specialized) Terminal New Types of Cargo

- Specialized cargo industries; Shipping companies; Port authority;
- Storage facilities for unique cargo; Tailored infrastructure for handling specific cargo; Buffer zone;
- Limited expertise and infrastructure; Possible competition for space;



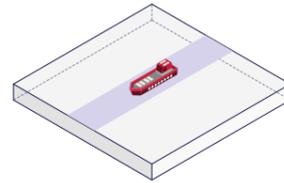
#### Dry Bulk Terminal

- Mining and agricultural companies; Shipping companies; Port authority;
- Large storage yards for bulk material;
- Dust emissions; Possible competition for space;



#### Liquid Bulk Transport Terminal

- Chemical companies; Shipping companies; Port authority;
- Space for tanks; Buffer zone; Pipelines and loading docks;
- Safety risks; Competition for space;



#### Short Sea Shipping Infrastructure

- Shipping lines; Port authority; Municipality; Province;
- Accessible port facilities; Efficient hinterland transport connections;
- Competition waterfront space; Traffic congestion port areas;



# What is changing?

Flows for the future

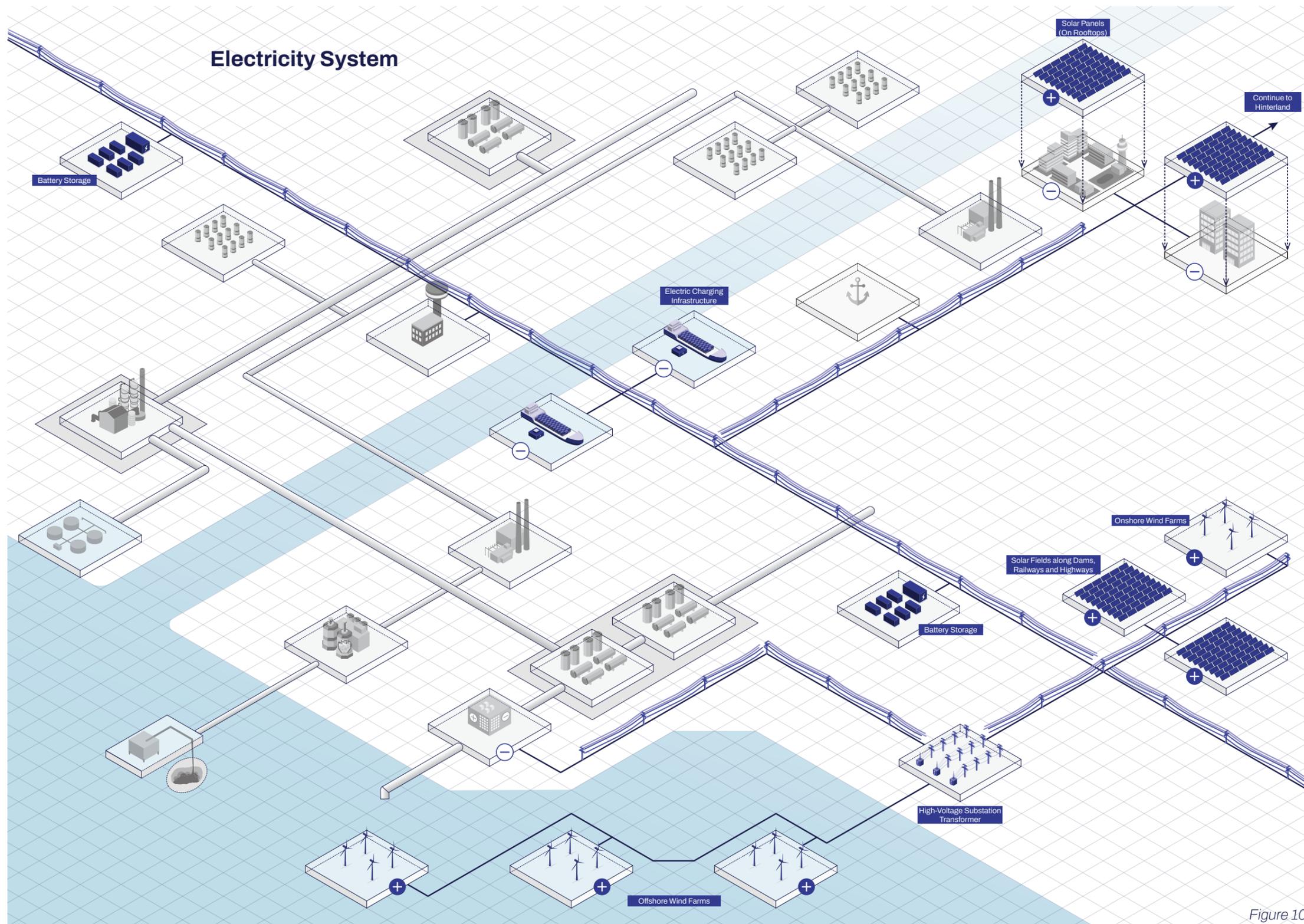


Figure 101: Electricity system

# What is changing?

Flows for the future

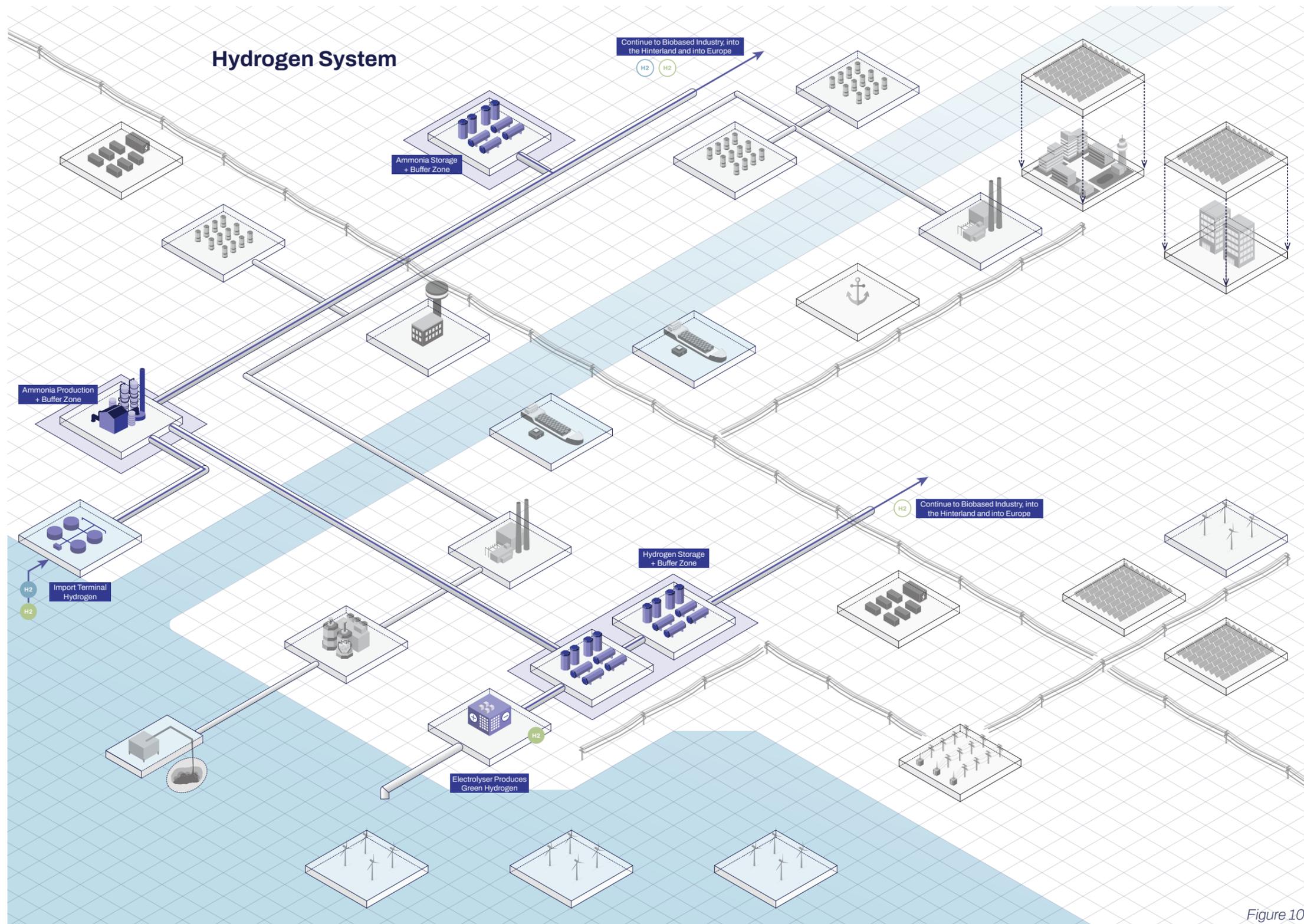


Figure 102: Hydrogen system

# What is changing?

Flows for the future

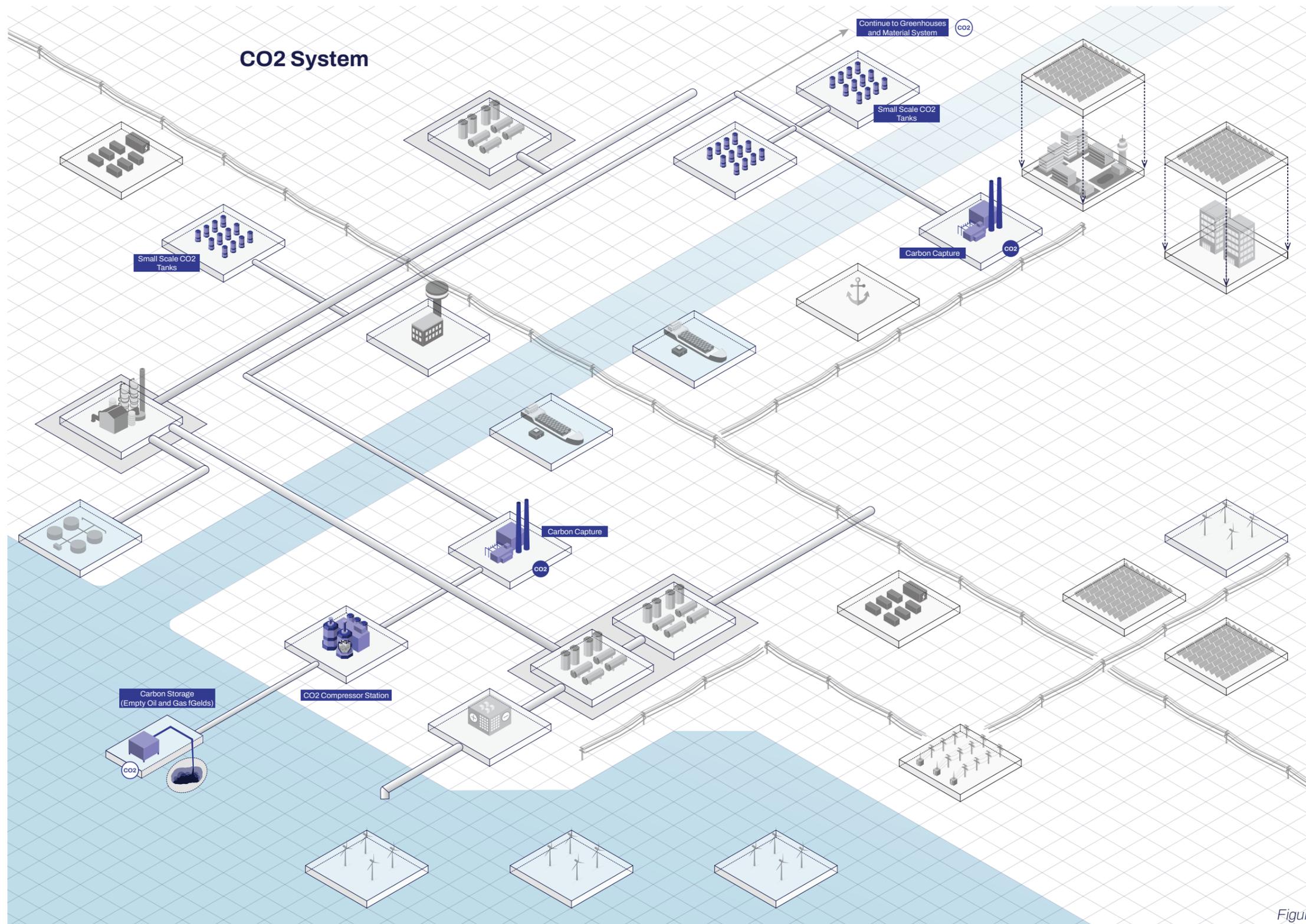
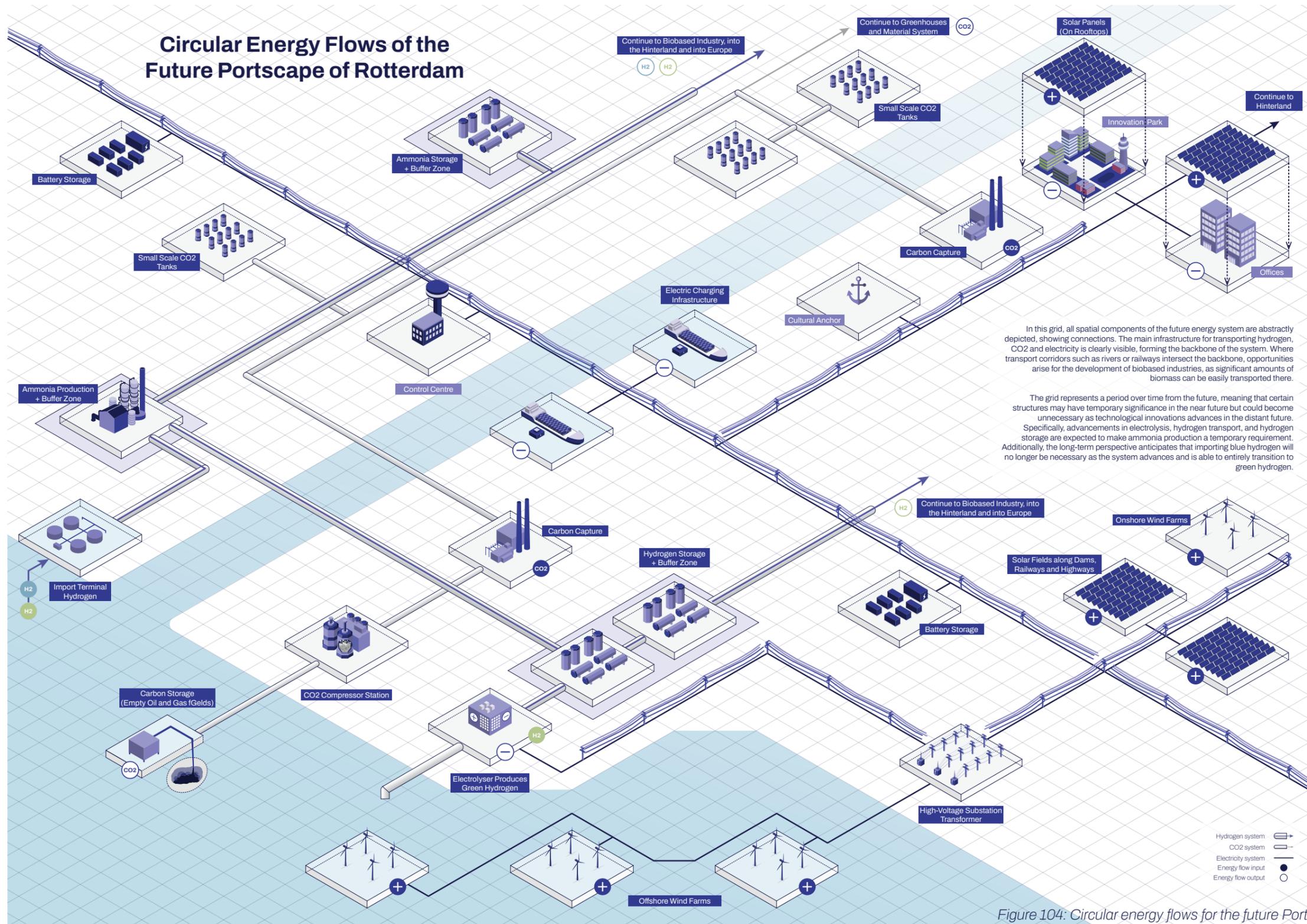


Figure 103: CO2 system

# What is changing?

## Flows for the future



In this grid, all spatial components of the future energy system are abstractly depicted, showing connections. The main infrastructure for transporting hydrogen, CO<sub>2</sub> and electricity is clearly visible, forming the backbone of the system. Where transport corridors such as rivers or railways intersect the backbone, opportunities arise for the development of biobased industries, as significant amounts of biomass can be easily transported there.

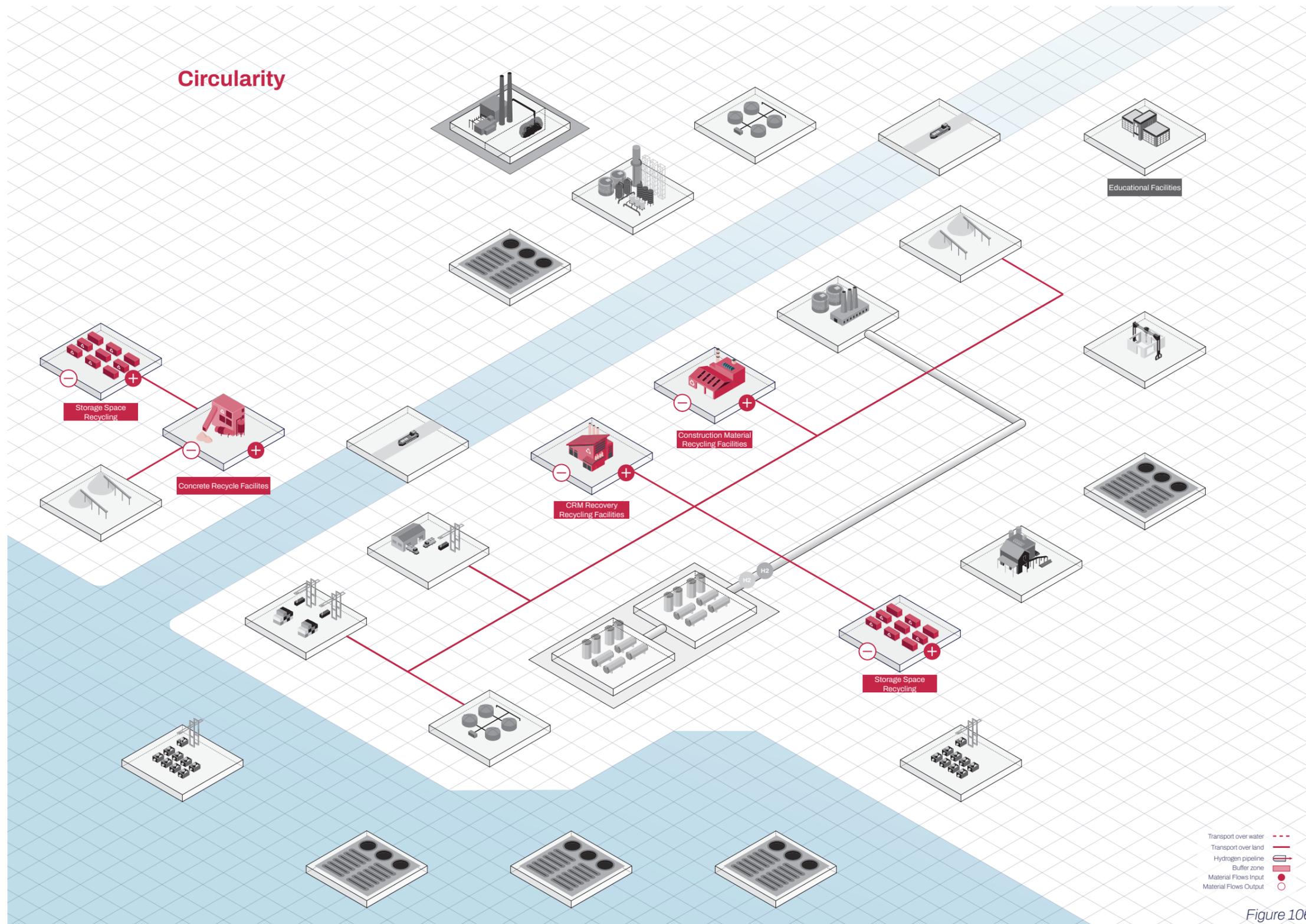
The grid represents a period over time from the future, meaning that certain structures may have temporary significance in the near future but could become unnecessary as technological innovations advances in the distant future. Specifically, advancements in electrolysis, hydrogen transport, and hydrogen storage are expected to make ammonia production a temporary requirement. Additionally, the long-term perspective anticipates that importing blue hydrogen will no longer be necessary as the system advances and is able to entirely transition to green hydrogen.

