

WORK IN PROGRESS



AR2U086 Research & Design Studio
Spatial Strategies for the Global Metropolis
Final Report

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Introduction

The Energy Transition

The twenty-first century camps with various challenges, but decarbonising fossil fuel-dependent industries might be the most socially and spatially consequential one. With climate change worsening, and international agreements shifting the energy markets, there persists growing pressure to reshape carbon-intensive industries. However, the transition creates inequalities through concentration of emerging energy hubs and innovation districts, whilst burdens disproportionately affect working-class territories in proximity to phased out industries (Liu & Dąbrowski, 2024). This spatial asymmetry is the structural consequence of a governance system that views decarbonisation as a technical instead of social problem, with labour displacement forming a secondary concern instead of a co-equal governance challenge (Lempinen et al., 2025).

On the European scale, the European Green Deal progressively institutionalised equitable transition policies such as the 2021 Just Transition Fund (JTF), operationalised through Regulation (EU) 2021/1056 (European Commission, 2021). Instruments like these formulate procedural requirements for the inclusion of social partners in transition planning by jointly setting decarbonisation targets and co-funding mechanisms. The Russia-Ukraine war accelerated this development through REPower (2022), making port-based hydrogen infrastructure a strategic European priority. Nevertheless, the dominant governance mechanism, even in European ports, remains “accompanying”, neglecting actual collective co-production which

enables the affected workers and communities to become transition decision-makers as actual co-governors.

This institutional gap concentrates in the national Klimaatakkoord (2019) in the Netherlands, requiring a 55% greenhouse gas emission reduction by 2030. In the Meerjarenprogramma Infrastructuur Energie en Klimaat (MIEK), the Rotterdam-Moerdijk industrial cluster consistently forms a fundamental site for e-fuel infrastructure, CCS, and hydrogen investments in the country (Ministerie van Algemene Zaken, 2022). This makes the Port of Rotterdam a battleground for the energy transition, with around 14% of all EU maritime freight coming in here, adjacent to the continent's biggest petrochemical complex, making it the most carbon-intensive industrial zone in the country (van Erp, 2017). The Port Authority holds joint ownership by the Dutch state and Municipality of Rotterdam, basing national industrial policy and urban governance in industry decarbonisation in an institutionally inseparable way (de Langen, 2023).

Precisely at this regional scale of the industrial cluster the transition's contradictions become most prevalent. The governance model of the Port of Rotterdam is a multi-layered, hybrid system consisting of a landlord-plus concession model, corporatised public Port Authority, and a co-produced Port Vision by PoR, national and provincial governments, and Deltalinqs (de Langen & van der Lugt, 2006; Vieira et al., 2014). This governance system has consistently attracted industrial investments and successfully realised large-scale infrastructure coordination. Since the

PoR's corporatisation in 2004, the role of trade unions has been increasingly marginalised, reducing from co-governing actors to peripheral, conflict-driven participants (de Langen, 2007). Whilst the port's refinery and terminal workers have previously housed communities in Rotterdam South, they become increasingly disconnected from the new e-fuel cluster in the Maasvlakte where new employment opportunities reside (Notteboom et al., 2015). This demonstrates that the port is the site where the transition burdens are most concentrated in the Netherlands, whilst simultaneously offering the most significant decarbonisation opportunities. In a governance system that is shaped to serve industrial efficiency, such contradiction cannot be resolved without structural redesign (Sornn-Friese, 2024; Carter & Drouaud, 2022).

This project aims to formulate a 2100 vision that translates the just energy transition into a operational spatial and governance strategy for the Port of Rotterdam. The central research question reads: **How can the Port of Rotterdam reduce dependence on oil by shifting refinery and terminal operations toward renewable based e-fuels (using green hydrogen and renewable electricity), while bridging the gap between declining oil-related jobs and the education, reskilling, and new career pathways needed for young workers in the emerging low-carbon economy?** To achieve this, the port is analysed on spatial and institutional grounds, harnessing the design of new governance instruments that see the transition's territorial and social consequences as the constitutive challenge (Ninan et al., 2025; de Langen, 2023).