Figure 104: Circular energy flows for the future Portscape of Rotterdam



# What is changing?

Flows for the future



# What is changing?

Flows for the future

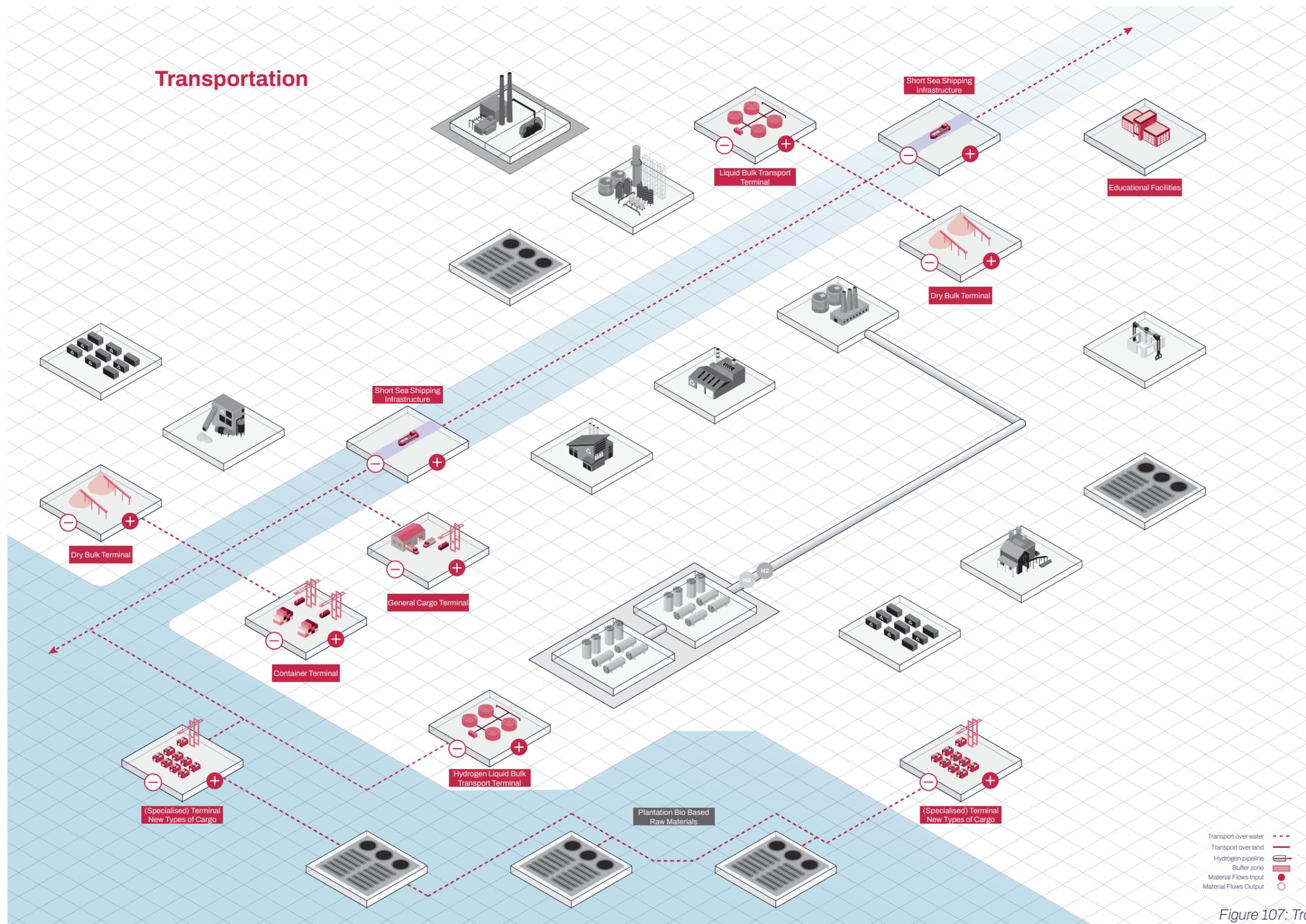


Figure 107: Transportation system

# What is changing?

## Flows for the future

### Material Flows of the Future Portscape of Rotterdam

This grid showcases the spatial components regarding future material flows in which transportation, production/manufacturing and circularity become visible. The material flow system is powered by the circular energy system and is oriented along the river and its infrastructural backbone. This way it optimizes logistical operations and emphasizes resource efficiency.

The grid represents a period over time from the future, meaning that certain structures may be scaled up or down as technological innovations advance in the distant future. As an example, floating plantations for bio based raw materials and its terminal for transport will be upscaled as we move through time. Also the storage space for recycling will be upscaled as recycle centers become more important within ports.

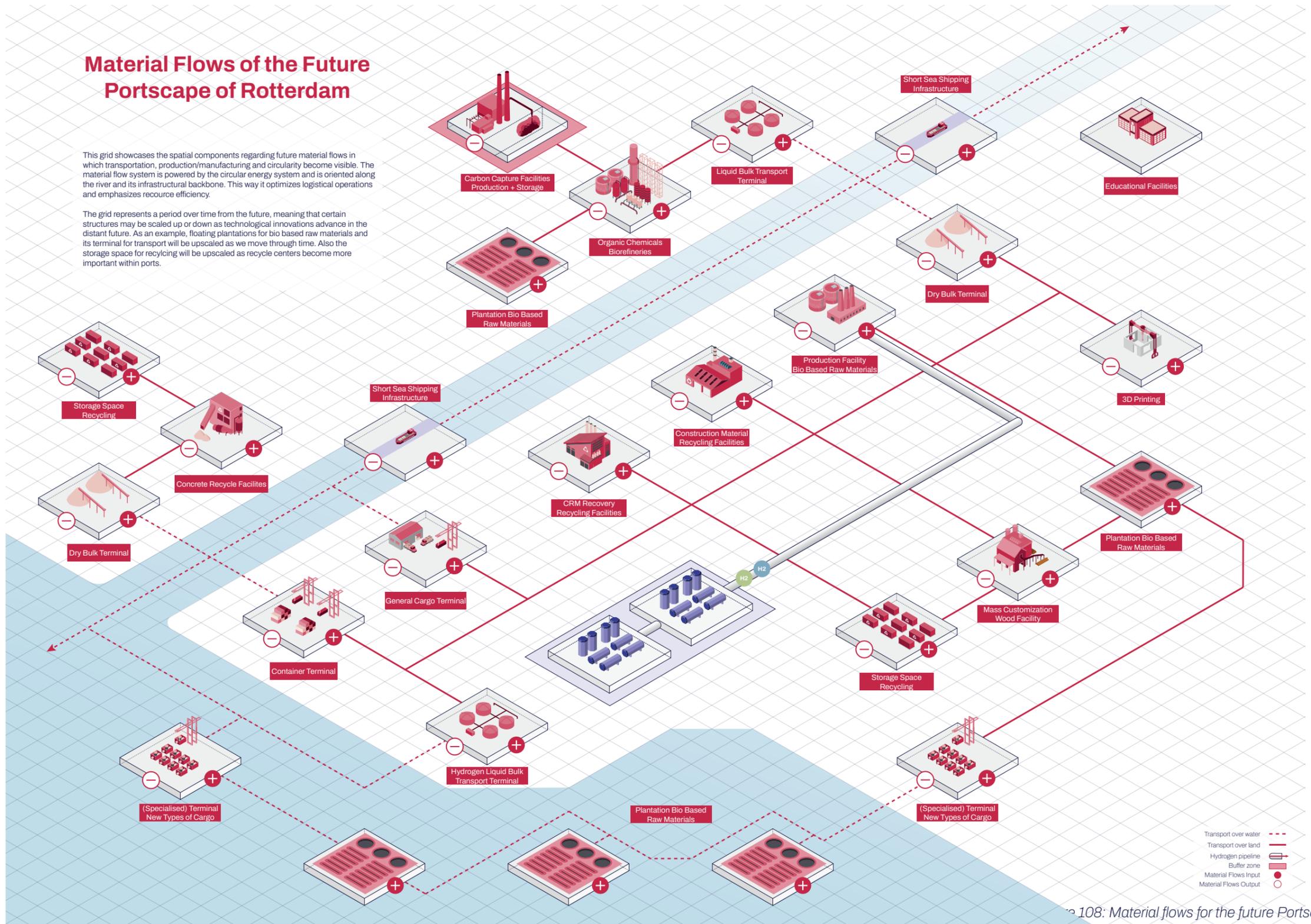


Figure 108: Material flows for the future Portscape of Rotterdam

# How can we get there?

## A phased approach: 2025-2030

Spatially, the implementation of our strategy is guided by the succession of land becoming available in the port.

In the Maasvlakte, these relatively large spaces will be at first dedicated to hydrogen, as we expect that relatively soon, great quantities will be needed. As mentioned before, there's a temporary need to import blue hydrogen to kick-start hydrogen pilot projects. With an interim significance of ammonia production it's important to build this further away from the urban environment as its processes can be pollutant with some safety issues. With new innovations and technologies, green hydrogen production will take over in the port, supported by large-scale imports of green hydrogen, and ammonia production can be removed.

Likewise, initial patches of land in the more central areas of the port will be given to pilots in the field of energy storage (batteries) and circular materials to achieve quick wins and get a foot on the ground in these fields.

In this first phase, we also start the transformation of the open space network: making shores in the urbanised areas more attractive to residents in line with objectives 1 and 5; begin preparation for linkage of green spaces: partly through greening shores and giving room to biodiversity, but also in the hinterland: stabilise and secure existing nature areas, delineate where future green corridors both on the north (Westland) and south (Voorne) sides will be established and start small scale interventions as well as safeguard space for them in the regional development.

2025 - 2030



- | Measure Scope                      | Spatial Measures by 2030        |
|------------------------------------|---------------------------------|
| ■ Materials                        | 01: Hydrogen production         |
| ■ Energy: Hydrogen                 | 02: Hydrogen terminal           |
| ■ Energy: Electricity / other      | 03: Circular materials pilot    |
| ■ People                           | 04: Biorefinery pilot           |
| ■ Transport and Logistics          | 05: Storage battery             |
| ■ Productive nature                | 06: Starting corridor Voorne    |
| ■ Protected nature                 | 07: Starting corridor dunes     |
| — Multi-utility transport corridor | 08: Starting corridor Rozenburg |
| ◆ Urbanisation projects (current)  | 09: Green link Westland         |
|                                    | 10: Green links Voorne rivers   |
|                                    | 11: People-friendly shorelines  |
|                                    | 12: Starting green shorelines   |
|                                    | 13: Offshore wind farms         |

Figure 109: Phasing maps - 2025-2030

# How can we get there?

## A phased approach: 2030-2050

In this phase, we predict an increased need for cargo spaces due to changed production and energy generation methods: Due to this, we propose expanding the Maasvlakte outwards, for hydrogen and/or bio-based materials that need to be carried from further away. This should be done in a floating manner in order to reduce (harmful) impact on flora and fauna.

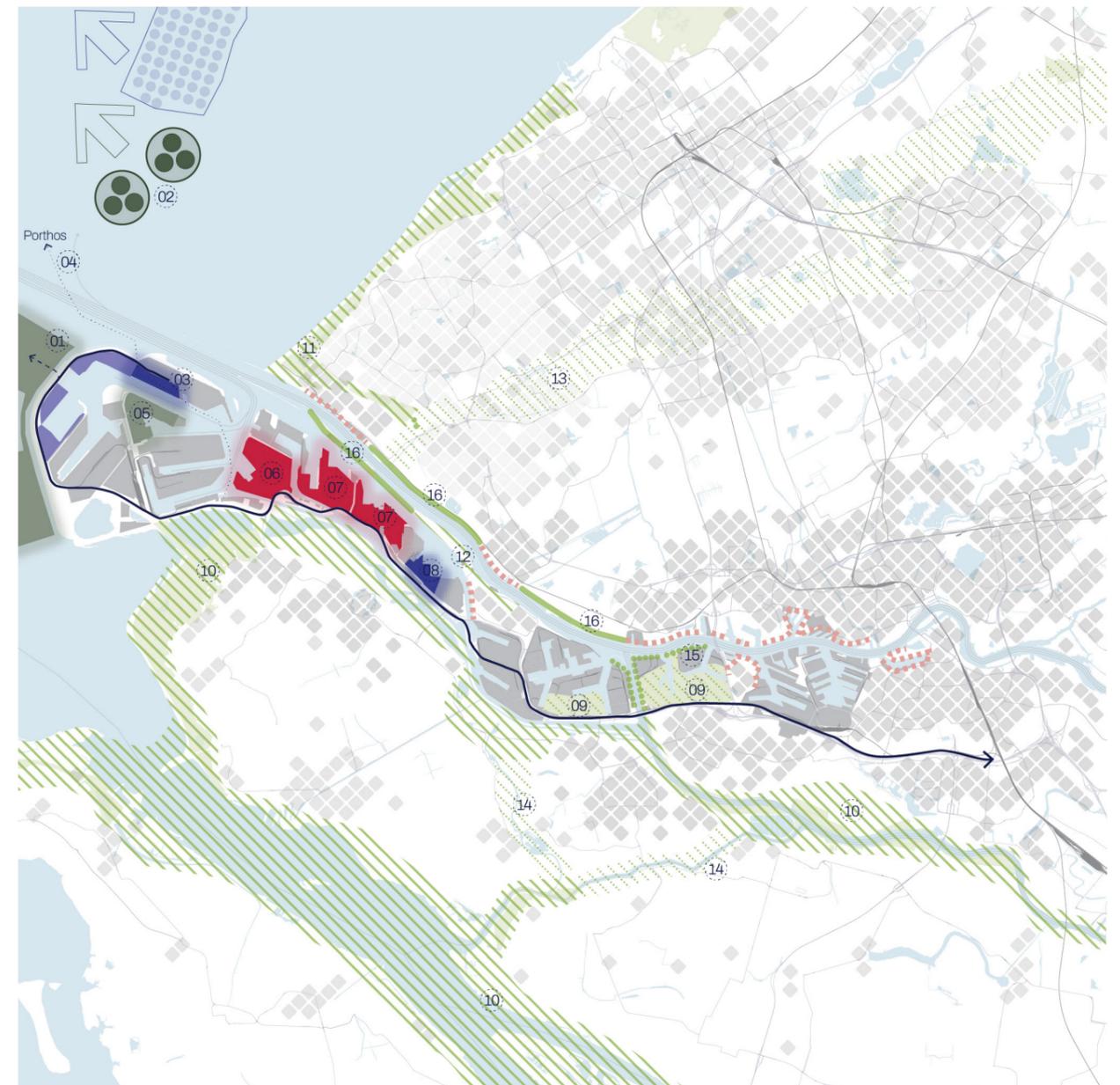
Several other activities will also be offshore, partly aiming at the production of bio-materials as well: floating islands further off the Dutch shore can cater for increased bio-material need; wind farms will be expanded and finally the Porthos scheme will materialise under the North Sea, where gas fields will be used to store captured carbon. This will also need infrastructure in the sea (pipeline that links with hinterland) as well as on the shore (compressing, processing, maintenance activities).

In the Portscape, bio-materials and circular production will be expanded in this phase, meanwhile, oil terminals will become redundant due to the complete phasing out of fossil fuels in line with European and worldwide climate goals. Here, we provide more space for energy, but for now it is not clear yet if this space is needed for hydrogen or electricity storage: this is why it is becoming a so-called flex-zone.

In the Botlek area, the space that is today used by the oil industry, the soil is heavily polluted. Therefore, remediation schemes are needed before the land can be used for other, more human-centred purposes, which makes sense due to the location relatively close to the city. This remediation will create the unique opportunity to develop a temporary park, which will see shifting functions as well as locations, as the remediation will be carried out gradually, aligning with the departure of the oil industry in steps.

In current natural areas, as well as along the southern fringe of the port, green corridors will be fully established, while those begun in the first part in the hinterlands of Voorne and Westland will continue to be established.

# 2030 - 2050



### Measure Scope

- Materials
- Energy: Hydrogen
- Energy: Electricity / other
- People
- Transport and Logistics
- Productive nature
- Protected nature
- Multi-utility transport corridor
- - New rail link
- ⋯ New pipeline infrastructure

0 2.5 5 km IN

### Spatial Measures by 2050

- 01: Floating terminal (biobased)
- 02: Offshore biomaterial production
- 03: CCS terminal
- 04: Link to Porthos scheme
- 05: Biomaterials terminal
- 06: Circular materials centre
- 07: Biochemicals
- 08: H2/Electricity Flexzone
- 09: Soil remediation / park
- 10: Established corridor Voorne
- 11: Established corridor Dunes
- 12: Established corridor Rozenburg
- 13: Starting corridor Westland
- 14: Starting corridor Voorne rivers
- 15: Starting green shores Botlek
- 16: Established green shores Botlek

Figure 110: Phasing maps - 2030-2050

# How can we get there?

## A phased approach: 2050-2065

Our trajectory aligning to the five vision objectives for development is followed further in this phase, with the space in the centre of the port being the focus. More areas will be used for green hydrogen production. In the middle of the port, next to Rozenburg, space that is currently being used for liquid bulk is dedicated to new modes of productive nature. This also gives the opportunity to link nature zones north and south of the Nieuwe Waterweg via this area, as can be seen depicted by the arrow on the map.

The now remediated areas of the Botlek can be used for bio-materials production and an innovation park, creating new employment opportunities for the residents of the Portscape. However, key physical features of the past will be kept, alongside some of the green spaces that were created earlier as part of the temporary park.

# 2050 - 2065

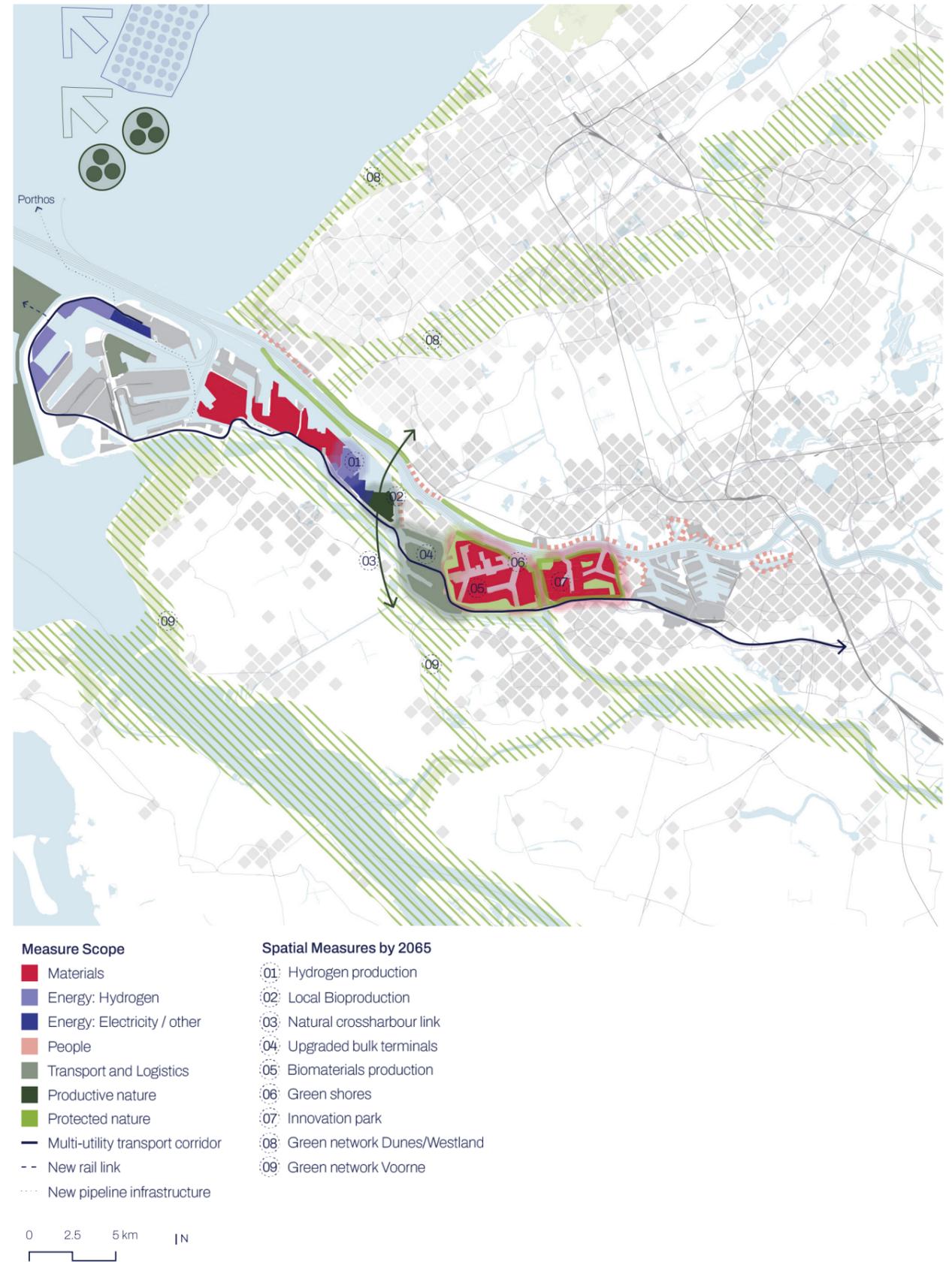


Figure 111: Phasing maps - 2050-2065

# How can we get there?

## A phased approach 2065-2100

This is the phase that is the furthest away from today, which means that our measures are more indicative, as the very specific developments that will occur and influence our strategy are hard to predict. What is known today already however is that the Maeslantkering will need to be replaced by around 2070. Moving the new barrier a few kilometers inward will mean that it can further strengthen the crossharbour green link. It has to be noted that the flood barrier will probably need to close more often in the future, due to rising sea levels. This shifted pattern will have different spatial impacts than today, which means that an integration into the crossing will generate new opportunities

In the hinterlands on both the northern and southern sides of the port, we envision new types of land use that replace the current, non-sustainable forms of agriculture. Aligning with the needs that might be present, we could envision expanded areas for materials and production, new settlement spaces, or productive types of nature. In any case, we propose having a healthy mix of functions, as well as strong green elements of protected nature, so that these areas link better with the green corridors around this land than today.

Closer to the city of Rotterdam, there is the opportunity to intensify the urban fabric of the Waalhaven. This is being done in the latest phase for two reasons: Firstly, it is today being redeveloped as a commercial area, so there is another life cycle just starting. Also, we see it as a linking piece between the Botlek and the more central parts of Rotterdam, so redevelopment has more benefits when the Botlek area with the innovation park is already flourishing.

2065 - 2100

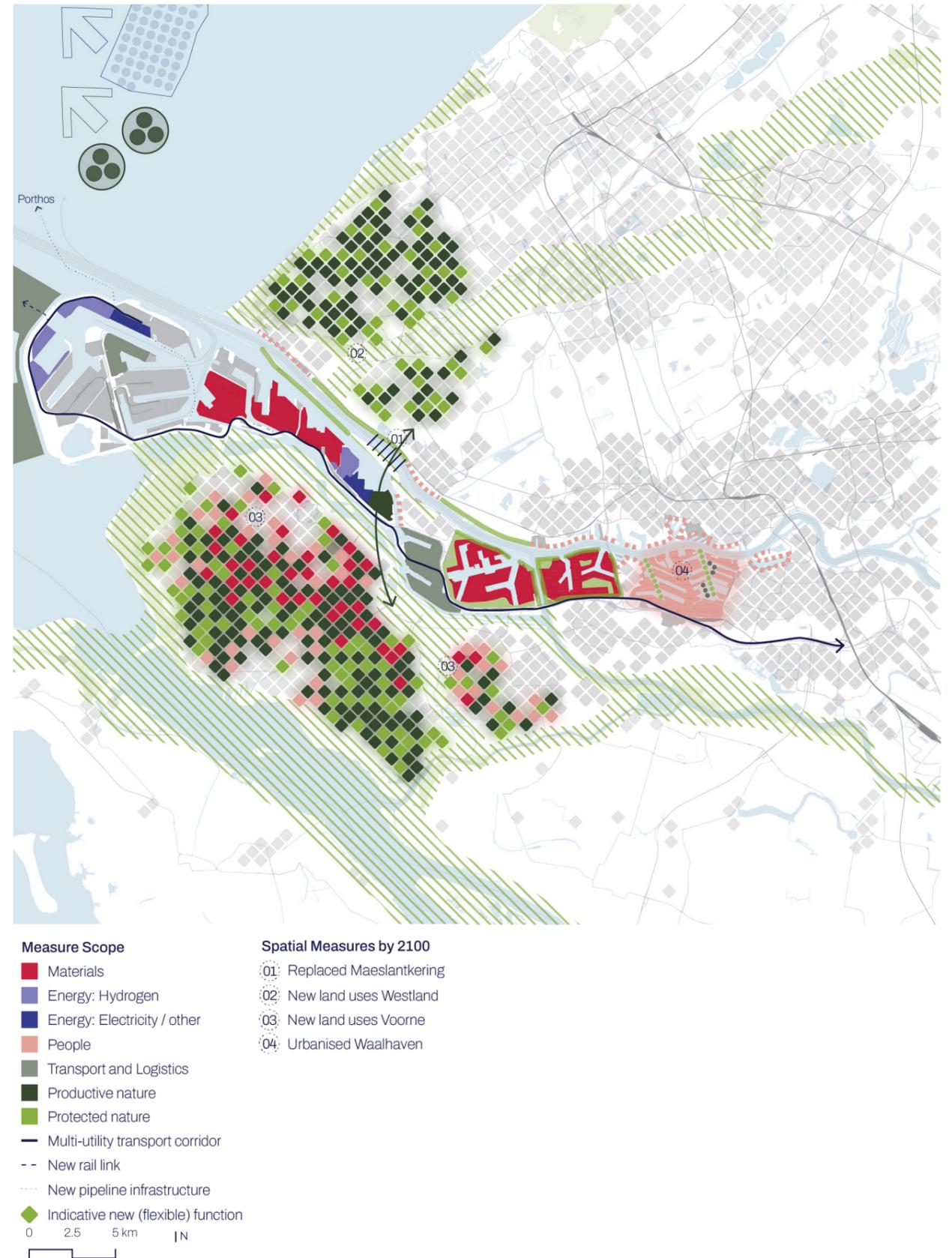


Figure 112: Phasing maps - 2065-2125

# How can we get there?

## Re-imagining Port, Portscape and Port Landscape governance

With the circular transition of the port public actors are managed and practice a proactive multi-governance approach as it speeds up the process. Increased interest of higher governmental levels and increased power of lower governmental levels would allow for more action.

The transition allows innovative energy companies to increase in both their power and interest while fossil fuel companies decrease. Companies regarding recycling of construction materials increase in their interest.

Community stakeholders are mainly increased by their interest as they are both engaged and empowered. Taking people into account for the port transition would allow for a holistic approach to sustainability and can therefore not be neglected.

Universities and research institutes increase in interest as they are empowered. They are important for the share of knowledge and improve the collaboration of academia, industries and governance.

Capital such as investors and landowners have a high power but may have lower interests. Therefore, it is crucial to persuade them to realise the developmental projects.

- Public Services**
- P1 EU
- P2 Rijksoverheid (State)
- P3 Province
- P4 Municipality
- P5 Port Authority
- Businesses**
- B1 Energy Companies
- B2 Fossil Fuel Companies
- B3 Chemical Companies
- B4 Waste Collection Companies
- B5 Construction Companies
- B6 Cargo Companies
- B7 Shipping Lines / Companies
- Community**
- C1 Residents
- C2 Employees
- C3 NGO's
- C4 Nature
- C5 Future Generations
- C6 Farmers
- Knowledge**
- K1 Universities
- K2 Research Institutes
- Financial Capital**
- F1 Land owners
- F2 Investors
- F3 Housing Corporations

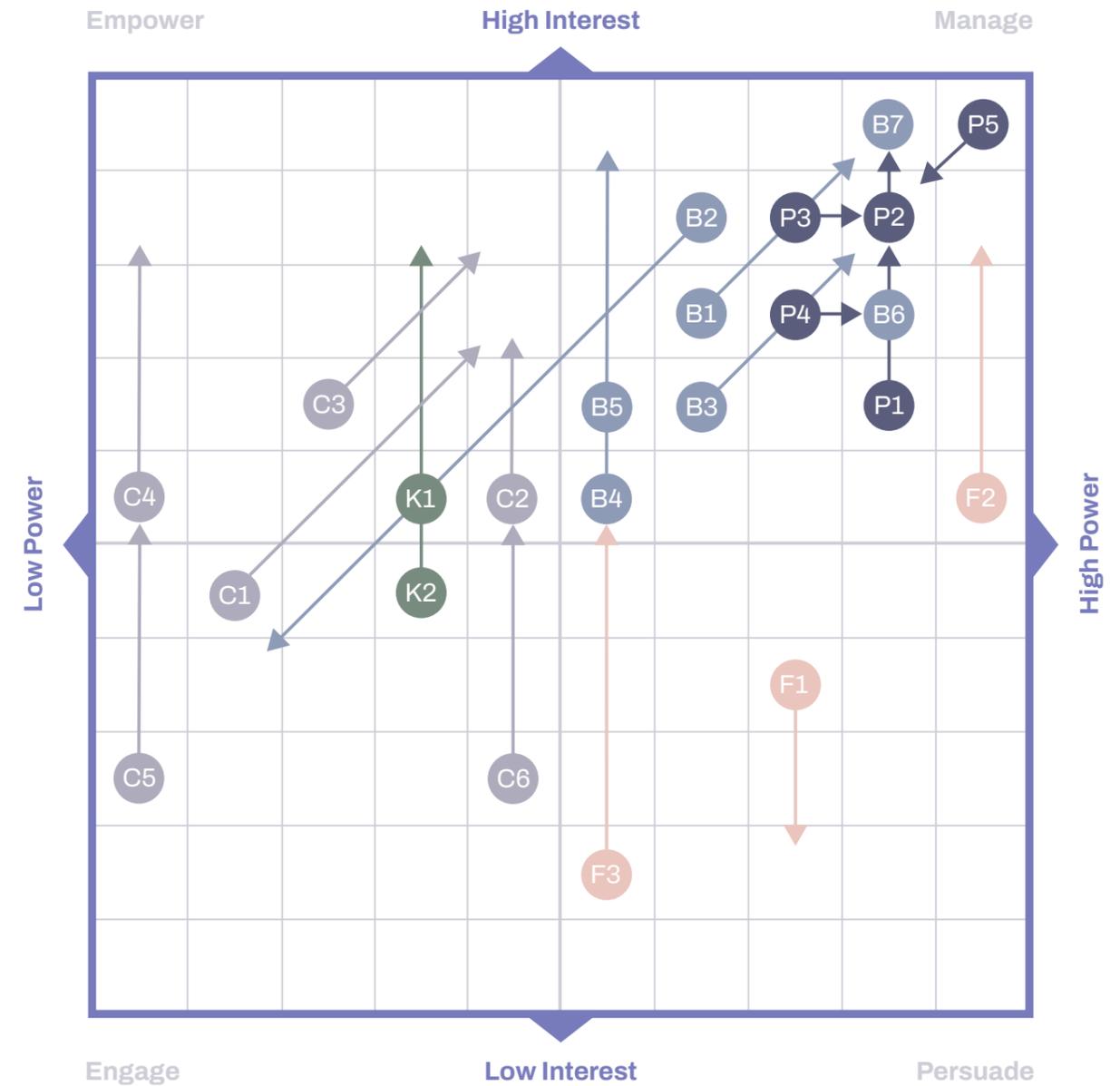


Figure 113: Stakeholders' power / interest shift

# How can we get there?

## Enabling change top down and bottom up

### Our approach

Our recommendations are split in 4 types:

- Policy
- Legislation
- Funding
- Facilitation

For each recommendation, the affected objectives have been indicated. This emphasises the multidimensional aspect of our proposals and strategy.

### Top down

The Portscape of Rotterdam is in a critical position currently as it is in the crossroads of the transition. Indeed, in order to facilitate change, and especially in approaching the “chaos” phase of our X Curve, some things need to be enforced by governmental and public actors. Indeed, one key way to achieve our goals is via policy and legislation, from actors at different scale (Port Authority, European Union...).

In particular, instauring new laws like Carbon Taxing, Eco-labels and Performance goals will help monitor and quantify the progress. In addition to ensuring direct change in the Portscape of Rotterdam, certain elements contribute to indirect change, more specifically behaviour and public conscience shifts. Namely:

- 1.2 Research partners
- 2.1 Eco label for goods
- 2.2 Local produce use
- 4.3 15min Portscapes

The power of people on change is better detailed in the Bottom up section.

While one size does not fit all, and every port in the EU Port Landscape having its own unique trends and Portscape, certain actions remain common to various authorities, and this plan could be applied, with adaptation, to multiple stakeholders in the Port Landscape. In fact, despite celebrating and planning for each port's individual future role and processes, it is crucial to have a common ground in order to have a truly holistic and integrated Port Landscape. The applicable frameworks to enable this cohesion would be:

- 1.0 Port collaboration
- 1.1 Monitoring impact
- 1.2 Research partners
- 4.0 Net Zero Ports
- 4.2 Digital landscape

### Bottom up

The importance of collaborative planning is being increasingly recognised and there is a loss of confidence in Europe in political systems as mechanisms for conflict mediation and strategic management (Healey, 1996, p.217). It is understood that planners are not neutral experts and knowledge is “socially constructed” which leads to the idea that of the value of people's voices, especially the people we are designing for. This approach also aims to mitigate any unforeseen (by planners) rebound effects, or spatial justice issues - as planners, our strength relies in bringing the multiple groups at stake in the problem together to help steer a collaborative design process. This is enabled via joint design / responsibility frameworks such as:

- 2.2 Local produce use
- 3.0 Participatory Portscape
- 4.1 Transition for people plan

On top of involving people into planning our planning processes, a few of our strategies also remove planners / urbanists / governments completely and aim to provide the means for people to participate in creating livable spaces, in particular, funding for Grassroots projects (3.1) and Adaptive buildings (3.2)

## POLICY

**1.0 Port Collaboration**

Port representatives 2025

- Paradigm shift away from competition
- In line with European Port Strategy
- Embracing modern methods of collaboration / communication via online forums

O1 O2 O3 O4 O5

**1.1 Monitoring impact**

Port Authority 2025

- Monitor and report on impact of ports on portscapes in terms of biodiversity loss, pollution levels (air, water, soil) and energy intensity
- Publishing report yearly with clear targets

O1 O2 O3 O4 O5

**1.2 Research partners**

Private companies Knowledge hubs 2045

- Knowledge sharing and open data throughout port landscape
- Collaborate with local educational hubs and research institutions within Innovation Park (ie funding PhDs etc)

O1 O2 O3 O4 O5

## LEGISLATION

**2.0 Port Carbon Taxing**

Shipping companies Passengers 2025

- Carbon as a currency - tax based on carbon impact + circular potential (back of)
- In line with European Strategy (CHECK)
- Tax to fund fair transition scheme and soil remediation / temporary park

O2 O3 O5

**2.1 Eco-label for goods**

Shipping companies Goods providers / users 2030

- Score the ecological impact of goods and transport flows
- End user empowerment and port transparency

O1 O2 O3

**2.2 Local produce / use**

Goods providers / users Regional authority 2030

- Encourage (via subsidies) local production and distribution of goods
- Create links for circularity opportunities throughout portscapes and port landscape

O1 O2 O3 O5

**2.3 Performance goals**

Port Authority European Authority 2025

- Ports in performance contract with EU
- Clear and measurable goals reported 5 yearly

O1 O2 O3 O4 O5

## FUNDING

**3.0 Participatory Portscape**

Residents Port Authority ad hoc

- Engagement workshops and forums for people's participation
- In line with the reviewed governance
- Use digital tools for participation

O1 O3 O4 O5

**3.1 Grassroots funding**

Residents European Authority 2050

- Opportunity for locals to activate spaces and initiate projects
- Funding allocation for port involvement in educational / cultural projects

O1 O3 O5

**3.2 Adaptive buildings**

Urban planners Developers 2055

- Incentives for adapting the existing building stock in line with our objective
- Funding for social and cultural anchors

O1 O2 O3 O5

## FACILITATION

**4.0 Net Zero Ports Framework**

Regional Authority 2065

- Framework for Port authorities giving key guidelines and roadmap strategy for NZ
- Tools for circularity
- In collaboration with waste industries

O1 O2 O4

**4.1 Transition for people plan**

Regional Authority 2035

- Ensuring a smooth transition from fossil fuel jobs to green jobs (train, upskill)
- In collaboration with affected businesses and Innovation Park businesses to ensure a just transition

O1 O2 O3 O4 O5

**4.2 Digital landscape**

European Authority 2035

- Digitalise and optimise flows and operations via AI and other modern technology
- Digital port landscape twin for a coherent strategy

O1 O2 O4

**4.3 15min Portscape**

Regional planners 2040

- Design principles for regenerating portscapes
- Increased accessibility and social amenities

O1 O3 O5

Figure 114: Policies, Legislation, Funding and Facilitation for the future Portscape of Rotterdam

# How long will change take?

## Timeline and actions

This timeline shows the actions (both spatial and regulatory), their sequence with one another and their overall phasing through time.

To achieve our aim of a circular and just Rotterdam Portscape, we envisage 4 phases:

- Phase 1: the quick and easy wins, what is achievable in the next 5 years
- Phase 2: the slower motion projects, phasing out of the fossil fuel dependency towards 2050
- Phase 3: reinforcing the change post 2050, rethinking linear spaces
- Phase 4: affirming space for the truly circular Portscape for 2100

For each action, the affected ones out of our five objectives are indicated, again demonstrating our integrated, cohesive and multidimensional approach, with understanding that one action has more than one consequence (or in this case, benefit).

When planning for 100 years in the future, there needs to be an element of flexibility and adaptability in our strategies, as it is difficult to predict the situation in 50 years time, with new technologies being on the horizon, for instance. For this reason, the key actions are taken early on in the timeline, with more uncertainty and open-ended-ness as we go through the decades.

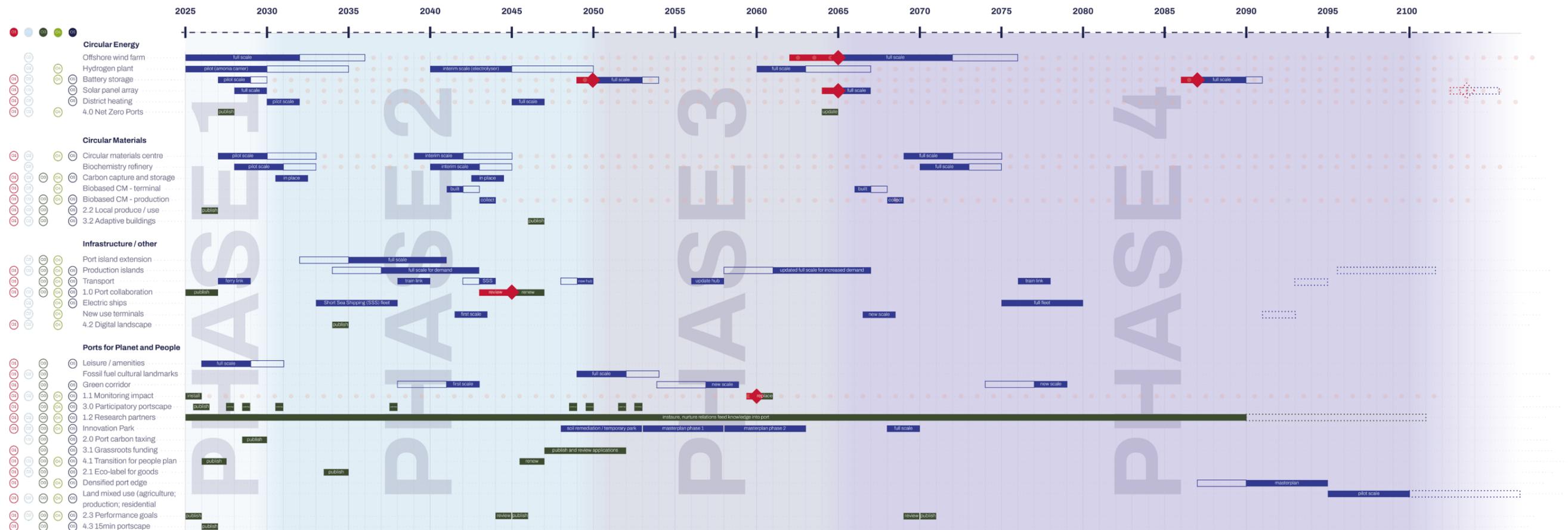


Figure 115: Timeline - full

# How long will change take?

## Phases 1 and 2

Phases 1 and 2 focus on achievable but determining actions. Indeed, these are the ones we have most control and certainty of. In particular, the energy transition is currently well documented and can be applied almost immediately. This contrasts with the material transition, for which there are less industry guidelines and for which the technologies are still developing.

As such, we have designed most of the key regulatory implementations as well as large scale energy transition enablers within the first 5 years. On top of implementing the tried and tested technologies (wind turbines, solar panels) we also aim to start the small scale pilots for the emerging transition to circularity, in particular relating to hydrogen and materials.

Spatially, two major changes are island developments - one directly attached to the port as an extension, and others as remote production island, extending the boundaries of Rotterdam's Portscape.

Finally, the social and natural regeneration is integral to the changes, as more links and amenities and relationships are created.

In line with global commitments, we aim to have decarbonised the Portscape of Rotterdam by 2050.

- 1 ○2 ○3 ○4 ○5
- Circular Energy**
- 2 Offshore wind farm
- 2 ○4 Hydrogen plant
- 1 ○2 ○4 ○5 Battery storage
- 1 ○2 ○5 Solar panel array
- 1 ○2 ○5 District heating
- 1 ○2 ○4 4.0 Net Zero Ports
- Circular Materials**
- 1 ○2 ○4 ○5 Circular materials centre
- 2 Biochemistry refinery
- 1 ○2 ○3 ○4 ○5 Carbon capture and storage
- 1 ○2 ○3 ○4 ○5 Biobased CM - terminal
- 1 ○2 ○3 ○4 ○5 Biobased CM - production
- 1 ○2 ○3 ○5 2.2 Local produce / use
- 1 ○2 ○3 ○5 3.2 Adaptive buildings
- Infrastructure / other**
- 2 ○3 ○4 Port island extension
- 1 ○2 ○3 ○4 ○5 Production islands
- 1 ○2 ○3 ○4 ○5 Transport
- 1 ○2 ○3 ○4 ○5 1.0 Port collaboration
- 2 ○4 ○5 Electric ships
- 2 ○4 ○5 New use terminals
- 1 ○2 ○4 4.2 Digital landscape
- Ports for Planet and People**
- 1 ○3 ○5 Leisure / amenities
- 1 ○2 ○3 Fossil fuel cultural landmarks
- 1 ○3 Green corridor
- 1 ○2 ○3 ○4 ○5 1.1 Monitoring impact
- 1 ○3 ○4 ○5 3.0 Participatory portscape
- 1 ○2 ○3 ○4 ○5 1.2 Research partners
- 1 ○2 ○3 ○4 ○5 Innovation Park
- 2 ○3 ○5 2.0 Port carbon taxing
- 1 ○3 ○5 3.1 Grassroots funding
- 1 ○2 ○3 ○4 ○5 4.1 Transition for people plan
- 1 ○2 ○3 ○5 2.1 Eco-label for goods
- 1 ○3 ○4 ○5 Densified port edge
- 1 ○2 ○3 ○4 ○5 Land mixed use (agriculture; production; residential)
- 1 ○2 ○3 ○4 ○5 2.3 Performance goals
- 1 ○3 ○5 4.3 15min portscape

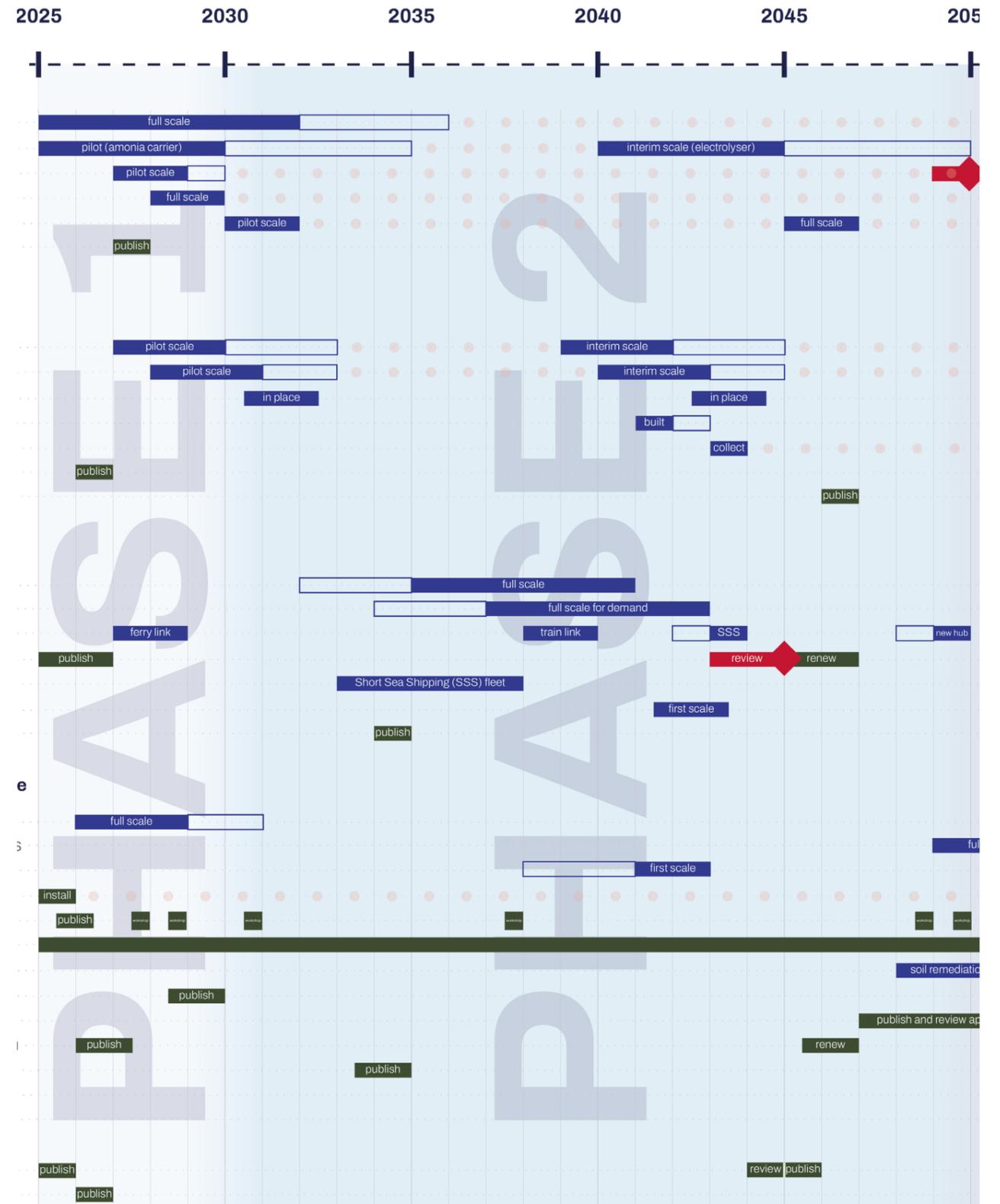


Figure 116: Timeline - Phases 1 and 2

# How long will change take?

## Phase 3

Throughout Phase 3, there will be a number of technologies reaching their end of life, which will need careful consideration in applying circularity principles, looking to recommission and reuse before, as a last resort, recycling critical elements.

Additionally, the Port's critical area (previously fossil fuel dominated) will start its major redesign and retrofit, starting with soil remediation. To ensure social justice and general social sustainability, participative planning processes will reappear, in the form of workshops and co design sessions, to ensure a collaborative approach to the redevelopment of the critical area into an Innovation Park, for cycles of care, knowledge and ecosystem. With these developments, new infrastructure will be developed.

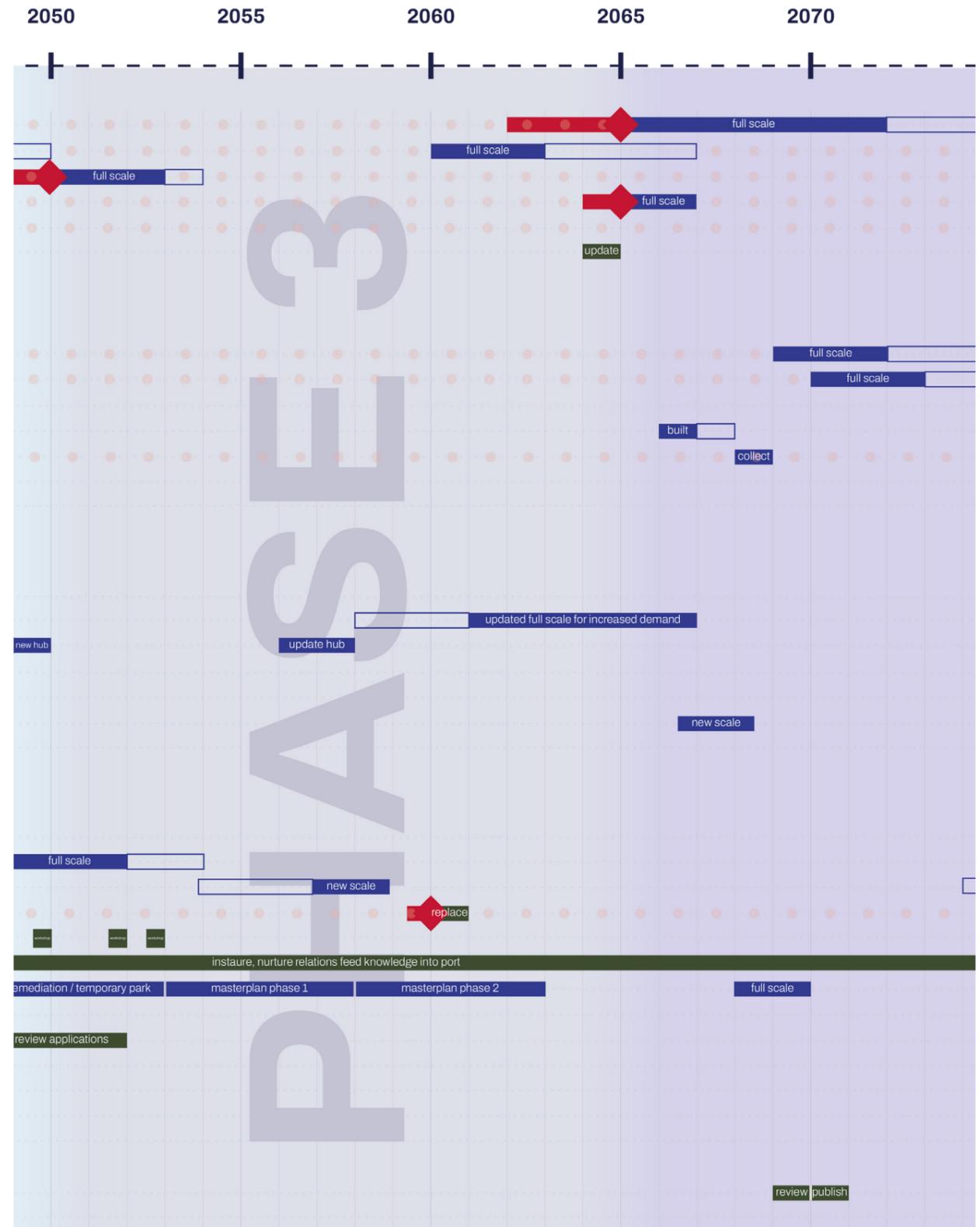
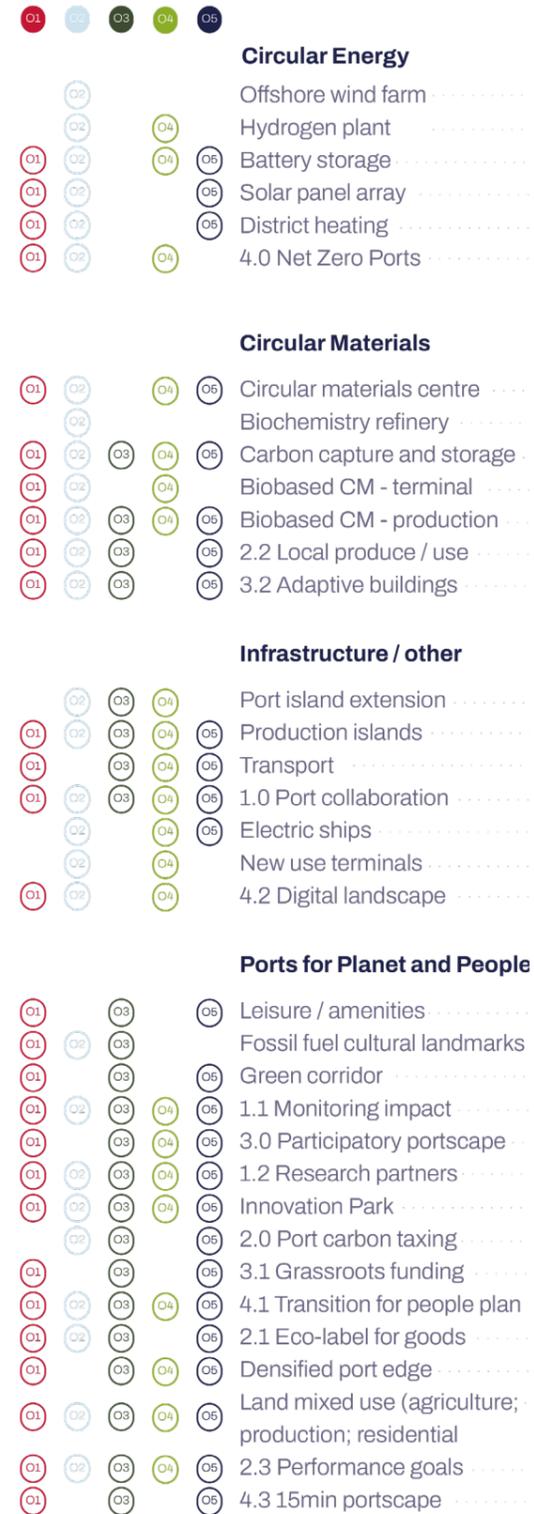


Figure 117: Timeline - Phase 3

# How long will change take?

## Phase 4

This phase is the least populated and most uncertain, as we are approaching the 100 year mark. Again, it is important to consider the end of life of our previously implemented spaces. By this point, there will be a densification and diversification of the urban fabric, with a mixed land use between urban, production and natural spaces.

- Circular Energy**
  - 01 02 03 04 05
  - 02 Offshore wind farm
  - 02 04 Hydrogen plant
  - 01 02 04 05 Battery storage
  - 01 02 05 Solar panel array
  - 01 02 05 District heating
  - 01 02 04 4.0 Net Zero Ports
- Circular Materials**
  - 01 02 04 05 Circular materials centre
  - 02 Biochemistry refinery
  - 01 02 03 04 05 Carbon capture and storage
  - 01 02 04 Biobased CM - terminal
  - 01 02 03 04 Biobased CM - production
  - 01 02 03 2.2 Local produce / use
  - 01 02 03 3.2 Adaptive buildings
- Infrastructure / other**
  - 02 03 04 Port island extension
  - 01 02 03 04 05 Production islands
  - 01 02 03 04 05 Transport
  - 01 02 03 04 05 1.0 Port collaboration
  - 02 04 05 Electric ships
  - 02 New use terminals
  - 01 02 04 4.2 Digital landscape
- Ports for Planet and People**
  - 01 03 05 Leisure / amenities
  - 01 02 03 Fossil fuel cultural landmarks
  - 01 03 05 Green corridor
  - 01 02 03 04 05 1.1 Monitoring impact
  - 01 03 04 05 3.0 Participatory portscape
  - 01 02 03 04 05 1.2 Research partners
  - 01 02 03 04 05 Innovation Park
  - 02 03 05 2.0 Port carbon taxing
  - 01 03 05 3.1 Grassroots funding
  - 01 02 03 04 05 4.1 Transition for people plan
  - 01 02 03 05 2.1 Eco-label for goods
  - 01 03 04 05 Densified port edge
  - 01 02 03 04 05 Land mixed use (agriculture; production; residential)
  - 01 02 03 04 05 2.3 Performance goals
  - 01 03 05 4.3 15min portscape

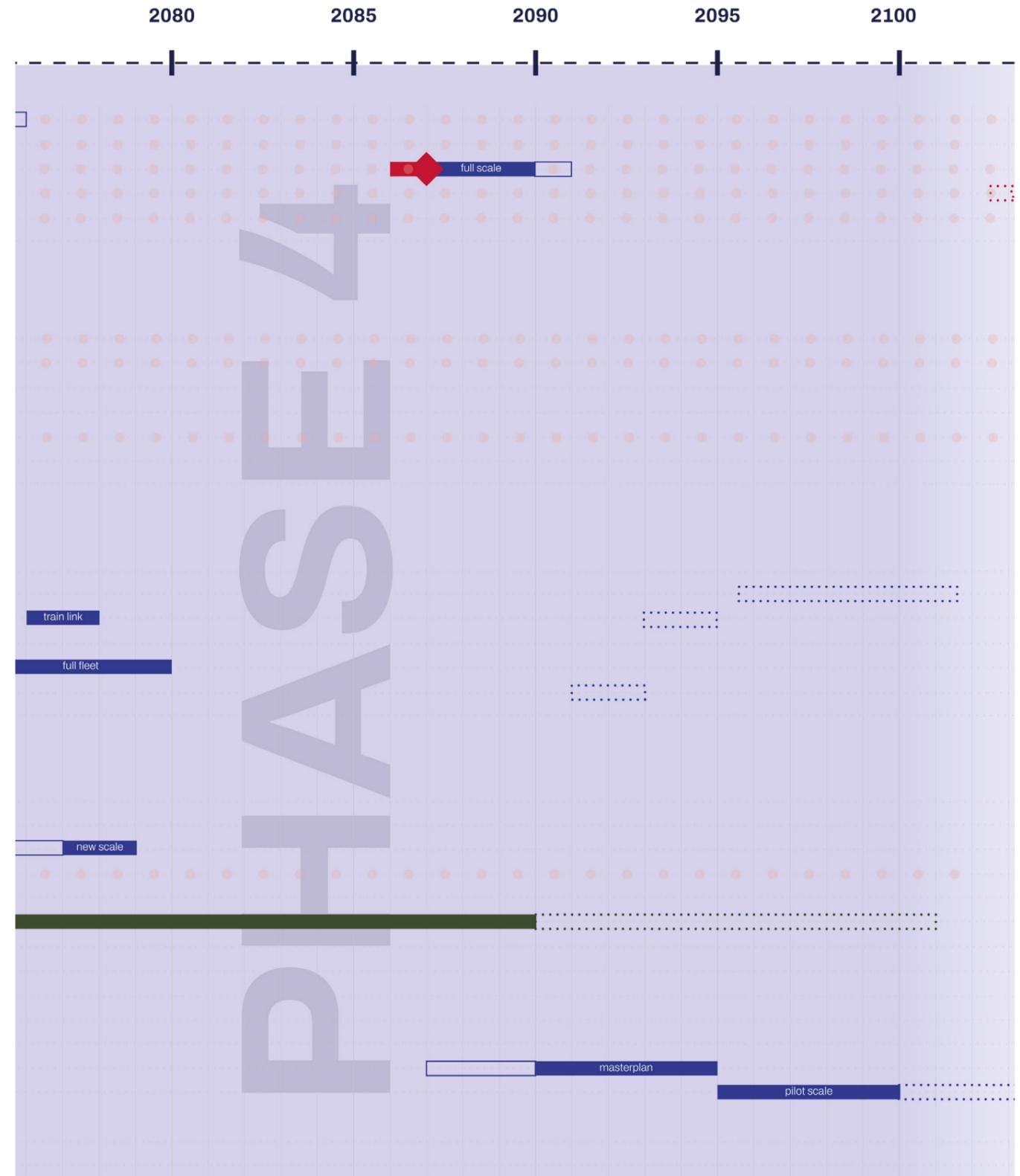


Figure 118: Timeline - Phase 4

# What will it look like?

## The 100 year Port plan - critical area

We chose Botlek and Vondelingenplaat as our critical area. This area got our attention as it contains a lot of polluting, linear industries, including oil refineries and chemical refineries; Botlek is known for its heavy industrial activity.

The traditional linear economy model in this area, relying on extraction, production, consumption and disposal, leads to environmental degradation. Botlek's industrial activities contribute to pollution, gas emissions, and waste generation. To transition to a circular economy, it helps to minimise these environmental impacts by promoting resource efficiency, waste reduction and recycling. As our aim is to create a clean, circular and green Portscape, this area should change; the critical area will take an important role in the transition of the port.

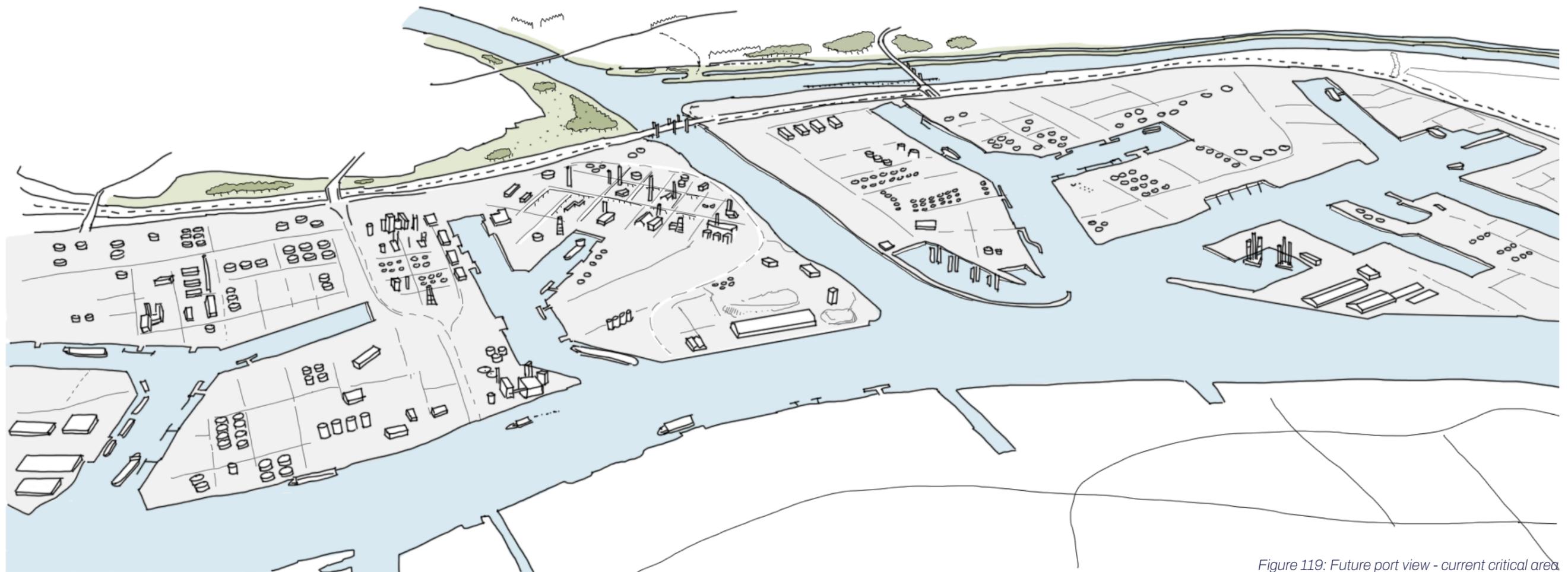


Figure 119: Future port view - current critical area

# What will it look like?

## The 100 year Port plan - soil remediation

Soil remediation can play a crucial role in transitioning Botlek and Vondelingenplaat into a circular economy. Many industrial activities in the critical area have led to soil contamination due to spills, leaks or improper waste disposal. Remediating the soil can help restore these polluted areas, and improve the environmental quality.

When the soil remediation is complete, the new clean land can be re-purposed, for sustainable projects, such as a temporary park. Creating a temporary park at the critical area, can function as a catalyst for community participation in the transition towards a circular economy. When residents are involved in the development of the park, awareness of the circular economy can be fostered. In addition, transitioning to a circular economy is a long-term process. Introducing this new park offers immediate benefits, such as recreation, and improved quality of life. To keep the identity of the old place, the park will reuse some buildings of the old situation as heritage.

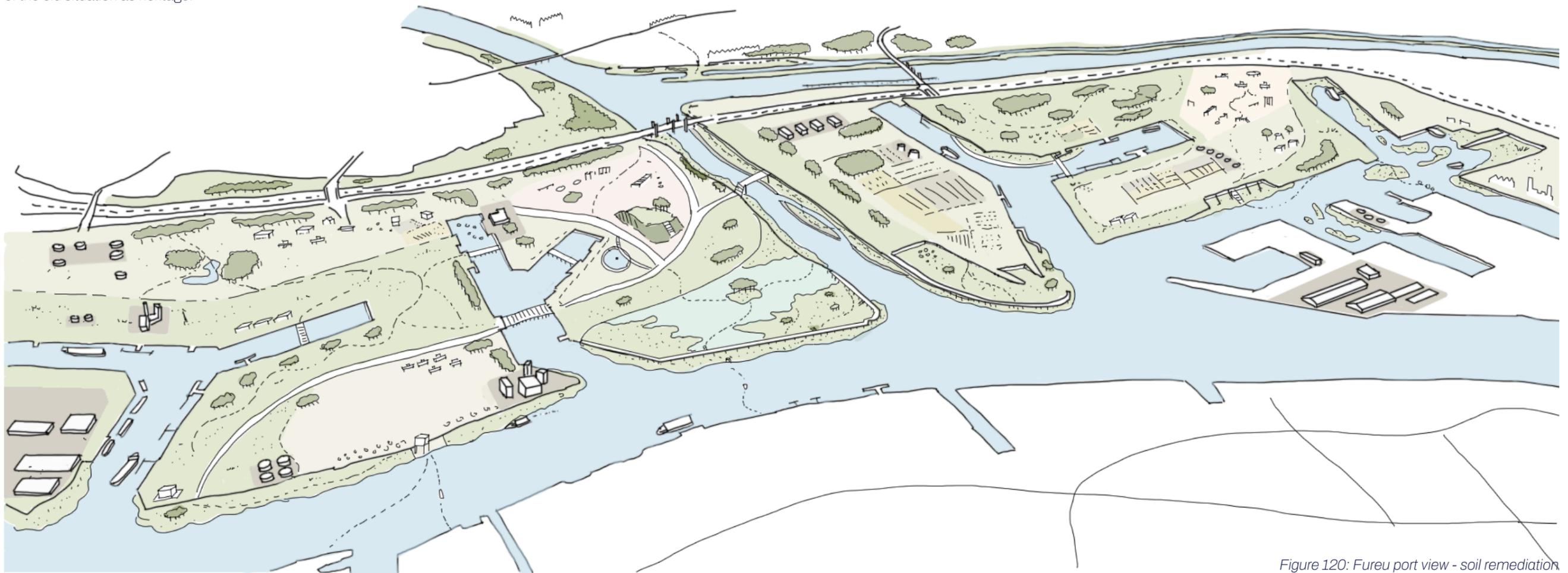


Figure 120: Fureu port view - soil remediation

# What will it look like?

## The 100 year Port plan - innovation park

The last step for the critical area would be transforming the temporary park into an innovation park with bio-based material production. The new bio-based refineries use biomass feedstock, like forestry waste or agricultural residues. By leveraging these renewable green resources, the reliance on fossil fuels will be reduced, and contribute to the circular economy by closing the loops on organic waste flows. It also reduces the environmental impact.

At last, the innovation park focused on bio-based refineries can foster collaborations between industry and research institutions. This new collaborative environment encourages innovation and technology development. It also creates new opportunities for employment and investment in the critical area, which can contribute to job creation and economic growth in the region. Also some of the old buildings or landscape structures will be maintained as heritage.

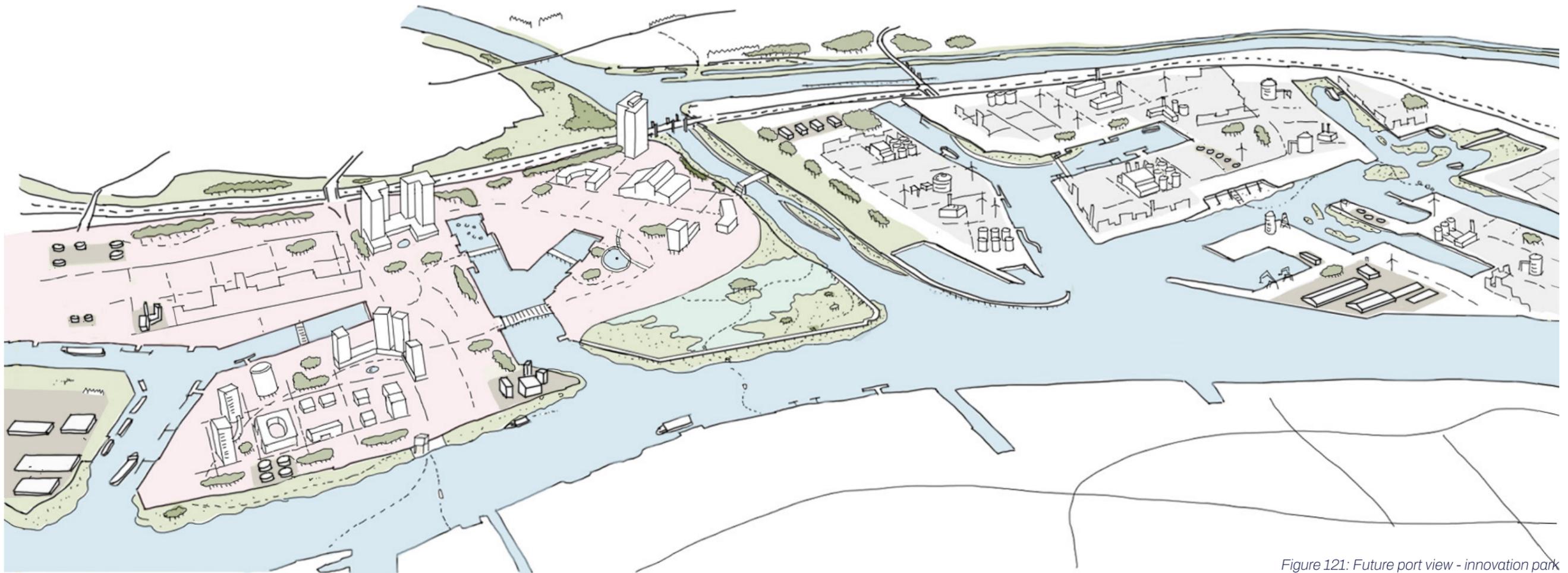


Figure 121: Future port view - innovation park

# What will it look like?

The 100 year Portscape plan

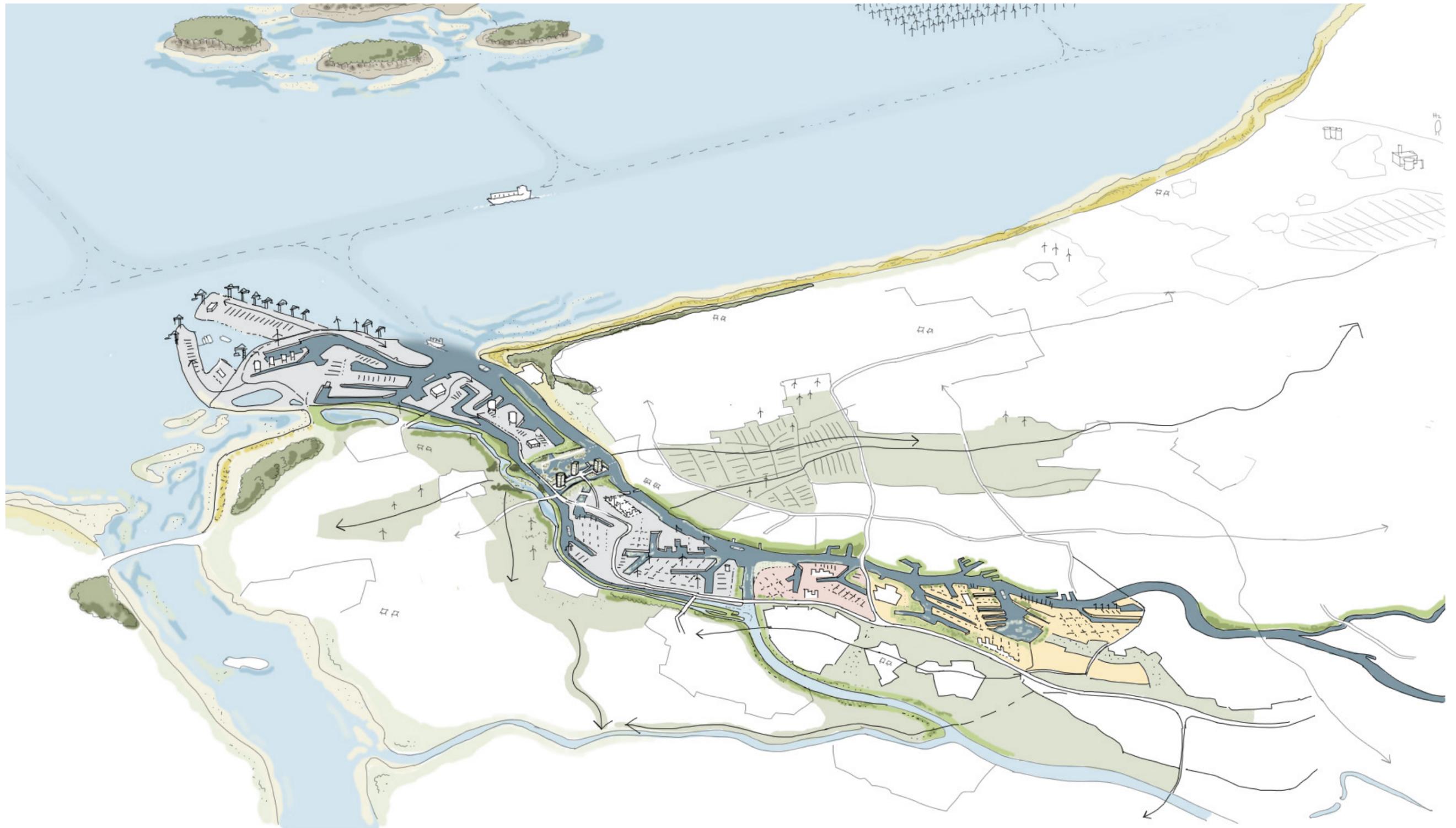


Figure 122: The Future Portscape of Rotterdam - view

# What will it look like?

The 100 year Port Landscape plan

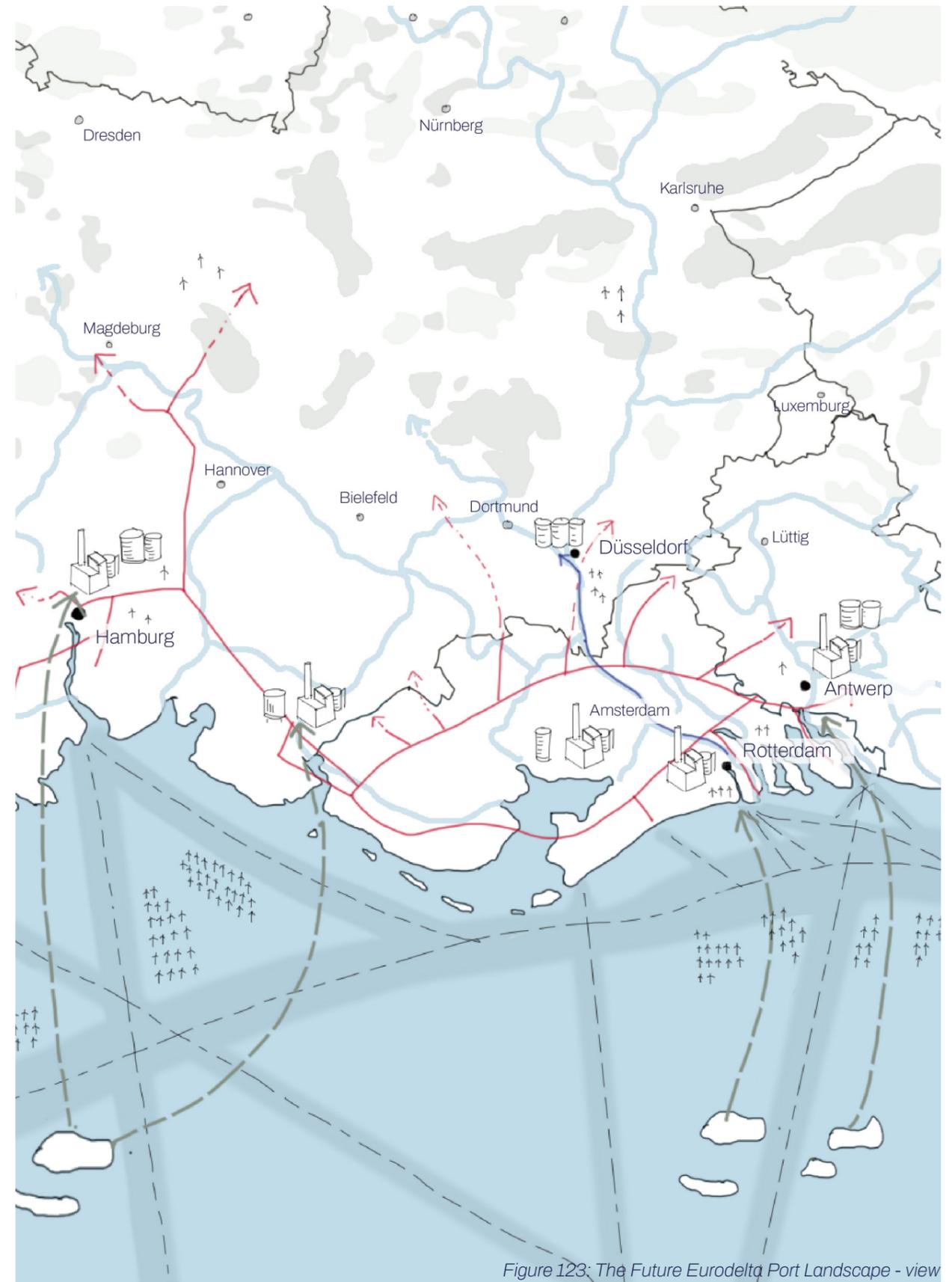


Figure 123: The Future Eurodelta Port Landscape - view

# 05

## Conclusion and Reflections

### Conclusion

#### Answering our research questions

- 1. *Definition*  
**How can Ports, Portscapes and Port Landscapes be defined?**
- 2. *Spatial relations*  
**What is the impact of Portscapes on surrounding environments and communities?**  
**What is the Portscape of the linear economy?**
- 3. *Envisioning the future*  
**What is the Portscape of the future?**  
**How can Portscapes be key in the transition to a Circular Economy?**  
**What role do they play in ensuring a just transition?**

#### 1. Definition

From our analysis, we have defined Port, Portscape and Port Landscape, both spatially and in terms of processes. Indeed, the disconnect between spatial relation and organisational relation was clear and it became apparent the Portscape especially had been thoroughly under-considered and valued by spatial planners and developers.

#### 2. Spatial relations

The impact of the Port on the Portscape and vice versa is clear - may it be beneficial or detrimental. Indeed, most processes through the Port and Portscape are characterised by their linearity, of which people and nature flows are the first victims (and in the case of people, part-enablers). If circularity encompasses all 7 cycles (Figure 124), then linearity excludes them. Indeed, although cycles of power and wealth prevailed, our analysis showed that the traditional port economy has a lack of social and environmental considerations, specified by the missing cycles of care, resource, knowledge, ecosystems, and biogeotechnical.

These missing cycles are noticeable and emphasised by the monofunctional and one-dimensional planning of current processes. Indeed, the foundations for implementing circular processes are there, and by applying integrated thinking, we can achieve cohesion.

#### 3. Envisioning the future

As a conclusion from answering the above questions, it became clear that the Portscape of the future needed to strengthen and nurture circularity in order to achieve a just and sustainable transition. We set out 5 objectives, which were considered in parallel to every future thinking - these were focused on: integration, resource efficiency, regeneration, innovation and spatial justice, shaping the Ports, Portscapes and Port Landscapes of the future.

Ports, Portscapes and Port Landscapes have the benefit of being central to the problem, which means they are also central to the solution. As such, we plan for Portscapes to play a key role in the transition to a Circular Economy, not just for resource and wealth but all other cycles too. Their spatial attributes mean that they are adaptable to future needs.

Indeed, we have envisioned a spatial, temporal and political phasing to reach circular and just Portscapes, however, as with all long term planning, throughout our strategies, we have emphasised the value of spatial adaptability and resilience, notably in the reuse of existing structures for the transition and the application of flexible spaces, shaped by time and people both.

#### Closing note

Overall, the planning of Ports, Portscapes and Port Landscapes for the future require a layered, multidimensional approach which is currently lacking in most local, regional and national port transition strategies. More than planning objectives, it is essential to: understand the space we are designing for, consider its current operations and functions and finally, understand the social, spatial and environmental implications of implementing set objectives. Throughout this study, this is the approach we have taken, in order to present a thoroughly considered and well defined plan for Ports, Portscapes and Port Landscapes of the future.

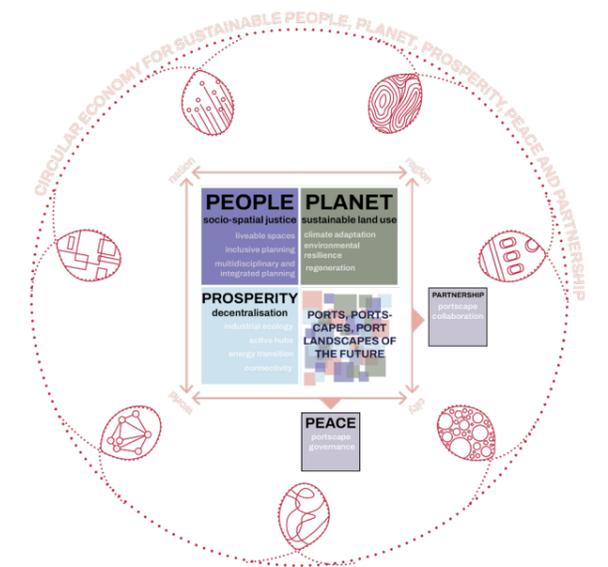


Figure 124: Conceptual Framework

# Group reflection

## Regional design for peri-urban areas

A thorough reflection of our project is necessary to assess its impact and effectiveness in achieving its goals. This process of stepping back and thinking critically about our work allows us to identify strengths and weaknesses. This enables us to learn from both successes and (potential) shortcomings. Moreover, it provides an opportunity to evaluate the ethical implications of our actions and decisions throughout the studio project. This also helps us to clarify our own values that are consciously or unconsciously underlying in the process and to reveal if our proposals align with our ethical principles. In this light, the focus of our project on Portscapes provides a unique lens through which to examine issues of sustainability and social justice in North-Western Europe. It also allows us to consider the broader societal implications of our work and its contribution to public goods. One tool for performing that exercise is examining the project's relations with the Sustainable Development Goals. This examination can then form our basis for further reflection on the project, which we introduce on the following pages of the report.

### Aligning with the SDGs

The Sustainable Development Goals (SDGs) originate from the 2030 Agenda for Sustainable Development, a document that was adopted by all United Nations Member States in 2015. This agenda provides a shared blueprint for securing peace and prosperity for both people and the planet, now and also in the future. Central to this document are the 17 SDGs, which call for collective action from all nations, regardless of their level of development. These goals acknowledge the interconnectedness of various challenges: The stress the need to simultaneously address poverty, enhance health and education, reduce inequality, stimulate economic growth, combat climate change, and safeguard the world's oceans and forests. (United Nations, 2024).

The graphic on the right shows to which degree we estimate that the results of our project (both vision and strategy) address the 17 SDGs. Reflection on the project's process and results then allows us to identify areas where we have made progress towards the SDGs. Below, we highlight the most important conclusions.

Our commitment to spatial justice and regeneration, as well as the reduction of the emissions of harmful substances, supports SDG 3 (Good Health and Well-being). The consideration of diverse stakeholders and types of economy, fair distribution of benefits generated and participatory approaches relate to SDG 8 (Decent Work and Economic Growth). The integration of technological innovation, which we put central in our vision objective 3, aligns with

SDG 9 (Industry, Innovation, and Infrastructure).

By examining the project's impact on marginalised and vulnerable populations (which falls together with our vision objective 5), we can ensure that our efforts contribute to leaving no one behind, as outlined in SDG 10 (Reduced Inequalities). Moreover, a plethora of our actions contributes to addressing SDG 11 (Sustainable Cities and Communities): We weave the different and currently partly discrete parts of the urban fabric more closely together, also taking into account the spatial nature of big parts of the Portscapes being peri-urban, as mixed functions and decentralised facilities can contribute to enhanced sustainability. However, we do not only see this in a physical way only, which is why our efforts in governance and participation should also enshrine the social aspects of sustainability.

Making the economy more circular is a key pillar of both our vision and strategy. Greatly increasing resource efficiency and improving material, waste and other flows contributes to SDG 12 (Responsible Consumption and Production). Reflecting on the project's contribution to environmental sustainability, which we envision to happen both onshore and offshore in several ways, underscores the urgency of addressing climate change and protecting biodiversity. This is outlined in SDG 13 (Climate Action) and SDG 15 (Life on Land).

To put it in a nutshell, we can conclude that by aligning our project with the SDGs, we contribute to a global agenda for sustainable development and collective action. However, this quickscan also highlights areas where further action is needed to fully address the SDGs: during the process of implementing our strategy, it would still be crucial to keep on track with distributing costs and benefits fairly and take into account current disadvantages in order to fulfil SDG 1 (No poverty). Additionally, it needs to be ensured that the realisation of the strategy works in a way that gender imbalances are reduced (in line with SDG 5).

### Ethical Issues Related to Our Project on Portscapes

In terms of ethical issues we made sure to focus on the equitable distribution of resources and benefits to all stakeholders that are involved in port development and transformation. This is seen in our plans for creating job opportunities and creating more green space in port communities. In our project, we have made sure that everyone, especially those who are already disadvantaged, will be treated fairly when dealing with the environmental problems. This involved taking action to reduce the extra burden that the



Figure 125: SDG relevance to our strategy

# Group reflection

## Regional design for peri-urban areas

environmental issues might place on these communities. Also the ethical issue on minimising the negative externalities, such as pollution and habitat destruction has been taken into account when creating our strategy. With our strategy, especially objective 2 about increasing resource efficiency of Portscapes by closing the loops, safeguards the well-being of both current and future generations.

In our design, we foresee a future where decisions are made openly and honestly, and that those who make the decisions are held responsible for their actions. The oil companies take a huge part in this, as they could be against our plans and do not always take responsibility for their actions. Shell has faced criticism and legal actions related to oil pollution incidents. Perhaps it is up to the current and future generation to push them into a position where they need to take responsibility.

Also, our project really works well in terms of respecting cultural heritage in port development. We aimed to maintain the identity and heritage of the local port communities. This is achieved by keeping some of the old buildings of the critical area. By reusing these buildings with its industrial identity in the temporary park and innovation park, we put a highlight on respecting the cultural heritage.

Finally, in our strategy we wanted to be sure that new inventions and improvements in technology can help all the residents in society and don't make unfair differences between them even bigger. But on the other hand, we want to apply AI to a greater extent in the Portscape, to develop smart Portscapes. This can cause that port communities that are adjacent to the Portscape could benefit more from the new technical inventions.

### Values Related to Our Project on Portscapes

When we examined our project using the SDGs, it became apparent that several values could be identified underlying our strategy and actions. We list them below:

- **Sustainability:** The focus on solutions that promote the long-term health of Portscapes and surrounding ecosystems in a social, ecological and economic manner
- **Equity:** Fairness and justice in the distribution of benefits and burdens that can be associated with the development of ports, Portscapes and Port Landscapes in the future.
- **Integrity:** Acting with honesty, transparency in all aspects of planning, development, and maintenance, which also applies to large-scale issues, such as competition between ports and the creation of level playing fields.

- **Collaboration:** The focus on partnerships and cooperation among diverse stakeholders to achieve the objectives we outlined together.
- **Adaptability:** Recognising the highly dynamic nature of Portscapes, which means embracing flexibility in planning and decision-making processes in the short – and more importantly – the long term.
- **Resilience:** Building resilience to climate change and other external stressors to enhance the long-term benefits of our proposals.
- **Innovation:** Embracing innovative approaches and technologies that are arriving or on the horizon to harvest most of the benefits for the Portscape stakeholders.

**Public Goods Our Project on Portscapes Aims to create:**  
In line with the values of the project, we also think about public goods, which are non-excludable and thus accessible to all individuals. Therefore, they play a crucial role in ensuring welfare and quality of life. Hence, ensuring the provision of public goods is essential for sustainable development, also in line with the SDGs. We can identify several public goods that are to be created according to our vision and strategy

- Environmental Conservation
- Social Cohesion
- Cultural Heritage
- Conditions that ensure public health
- Accessibility to transport amenities and services
- Resilience and Adaptation
- Public Safety
- Democratic Governance

### Conclusion

Our project on ports, Portscapes and Port Landscapes underscores the importance of holistic and inclusive approaches to urban planning and development. By aligning our efforts with the Sustainable Development Goals, we contribute to a global agenda for sustainable development and collective action. Moving forward, continued reflection and engagement with stakeholders will be essential to address ethical considerations, uphold our values and maximise the positive impact of our scheme on Portscapes and surrounding communities.

#### References

United Nations (2024). *The 17 Goals*. <https://sdgs.un.org/goals>

# Individual reflections

## Author 1: Elena Agterdenbos

I started this quarter knowing that the assignment could be a challenge for me, as I did not have any previous experience with the regional scale. I also didn't have knowledge about the Eurodelta. The difference between this scale and the previous quarter about the neighbourhood scale was huge. I wasn't quite sure what to expect. The expectations I had, was that regional design contains mostly maps and drawings that show a new vision for a region. It turned out that it is way more. Working with the group and seeing other lectures gave me a new understanding of designing on a regional scale, and that it is also about policies, actions and stakeholders; non-physical things.

I was glad that I already knew two people from the group, because that helped me with going out of my comfort zone. Working in groups is always something that overwhelms me a bit. But the feedback halfway through the course helped to build some confidence. When we were given the topic 'water', we immediately started brainstorming. We started talking about ports and that is when I introduced the word 'Portscape'. I think this term popped into my head because the SDS lecture from Carola Hein about Global petroleum landscapes really got my attention. I learned from the lecture that oil has a lot of spatial impacts in the region. This was really important for our topic.

The other main topic in our project was the energy transition. To get a better understanding of the linear economy, it was important to analyse the flows of the Portscape. This is when the SDS course was really helpful for the studio. The lecture from Alexander Wandl about Territorial metabolism (Wandl, 2024) was really useful for this. I learned how to relate the resource flows of the Portscapes to spatial, environmental and social qualities. It gave me insights for analysing the Portscape flows.

During the process of our project, we set up clear tasks for everyone. Personally, I have been able to focus a lot on drawing the illustrations and making the maps. I have acquired a lot of knowledge collaborating with the team, especially in the way of thinking and handling. My teammates were also supportive when I was struggling, so thanks to them. I think we all felt comfortable with each other.

To me, this quarter has been the most organised yet. We felt really supported by our tutors Birgit and Alex and they have given consistent guidance providing helpful feedback. In addition, there was this fun and calm atmosphere during the sessions where I felt really comfortable which I really appreciate. Despite a moment of uncertainty when we were turning objectives into a strategy, the tutors' were really involved. To connect our diverse ideas, we were given the task to draw our concepts on tracing paper, later combining them - a method I found useful. This collaborative approach not only helped us regain focus, but also showed the importance of effective communication. I believe using this technique in future group projects could improve productivity and cohesion within teams.

In general I am happy with how the strategy has turned out. I know that our project could have been better if we had more time. Then we could have focused more on for example, spatial justice. Quarter 3 was the only course where I was introduced to regional scale planning. The new skills and knowledge I learned will definitely be used for a new regional project. Now I can say I am able to understand a region in both physical and non- physical ways.

Wandl, A. (2024, March). Territorial Metabolism: Facilitating Circularity [Slides]. Brightspace. <https://brightspace.tudelft.nl/d2l/le/content/594261/viewContent/3620837/View>

# Individual reflections

## Author 2: Fenne Manshande

The project for me was an eye opener to learn more about ports and Portscapes, but also to learn more about a regional design of such a big structure that already is such a big player in this game. Research and design on such a large scale was, especially at the start of the course, a great challenge for me, as I found it such a complex system that includes so many different dimensions and elements, as well as the study of many different scales, and on top of that thinking of the relationships between them. Through great tutoring from Birgit and Alex, lots of great input from peers and insightful discussions, I must admit that the challenge has pushed me to make this course one of the most learnful experiences of my master's so far.

Our group process was not a linear process at all. For example, when some of the group was still working on analysis, others were already designing and planning at the same, and we kept going back and forth. The strategy making was a process of jumping scales and all working towards the vision using many types of different products. This nonlinearity within the group sometimes made the process quite difficult to grasp for me and the rest of the group. To get a better grip on this complexity we tried to come together as a group quite often and talk through all of the information together and make more decisions as a group to all have better knowledge of the project we're working on. This made the process go slower, but, with confidence I can say, much greater depth. Now I realise that the non-linear nature of the group work, while challenging at times, was probably somewhat supposed to be like this, and has ultimately led to a richer and more comprehensive outcome.

This quarter also has made me realise even more how connected research and design actually are. In this project I was able to tackle bigger issues such as circularity in a different way than claiming "I will use recycled materials for this architectural design", as I have done loads of times in my bachelor's but also in Q2. During this course we could really relate these issues to governance structures and issues, greater economic trends and paradigm shifts.

Overall I look back on a very intense, challenging but also fun quarter. I really delved into the complexity of regional design and strategy and the importance of strongly relating research and design.

# Individual reflections

## Author 3: Niels Samuels

This regional design studio has challenged us to look at Portscapes within the Eurodelta. The topic itself is quite broad and complex as the port and its surroundings cover a large area in which a lot of systems and stakeholders are present. On the other hand, this makes it unique and valuable. The challenge within regional design is to address societal spatial problems based on a large and detailed analysis by creating a convincing vision and an elaborative strategy. Here, learning how to set the focus and choosing certain topics throughout the research and design process is crucial in order to create a holistic and convincing project. Especially in the case of portscapes. It made me realise that the larger the scale of a project, the more complex and less realistic it becomes due to the larger amount of systems and stakeholders involved. This also means that the social and spatial impacts are larger on regional scales and could influence a variety of places through different scales. Everything should be thought through for a successful regional design project. During the course this became clear as sustainability and circularity consist of more aspects such as wealth, knowledge, political power and, most importantly, care.

Besides the complex urban metabolism and its interconnected flows, the project shows that future Portscapes within the Eurodelta can become sustainable and an attractive live environment. The group achieved this through well-considered transition thinking.

Because of this complexity, the need for group work for regional design becomes even more important. In here, communication is crucial but could be challenging at times. This made me realise that future interdisciplinary group work may become more challenging as you work with people from different backgrounds, although this master course already offers this to an extent. Communication could offer a lot of insights, but it could also take up a lot of time. In this course I have learned that a clear task division is desirable in which the group divides and comes back together to openly discuss their work. Utilising everyone's unique qualities and abilities offer the most efficient workflow with possibly the best results. These, however, became clearer at a later stage of the project. As a group we found ourselves searching for ways to proceed. Being out of our comfort zone forced us to think differently by picking up certain tasks that we may not have been used to. Valuable and supporting tutoring helped the group move on with the complex topic to realise a project that effectively explains the future of Portscapes.

# Individual reflections

## Author 4 : Romane Sanchez

Coming from the MSc MADE, I chose this course as my elective as I was severely lacking a design aspect to my studies. Indeed, a BSc Architecture and Environmental engineering in hand and 2,5 years of work experience as a sustainability consultant in a UK based architecture firm had me missing creative design and solution finding. I was particularly hooked at the course description... design for the global metropolis... exactly what I needed in order to achieve my career ambitions as a key municipal actor and decision maker. Of course, then came the fatal day: the first lecture, delivered by Verena and Nikos where I first heard the key words: peri-urban.

I was disappointed,... what were peri-urban areas anyways?

Now, I am overly satisfied, excited and highly motivated.

The course was one of the better organised I've had, with a clear timetable, resources and communication from the start. The lectures were very interesting, I particularly enjoyed Alex Wandl's introduction lecture on circularity, as it is a topic I am quite passionate about and can't bear the common idea that it is limited to recycling and justified consumerism.

One thing I was anxious about when signing up to this course were the tutorials and reviews. I had stopped counting the amount of time my BSc tutors made me feel stupid and ashamed to present my work. I braced myself. I came, I saw and... there was nothing to conquer. It turns out tutorials don't automatically have to be an awful experience. In all seriousness, I would like to express my gratitude, admiration and congratulations to Birgit and Alex, my group's tutors. Gratitude for allowing me and the group to thrive, go at our own pace and explore without ever making us feel like less for it. Admiration for the quality of the conversations and the seemingly close to infinite depths of their knowledge, with contrasting yet complementary views and opinions. Congratulations for having succeeded in becoming great educators balancing quality of teaching with a safe and joyful atmosphere.

I loved our project from the moment "Portscapes" emerged out of our first brainstorm. It was new and exciting to me, and the promise of a canvas on which to push my conviction for integrated, multidisciplinary design strategies. It was an open ended question, and I am happy that our project went to find the answer.

The actual working period was intense, and I went through a quite existential crisis. I started Q3 as employed and finished as... not. Trying to balance ~20h of work, another elective, a presidency of the MADE IT association, team sport commitments and a desire for a vibrant social life led to the closest I have been to a burnout in my life. My mind and body simply shut down for a week, which led me to review my priorities in life and shift my full focus onto my studies. This decision came from my deep desire to fully dedicate myself to the course, a testament to how much value I eventually saw in it, as well as the desire to perform my best for my group. Like the tutorials, the group dynamics were also very refreshing to me. One is just fully on the same wavelength as me and we have great conversations and co-creation sessions. One is highly efficient, dedicated and caring, which led to a high quality of outputs and a rigorous, smart approach. One is an out of the box thinker, a silent creative and a dreamer, they brought new ideas and perspectives to the project. One is thoroughly practical and analytical, though sometimes slowing the group progress down. All in all, this all reinforced my perceived strengths (narrative, conceptualisation, graphical representation, communication), weaknesses (tunnel vision, page layout, people pleasing, background reading, lack of attention to detail) and role in a group (organisation, presentation).

To conclude this reflection, I come out of these intense couple months with a new skillset, of which I am proud:

# Individual reflections

## Author 5: Maximilian Theye

- thinking spatially rather than just strategically - especially in making space for circularity, as it is an easily thrown concept and big word but not often spatialised
- thinking in layers, flows and interconnections - things are not uni-dimensional nor should they be. Alex's insights on mapping out systemic flows was very valuable.
- more than the applied strategy, thinking about its implications, spatially, virtually and temporally - "we want a forest here" is easy to say, but thinking about, how much space does the forest need, how long will it take to grow, who will pay for it and whose land are we taking? Rebound or ripple effects are of huge importance - actually it's the misconsideration of those that has led to most modern challenges, especially environmental and social.
- thinking in the larger scale, rather than building / neighbourhood scale I was used to - being able to go beyond boundaries and link networks. The GIS workshops also helped with visualising that.
- thinking and exploring out of bounds, imagining changes for the next 100 years!! - I had never even spoken the year "2125". I understood the value of adaptability, flexibility and resilience for a robust spatial plan.
- applying spatial dimensions to philosophical debates (mainly from the Methodology course topics) - the commons, spatial justice, collaborative planning... all of these can be expressed spatially
- the value of tools and exercises like X curve, power/interest matrix and other smaller tasks for example, Birgit asking us to simultaneously mapping out spaces that will become empty and processes that will need space.
- I am reinforced in thinking that this is what I want to do in the long term future... and who knows, maybe in the short term one as well, I do have a dissertation due next year...

### Reflection on my learning process and the development of my personal skills

This studio was the third one during my master in Urbanism, now with a regional scale in focus, after having mainly dealt with the scales of the city and the neighbourhood in the previous two quarters. Mainly for the stark contrast to the before, I was very curious about this scale. I have worked on it before, mainly during my Bachelor's thesis about flood protection in the Elbe estuary in Germany, so I was curious if there would be similar issues and if the tools we use would be familiar to me. Arriving at the topic of "Portscapes" was quite a surprise to me, as I was mostly expecting to deal with agricultural issues. At first, it was not very easy for me to grasp what the issue we would tackle would be and I feel like we did need a little more time for delineating our field of action. Being from a port city myself, Bremen in North-Western Germany, this type of space was always familiar to me, as I remember having been taken to the local harbours by my family since I was very young. However, it always remained a sort of background for me, so only now, I started diving deeper into how they precisely work and how far their spatial impact actually reaches into the hinterland.

Throughout the studio, it was always a big part to structure the process with our group of five. I have the impression that we arrived at a very good result. During the nine weeks, it became also obvious that we are different characters when it comes to approaching design and research assignments and also the structuring of tasks works differently for all of us. While this cost us some time (and sometimes also energy), I think this situation is highly typical for the professional world, so reflecting on how to make the most out of this diversity is crucial for me.

Also, the tutoring by Birgit and Alex proved to be a very helpful guide for our development. I had the impression that they looked at our work from very different directions, which surely enriched the input, while there was a relaxed and sometimes quite fun atmosphere during the sessions. While the information on theory, methods, potential approaches, policies and reference projects was very rich, it was at times challenging for us to distil the most relevant information we could process in our project in the relatively little amount of time.

### Reflection our theme and its relation to the theoretical context of urbanism

Throughout Q3 I discovered many contact points between our group work and the broader theoretical body of urbanism and related fields. In the Capita Selecta and SDS lectures, many topics were covered that we processed in our work. The global petroleum space, which was introduced by Carola Hein for example is closely tied to our scope of action, the role of water landscapes and regional design as a field, which was spoken about by Verena Balz, Steffen Nijhuis and Remon Rooij, among others, is of course of core relevance as well. Here it matters for example to be able to properly define what a strategy actually is and how it is different from a vision or other instruments in (regional) design. To me, the Systemic design element was mostly also new and it proved to be really fruitful to think more about the systems and flows in which the design is actually embedded.

We also expanded on normative issues, mainly in the Methodology class, and for me it was enriching to become more clear about the values with which we operate as urban designers and to think about the underlying ethics. Looking at spatial justice clearly brings necessary responsibilities, but also political issues such as participation and governance, that are not exclusive to the field of urbanism but require collaboration and political backing.

Alongside this, we dealt with bigger issues such as sustainability (that appears throughout the studios in different ways), but also circularity. They are related to European political issues, greater economic trends and shifts in energy, production and others. They are actually neighbouring fields, but to know how they influence our work, be it in academia or practice, and how to incorporate these developments in a fruitful way is a key skill for urbanists.

### Reflection on the methods applied and the results of the project

In Q3, I sensed that I could apply methods I learned in earlier quarters. This was both regarding content production but also regarding organisation, which means that I am continuously building up my personal toolbox here at the TU Delft. For instance, I have the feeling that with the instructions I got now, my use of GIS is more refined, moving away from just representing to actually using it for analytical tasks. To me, the most important example in Q3 was the mapping of Peri Urban Areas in the Eurodelta. Building on the challenges of Q3, the selection and filtering of large amounts of data and forming hypotheses from the results was again an issue, but on this scale, it required a smarter approach. I think I need

to work on this more to dedicate my resources to the right spots, but I am confident that this will at least partly happen by itself in the professional realm. As a conclusion, Q3 for me was a lot about moving away from a given assignment with a specific question to defining the actual task myself through the problem analysis – something that might have far-reaching, sometimes even political implications because who actually frames what a problem is surely has considerable power on the distribution of attention and resources.

# References

## References Chapter 01

Bergqvist, R., & Monios, J. (2019). *Green Ports: Inland and seaside sustainable transportation strategies*. <https://trid.trb.org/view/1530183>

Clifford, J.P., Doran, J., Crowley, F., & Jordan D. (2022) *The relationship between city size, decentralisation and economic growth*. *Journal of Economic Studies*. Vol. 50 (6) pp. 1171-1189. DOI 10.1108/JES-03-2022-0146

ESPO. (2019). *Priorities for European ports for 2019-2024: What ports do for Europe, What Europe do for ports*. ESPO. <https://www.espo.be/media/Memorandum%20ESPO%20FINAL%20Digital%20version.pdf>

Ellen McArthur Foundation. (2024). *What is a circular economy?*. Ellen McArthur Foundation. <https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>

Evenhuis, E. (2024, February 13). *Space for Circular Economy* [Powerpoint slides]. Bouwkunde Urbanism Department, TU Delft.

Food and Agriculture Organisation of the United Nations (2024) *Sustainable Land Management*. FAOUN. <https://www.fao.org/land-water/land/sustainable-land-management/en/>

Friant, M. C., Vermeulen, W.J.V & Salomone, R. (2023). *Transition to a Sustainable Circular Society: More than just Resource Efficiency*. <https://doi.org/10.1007/s43615-023-00272-3>

Fritsch, M., Kahila, P., Németh Sarolta, & Scott, J. W. (Eds.). (2024). *Spatial justice and cohesion: the role of place-based action in community development (Ser. Regions and cities)*. Routledge. <https://doi.org/10.4324/9781003229681>

Healey, P. (1996). *The Communicative Turn in Planning Theory and its implications for spatial strategy formations*. *Environment and Planning B: Planning and Design*, 23(2), 217-234. <https://doi.org/10.1068/b230217>

Hein, Carola, 'Port Cities', in Peter Clark (ed.), *The Oxford Handbook of Cities in World History* (2013; online edn, Oxford Academic, 2 Apr. 2013), <https://doi.org/10.1093/oxfordhb/9780199589531.013.0043>, accessed 9 Apr. 2024.

Intergovernmental Panel on *Climate Change [IPCC]. (2014). Klimaänderung 2014: Synthesebericht. Beitrag der Arbeitsgruppen I, II und III zum Fünften Sachstandsbericht des Zwischenstaatlichen Ausschusses für Klimaänderungen (IPCC)* [Hauptautoren, R.K. Pachauri und L.A. Meyer (Hrsg.)]

Khambule, I. (2021). *Decentralisation or deconcentration: The case of regional and local economic development in South Africa*. *Local Economy*, 36(1), 22-41. <https://doi.org/10.1177/02690942211018427>

OECD. (2020). *Why do countries decentralise?*. OECDiLibrary. <https://www.oecd-ilibrary.org/sites/e5b9ba7d-en/index.html?itemId=/content/component/e5b9ba7d-en>.

OECD. (2020). *Towards Sustainable Land Use: Aligning Biodiversity, Climate and Food Policies*. OECD Publishing, Paris, <https://doi-org.ezproxy.library.wur.nl/10.1787/3809b6a1-en>.

Koninklijk Nederlands Meteorologisch Instituut [KNMI] (2023). *Zeespiegelstijging*. <https://www.knmi.nl/kennis-en-datacentrum/uitleg/zeespiegelstijging>

Rocco, R. (2022). *Spatial Justice: A crucial dimension of sustainability*. In R. Rocco, G. Bracken, C. Newton, & M. Dabrowski (Eds.), *Teaching, Learning & Researching Spatial Planning* (pp. 276-287). TU Delft OPEN Publishing.

Savini, F. (2023) *Futures of the social metabolism: degrowth, circular economy and the value of waste*. *Futures* 150. 103180. <https://doi.org/10.1016/j.futures.2023.103180>

Scottish Government. (2021). *Land use- getting the best from our land: strategy 2021-2026*. Scottish Government. <https://www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/pages/3/>

Verschuur, J., Koks, E.E., & Hall, J.W. (2022). *Ports' criticality in international trade and global supply-chains*. *Nature Communications*. <https://doi.org/10.1038/s41467-022-32070-0>

## References Chapter 02

Duisburg am Rhein. (2024). *Discover the city. Visit Duisburg*. [https://www.duisburg.de/microsites/visit\\_duisburg/discover\\_the\\_city/](https://www.duisburg.de/microsites/visit_duisburg/discover_the_city/)

Duisport. (2018). *Premium Port: Strategy is Decisive*. [https://www.duisport.de/wp-content/uploads/2019/09/duisport\\_Geschaeftsbericht\\_2018\\_EN\\_web.pdf](https://www.duisport.de/wp-content/uploads/2019/09/duisport_Geschaeftsbericht_2018_EN_web.pdf)

Duisport. (2023). *FACTS, FIGURES AND DATA: Financial year 2022*. <https://www.duisport.de/hafeninformation/?lang=en>

European Commission. (2013). *Europe's Seaports 2030: Challenges Ahead. Memo*. [https://ec.europa.eu/commission/presscorner/detail/en/MEMO\\_13\\_448#:~:text=In%20some%20cases,%20e.g.%20in,employ%20around%20110,000%20port%20dockers](https://ec.europa.eu/commission/presscorner/detail/en/MEMO_13_448#:~:text=In%20some%20cases,%20e.g.%20in,employ%20around%20110,000%20port%20dockers)

European Parliament. (2024). *Building a comprehensive European port strategy*. (Resolution 2023/2059(INI)). [https://www.europarl.europa.eu/doceo/document/TA-9-2024-0025\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-9-2024-0025_EN.html)

European Monitoring Centre for Drugs and Drug Addiction [EMCDDA]. (2022). *Europe and the global cocaine trade*. [https://www.emcdda.europa.eu/publications/eu-drug-markets/cocaine/europe-and-global-cocaine-trade\\_en#section3](https://www.emcdda.europa.eu/publications/eu-drug-markets/cocaine/europe-and-global-cocaine-trade_en#section3)

European Monitoring Centre for Drugs and Drug Addiction [EMCDDA]. (2022). *Cocaine – the current situation in Europe (European Drug Report 2023)*. [https://www.emcdda.europa.eu/publications/european-drug-report/2023/cocaine\\_en#level-8](https://www.emcdda.europa.eu/publications/european-drug-report/2023/cocaine_en#level-8)

European Sea Ports Organisation [ESPO]. (2023). *ESPO Environmental Report 2023*. <https://www.espo.be/media/ESPO%20Environmental%20Report%202023.pdf>

European Union Agency for Railways [ERA]. (2022). *Fostering the Railway Sector Through the European Green Deal*. [https://www.era.europa.eu/system/files/2022-10/fostering\\_the\\_railway\\_sector\\_through\\_the\\_european\\_green\\_deal\\_-\\_rail-ports\\_synergies\\_1.pdf](https://www.era.europa.eu/system/files/2022-10/fostering_the_railway_sector_through_the_european_green_deal_-_rail-ports_synergies_1.pdf)

European Parliament (2015). *Modal Share of Freight Transport to and from EU Ports*. [https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540350/IPOL\\_STU\(2015\)540350\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540350/IPOL_STU(2015)540350_EN.pdf)

Geldermans, B., Bellstedt, C., Formato, E., Varju, V., Grunhut, Z., Cerreta, M., Amenta, L., Inglese, P., van der Leer, J., Wandl, A. (2017). *Introduction to methodology for integrated spatial, material flow and social analyses*. [https://h2020repair.eu/wp-content/uploads/2018/03/Deliverable\\_3.1\\_Introduction\\_to\\_methodology.pdf](https://h2020repair.eu/wp-content/uploads/2018/03/Deliverable_3.1_Introduction_to_methodology.pdf)

Hein, C. (2023). *European Port City Territories in the Past, Present and Future*. In C. Hein, Y. Van Mil, & L. A. Momirski (Eds.), *Port City Atlas* (pp. 32–39). <https://doi.org/10.59490/mg.73>

IEA. (2018). *World Energy Outlook 2018*. <https://www.iea.org/reports/world-energy-outlook-2018>

IEA. (2019). *Putting CO2 to Use: Creating value from emissions*. <https://www.iea.org/reports/putting-co2-to-use>

Notteboom, T. (2008). *The Relationship between Seaports and the Inter-Modal Hinterland in Light of Global Supply Chains*. OECD, International Transport Forum, OECD/ITF Joint Transport Research Centre Discussion Papers.

Port of Antwerp Bruges. (2024). *Antwerp is home to the largest integrated chemical cluster in Europe*. Port Of Antwerp Bruges. <https://www.portofantwerpbruges.com/en/business/industry/chemicals>

Port of Antwerp Bruges. (2023). *2023 Feiten & cijfers*. <https://cdn.uc.assets.prezly.com/5aac51cb-abc3-4027-9c71-4453665b5acd/-/inline/no/brochurecijferboek-je-2023nl.pdf>

Port of Hamburg. (2023). *Statistics*. The Official Website Of The Port Of Hamburg. <https://www.hafen-hamburg.de/en/statistics/>

Port of Rotterdam. (2022). *PORT OF THE FUTURE: THE IMPORTANCE OF HYDROGEN*. <https://www.portofrotterdam.com/sites/default/files/2021-06/handout-port-of-the-future-the-importance-of-hydrogen.pdf>

Port of Rotterdam. (2023). *Top 12 energietransitieprojecten*. Port Of Rotterdam. <https://www.portofrotterdam.com/nl/nieuws-en-persberichten/uitgelicht-top-12-energietransitieprojecten>

Roberts, T., Williams, I., Preston, J., Clarke, N., Odum, M., & O'Gorman, S. (2023). *Ports in Storm: Port-City Environmental Challenges and Solutions*. *Sustainability (Basel)*, 15(12), 9722. <https://doi.org/10.3390/su15129722>

# References

Rodrigue, J. & Notteboom, T. (2022). Ports and Economic Development. In Notteboom, T., Pallis, A. & Rodrigue, J. (Eds.): *Port Economics, Management and Policy*. New York: Routledge.

Studio Marco Vermeulen. (2021). *Circular Mainframe: Een ontwerpverkenning naar een grensoverschrijdend Smart Multi Commodity Grid*. <https://marcovermeulen.eu/nl/projecten/circular+mainframe/>

Wandl, A., & Magoni, M. (2017). *Sustainable Planning of Peri-Urban Areas: Introduction to the Special Issue*. *Planning Practice & Research*, 32(1), 1–3. <https://doi.org/10.1080/02697459.2017.1264191>

Wandl, A., Rooij, R., & Rocco, R. (2017). *Towards Sustainable Territories-in-Between: A Multidimensional Typology of Open Spaces in Europe*. *Planning Practice & Research*, 32(1), 55–84. <https://doi.org/10.1080/02697459.2016.1187978>

## References Chapter 03

Bergqvist, R., & Monios, J. (2019). *Green Ports: Inland and seaside sustainable transportation strategies*. <https://trid.trb.org/view/1530183>

DRIFT. (2024). *The raw material transition for the Port of Rotterdam*. <https://drift.eur.nl/en/publications/the-raw-material-transition-for-the-port-of-rotterdam/>

## References Chapter 04

Silvestri, G., Diercks, G., & Matti, C. (2022). *X-Curve, A sensemaking device to foster collective narratives on system change*. 10.13140/RG.2.2.26842.82888

Healey, P. (1996). *The communicative turn in planning theory and its implications for spatial strategy formation*. *Environment and Planning*. 23 pp217-234.

Machler, L., Milz, D. & Innes, J. (2015). Innes - The evolution of communicative planning theory, Aesop Young Academics Booklet Series B. In: *Planning Netherlands*.

## References Chapter 05

United Nations. (2024). The 17 Goals. <https://sdgs.un.org/goals>

## Sources used for Mapping

Copernicus Land Monitoring Service. (2024). CORINE Land cover. <https://land.copernicus.eu/en/products/corine-land-cover>

European Commission. (2024). European Marine Observation and Data Network [EMODnet]. <https://emodnet.ec.europa.eu/geoviewer/>.

Google LLC. (2024). Google Maps. <https://maps.google.com>

Le Monde. (2023). 'Drug trafficking is a war that must be addressed in the political debate'. [https://img.lemde.fr/2023/12/05/66bb662\\_1701771910854-geopo-4823-routes-cocaines-web-carte-700-in-english.png](https://img.lemde.fr/2023/12/05/66bb662_1701771910854-geopo-4823-routes-cocaines-web-carte-700-in-english.png)

Nationaal Georegister. (2024). Catalog. <https://www.nationaalgeoregister.nl/geonetwork/opensearch/dut/catalog.search#/page/Over%20NGR?page=Over%20NGR>

OpenStreetMap Contributors. (2024). OpenStreetMap. <https://www.openstreetmap.org/>

Rijksoverheid. (2023). Ontwikkelperspectief NOVEX-gebied Rotterdamse haven: Samenwerken aan de toekomst van het Rotterdamse Havengebied. [https://www.zuid-holland.nl/publish/pages/32977/ontwikkelperspectief\\_novex\\_rotterdamse\\_haven.pdf](https://www.zuid-holland.nl/publish/pages/32977/ontwikkelperspectief_novex_rotterdamse_haven.pdf)

## Image Sources

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Chapter introduction pages: Rare Gallery. (2023): Water Pattern Free Wallpaper Photo. <https://rare-gallery.com/589428-free-stock-photos.html>

Figure 1: Greenhouse Effect and related effects. Own graphic, incorporating information from: Yale University. (2021). Yale Experts Explain Climate Change. <https://sustainability.yale.edu/explainers/yale-experts-explain-climate-change> <https://www.knmi.nl/kennis-en-datacentrum/achtergrond/knmi-23-klimaatscenario-s;>

Koninkrijk Nederlands Meteorologisch Instituut. (2023). KNMI'23-klimaatscenario's.

<https://www.knmi.nl/kennis-en-datacentrum/achtergrond/knmi-23-klimaatscenario-s>

Figure 2: SLR scenarios. Own graphic, incorporating information from: Intergovernmental Panel on Climate Change. (2022). Sixth Assessment Report. The challenge of coastal adaptation in the era of sea level rise. Figure Cross-Chapter BoxSLR. <https://www.ipcc.ch/report/ar6/wg2/figures/chapter-3/figure-3-cross-chapter-box-slr-1>

Figure 7: 7 Cycles of Circularity. Own graphic, incorporating information from:

Friant, M. C., Vermeulen, W.J.V & Salomone, R. (2023). Transition to a Sustainable Circular Society: More than just Resource Efficiency. <https://doi.org/10.1007/s43615-023-00272-3>

Figure 12: Global flows. Own graphic, incorporating information from: Eurostat. (2023). Global Transport Flows. Top 15 main extra EU flows by gross weight of freight handled in main EU ports. [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Maritime\\_ports\\_freight\\_and\\_passenger\\_statistics&oldid=218671#Most\\_EU\\_maritime\\_freight\\_transport\\_is\\_with\\_extra-EU\\_partners](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Maritime_ports_freight_and_passenger_statistics&oldid=218671#Most_EU_maritime_freight_transport_is_with_extra-EU_partners)

Figure 13: Port's cargo sizes. Own graphic, incorporating information from:

Central Commission for the Navigation of the Rhine. (2018). CCNR Market Observation - Annual report 2018. & European Commission. (2024). European Marine Observation and Data Network [EMODnet]. <https://emodnet.ec.europa.eu/geoviewer/>.

Figure 40: Economic effects. Own graphic, incorporating information from: Rodrigue, J. & Notteboom, T. (2022). Ports and Economic Development. In Notteboom, T., Pallis, A. & Rodrigue, J. (Eds.): *Port Economics, Management and Policy*. New York: Routledge.

Figure 46: Total energy supply by source. Own graphic, incorporating information from:

IEA. (2022). Total energy supply, the Netherlands, 2022 [png]. IEA. <https://www.iea.org/countries/the-netherlands> & IEA. (2021). Total energy supply, Europe, 2021 [png]. IEA. <https://www.iea.org/regions/europe>

Figure 49: Waste flows sankey diagram. Own graphic, incorporating information from:

Eurostat. (2022). Material flows in true scale, EU, 2022

[png]. Eurostat. [https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=516747#Sankey\\_diagram\\_of\\_material\\_flows](https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=516747#Sankey_diagram_of_material_flows)

Figure 63: Portscape of Antwerp - cargo. Own graphic, incorporating information from: Port of Antwerp Bruges. (2023). 2023 Feiten & cijfers. <https://cdn.uc.assets.prezly.com/5aac51cb-abc3-4027-9c71-4453665b5acd/-/inline/no/brochurecijferboekje-2023nl.pdf>

Figure 65: Portscape of Hamburg - cargo. Own graphic, incorporating information from: Port of Hamburg. (2023). Statistics. The Official Website Of The Port Of Hamburg. <https://www.hafen-hamburg.de/en/statistics/>

Figure 67: Portscape of Rotterdam - cargo. Own graphic, incorporating information from: Port of Rotterdam. (2023a). THROUGHPUT PORT OF ROTTERDAM. <https://www.portofrotterdam.com/sites/default/files/2024-02/throughput-port-of-rotterdam-2023.pdf>

Figure 72: Cones of the future. Own graphic, incorporating information from: Dunne, A., & Raby, F. (2013). *Speculative Everything: Design, Fiction, and Social Dreaming* (p. 5)

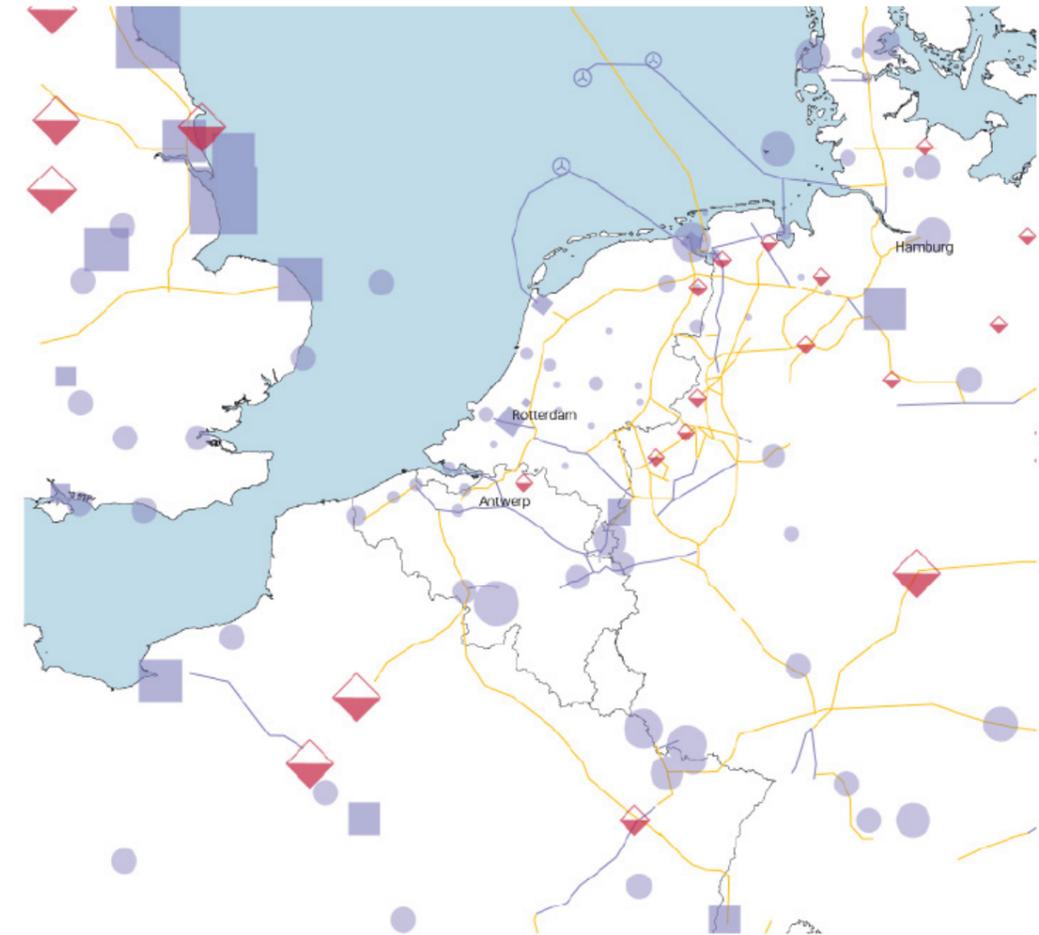
Figure 125: SDG relevance to our strategy. Own graphic, incorporating information from: United Nations (2024). The 17 Goals. <https://sdgs.un.org/goals>

# 06

## Appendix

### Analysis maps

#### Hydrogen plans 2030



Hydrogen facilities (announced, permitted)

- Low carbon
- Renewable

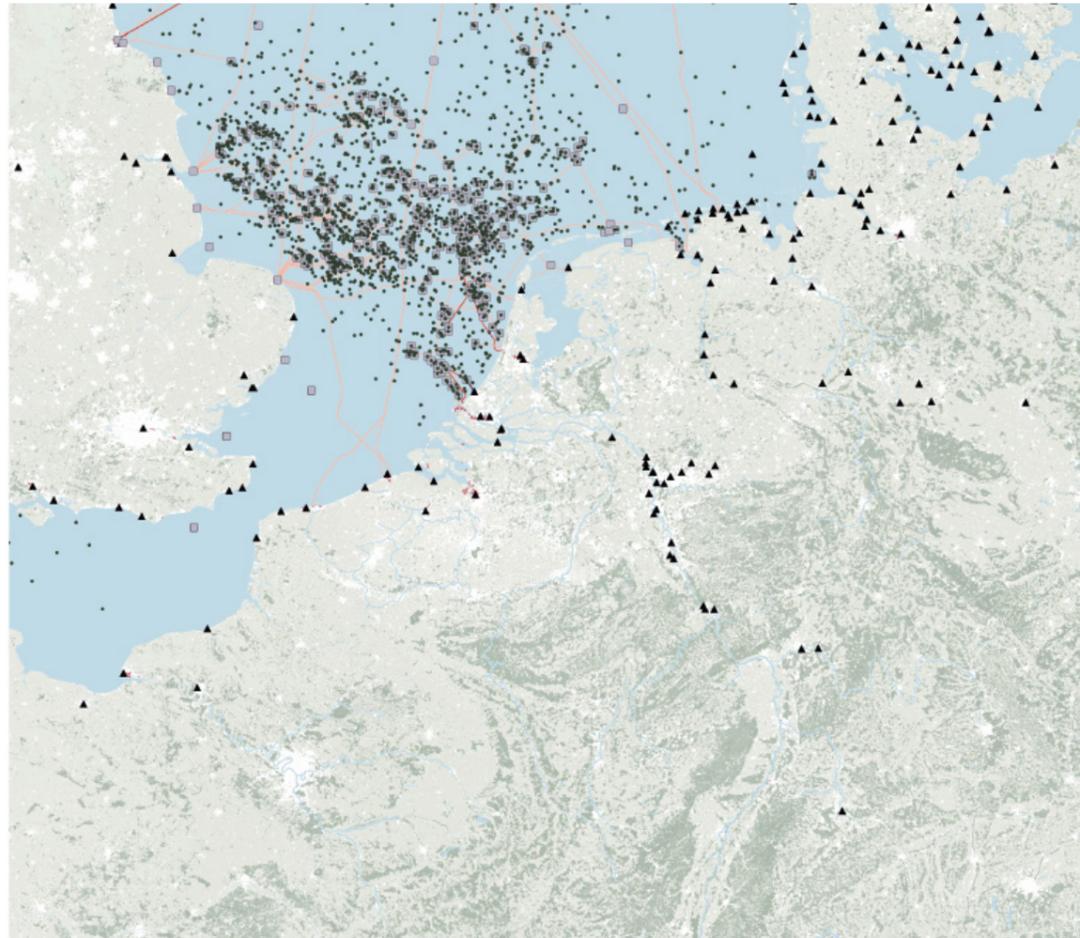
Hydrogen network pipelines

- ⊙ Offshore wind hydrogen production
- ◆ Storage

For the year 2030, a new European Hydrogen Backbone pipeline system will be realised. The pipeline system is about 31.500 kilometers long and connects supply and demand in North-West Europe. This new backbone will form a key element in the transition into clean energy. By using low carbon or CO<sub>2</sub>- free hydrogen as a raw material and fuel, the industry can reduce the emissions. This way, the hydrogen backbone will make a major contribution to the energy transition. In the first phase of the new hydrogen network, the backbone will comprise 52% re-purposed natural gas pipelines ( the yellow lines in figure X) . The rest of the pipelines will come from newbuild dedicated hydrogen pipelines ( the blue lines) . The port of Rotterdam will contain a new hydrogen pipeline and new hydrogen facilities that are low carbon intensive, and renewable as well.

# Analysis maps

## Offshore pipelines

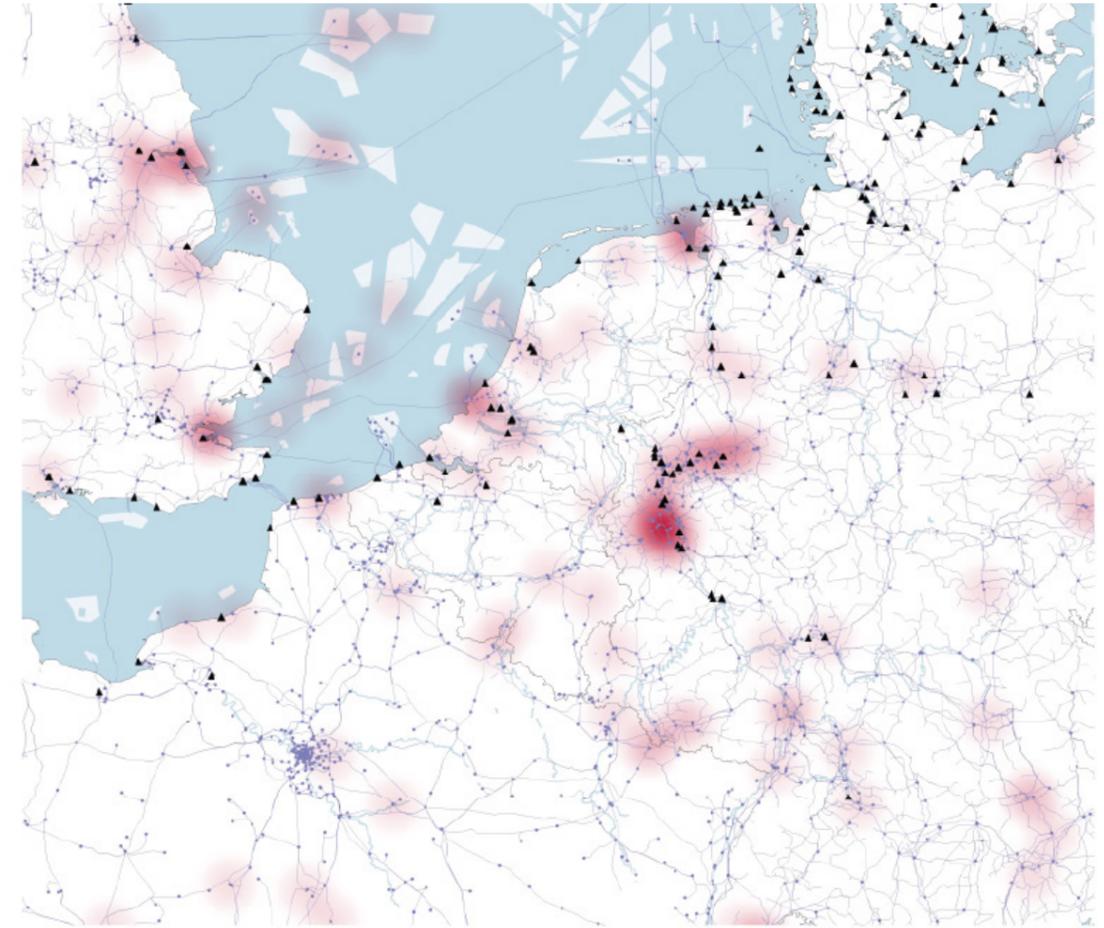


- ▲ Port location
- Boreholes
- Offshore platforms
- Gas
- Oil
- Sewage

The North Sea contains multiple boreholes and offshore platforms, as the North Sea is very rich in oil and gas reserves. This makes it an attractive location for extraction and production activities. The boreholes and platforms are connected to the ports by pipelines. The presence of this existing infrastructure, including the pipelines and ports, facilitates the transportation of the oil and gas to the markets and facilities on the land. This infrastructure includes pipelines that connect the offshore platforms to the onshore processing facilities and terminals. It appears that there are a lot of boreholes and offshore platforms adjacent to the port of Rotterdam.

# Analysis maps

## Powerlines and stations

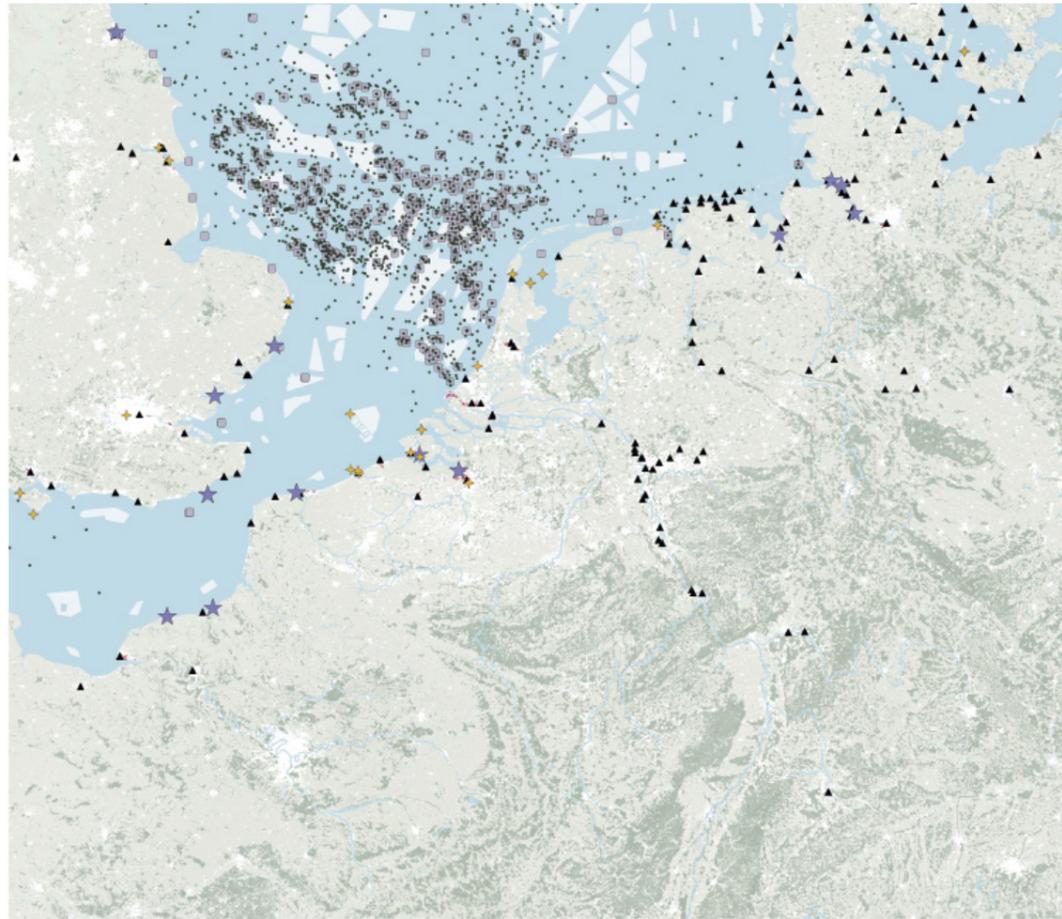


- ▲ Port location
- Powerplant point
- Powerline
- Power substation point
- Windfarms

Figure X shows that many of the powerplant points are adjacent to the port locations. This is because ports provide easy access to fuel sources, such as coal, oil and natural gas. These are often used for power generation. Power plants also require large amounts of water for cooling purposes. Due to their location close to water, ports offer access to abundant water sources which can be used for cooling. The ports also form a centre point where power substation points and power lines come together. The reason for this is that ports require energy. This energy from power lines is also provided from the offshore wind farms in the North sea. Most of the powerlines from the wind farms go to the ports; ports may serve as hubs for renewable energy generation, such as wind power. The power lines connect renewable energy projects located near the port to the electrical grid. This can allow the integration of clean energy into the port.

# Analysis maps

## Energy production



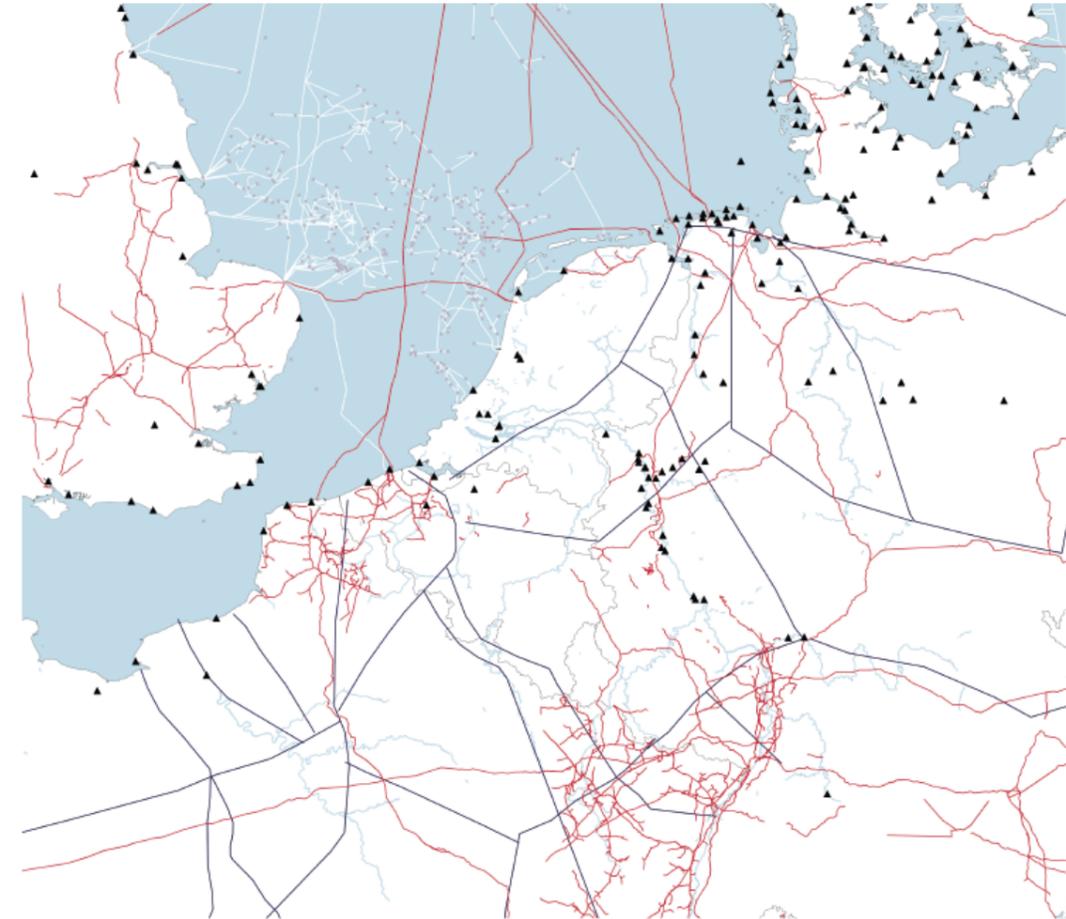
- ▲ Port location
- Boreholes
- Offshore platforms
- ★ Nuclear powerplant
- ★ Ocean Energy Facilities project locations
- Windfarms

The energy production today is mostly offshore or at the edge of the sea. This includes not only the platforms and boreholes, but also big wind farms in the North Sea. The nuclear power plants are also situated adjacent to water bodies. This is for cooling purposes as the power plants require a constant amount of cooling to dissipate the heat generated during the process. Water bodies like the North Sea provide a good source. Most of the nuclear power plants are located adjacent to ports, as the power plants require a constant supply of nuclear fuel, and ports provide access to transportation networks, allowing for the efficient importation of fuel via ships.

Figure X also shows that there are multiple Ocean Energy Facilities. These facilities apply the power of the ocean's natural resources. This could be waves, tides, or currents, resources that can also be used to generate electricity.

# Analysis maps

## Oil, gas and petroleum pipelines



- ▲ Port location
- Offshore installations
- Central European oil and gas pipelines
- Petroleum pipelines
- Northsea pipelines

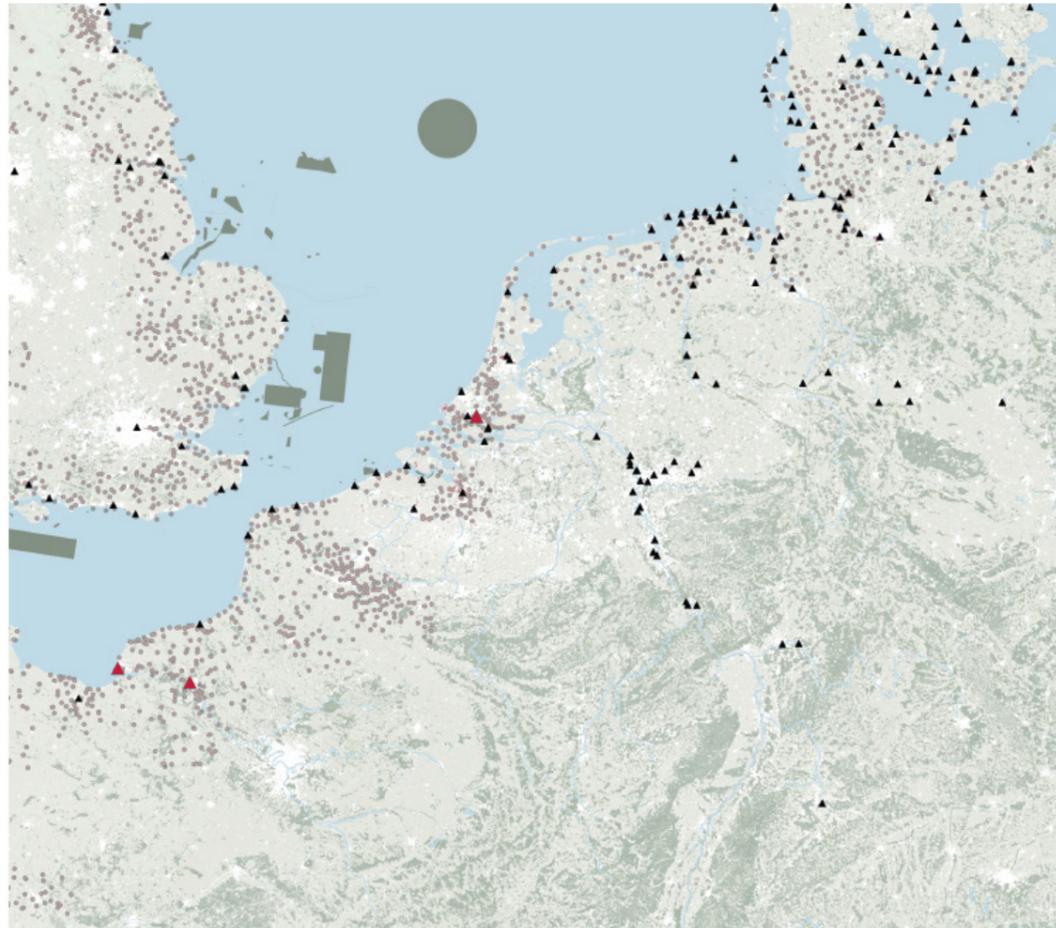
Multiple oil, gas and petroleum pipelines are heading towards the port locations. This is because ports need energy for their port activities. The offshore installations play a big role in this. The presence of multiple pipelines heading towards port locations is due to a combination of factors beyond just supplying the energy.

Ports function as transportation hubs for goods, including the energy resources. This could be natural gas, oil, and refined petroleum products. The pipelines should facilitate the efficient transport of these resources. Ports are also strategic locations for the energy infrastructure; they provide access to markets.

At last, pipelines connected to ports help meet the demand for oil, gas and petroleum, by transporting energy resources from the production sites to consumption centres.

# Analysis maps

## Waste flows



- ▲ Port location
- Dredge spoil dumpings
- Discharge points
- Treatment plants
- ▲ Waste at port

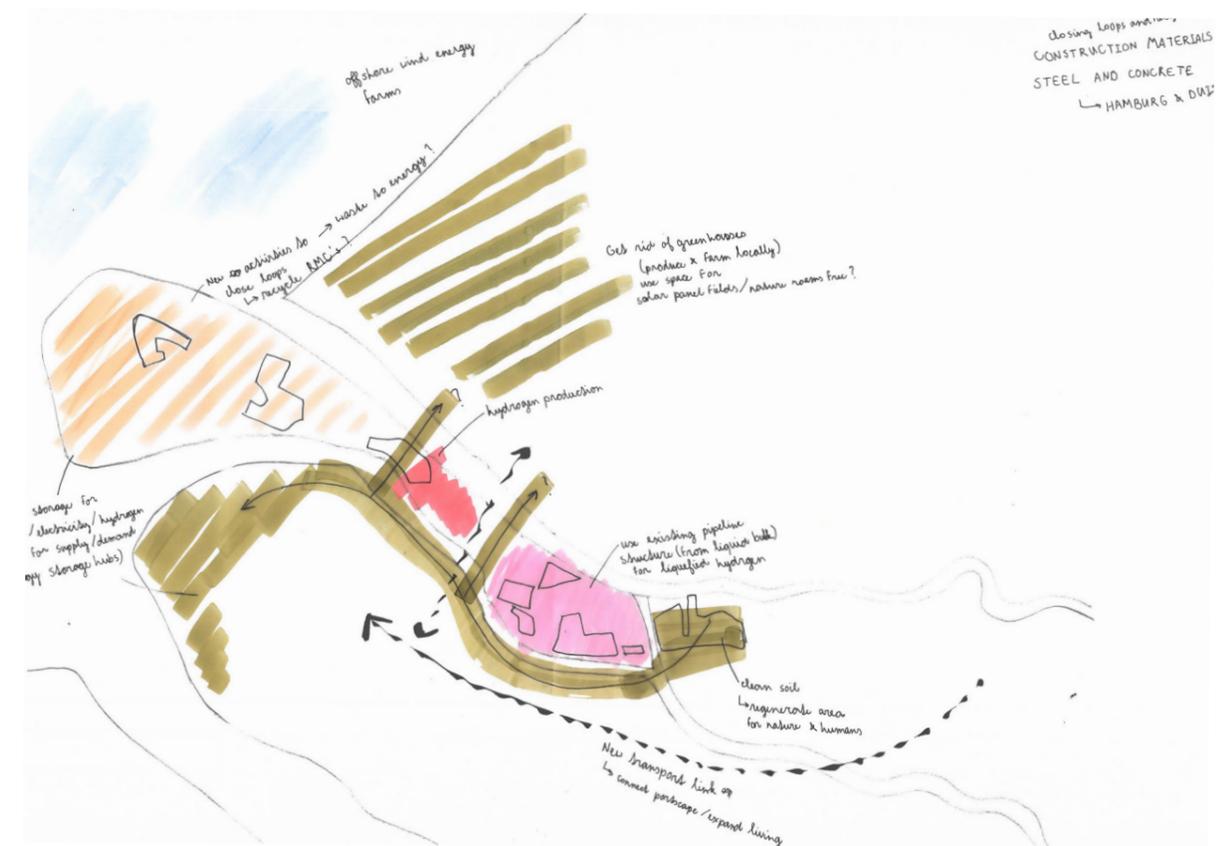
Ports cause a lot of waste, as ports are hubs for cargo and shipping handling activities. This generates various types of waste. Another way of waste are the accidental spills of oil, chemicals and other hazardous materials which can occur during ship loading and unloading. These spills contaminate the waterways, ecosystems and shorelines. Treatment plants and discharge points are related to this for managing and mitigating the environmental impacts due to the port operations. The treatment plants are responsible for treating the wastewater from the ports, including sewage from ships, to remove contaminants and pollutants before discharging the water into the environment. Ports have their own treatment plants to manage the wastewater generated within the port area. The discharge points are referring to locations where the treated wastewater is discharged into water bodies, like the sea or estuaries. These discharge points are strategically located to minimise the impacts on the ecosystems. The traditional model of the linear economy is the system where raw materials are collected and transformed into new products that is used for consumption until they are discarded as waste, with no concern for the ecological footprint and consequences.

# Exercise Individual Strategy Maps

## Fenne's map

In preparation for creating a comprehensive strategy map for the future, we did a pre-exercise focused on envisioning the 2100 Portscape of Rotterdam individually. Each team member engaged in the individual mapping exercises to project potential transformations and challenges within the Portscape environment.

Following the individual mapping exercise of envisioning the future Portscape of Rotterdam, we came back together and overlaid these individual maps to create a cohesive group strategy map. By overlaying these diverse perspectives and insights, we were able to identify key areas, opportunities and challenges.

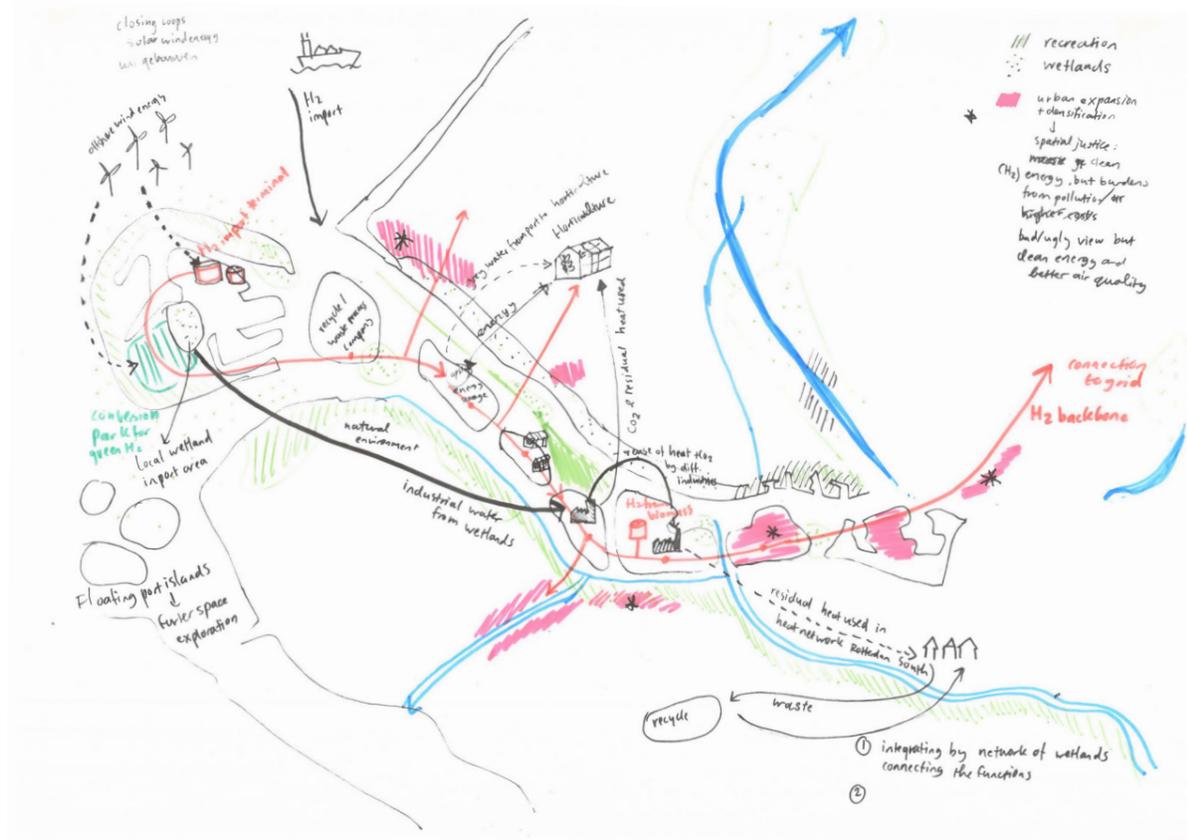


# Exercise Individual Strategy Maps

Elena's map

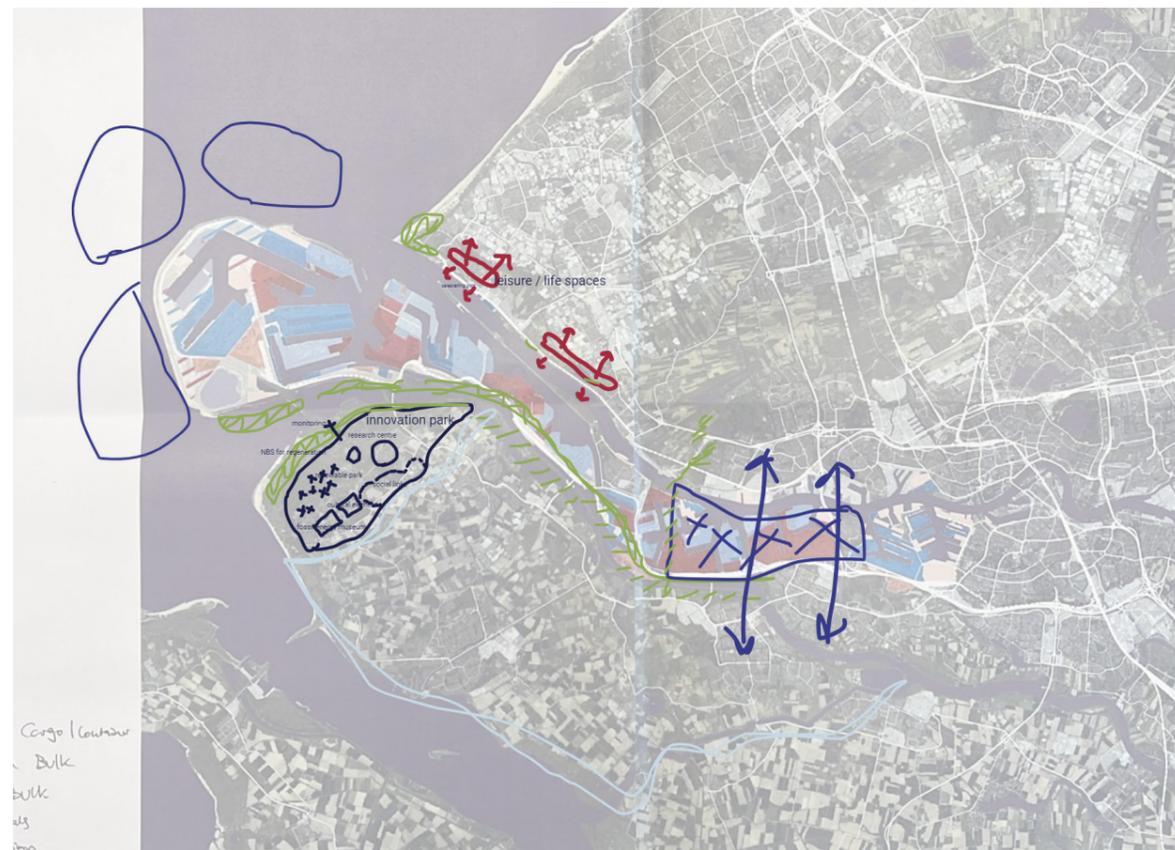
# Exercise Individual Strategy Maps

Max's map



# Exercise Individual Strategy Maps

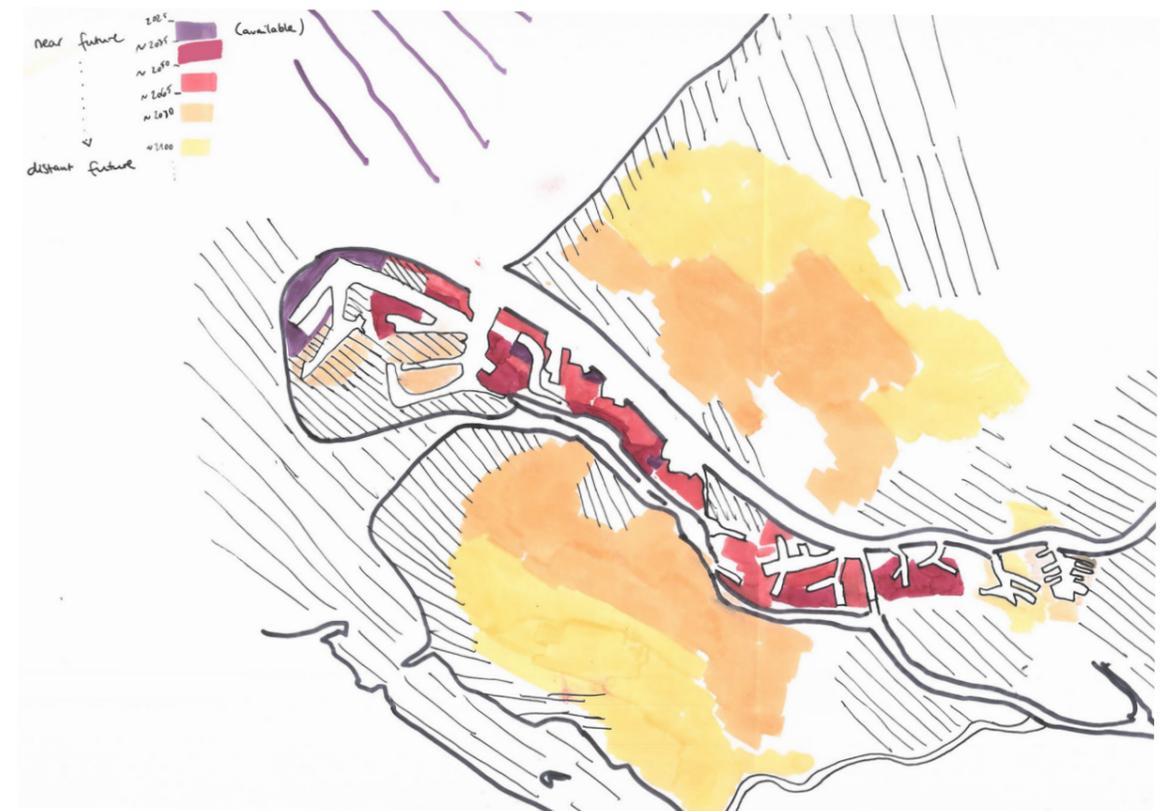
Romane's map



# Land use exercise

When will space become available?

Following the creation of the group strategy map, we did a new land use exercise where one group mapped out the availability of land, projecting when and where certain areas would become available. At the same time, the other group mapped out where spatial distribution of specific activities take place within the landscape. By combining land availability with activity requirements, we created the basemap for our strategy maps.



# Land use exercise

What activities do we need where?

# Land use exercise

Combined land use map