Figure 1: Introduction Collage

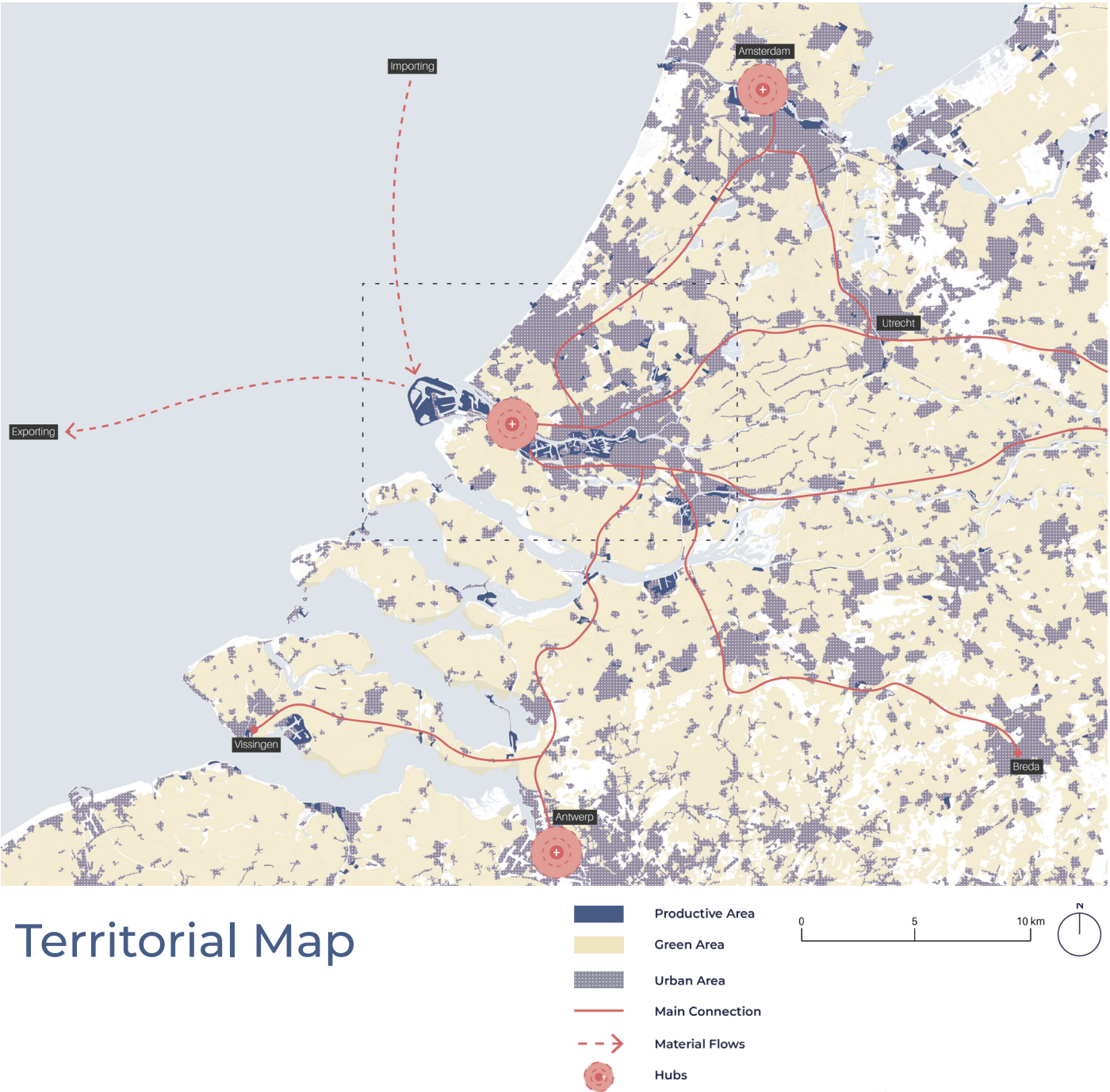
Problem Statement

The port of Rotterdam supports approximately 192,000 jobs across terminals, offshore services, logistics, heavy industry, and energy production (Streng et al., 2025). Still, employment is under pressure due to the relocation of companies caused by high costs, congestion, limited space, strict regulations, and rising energy prices (Rijnmond Redactie, 2025). Automation further reduces labor demand (Visscher, 2015). Most current workers have practical or vocational education backgrounds, which creates a potential skills gap in the transition toward hydrogen, electrification, and renewable energy systems (Dekker et al., 2024).

Economic forecasts indicate that Rotterdam’s economy will become less dependent on the port, whilst port employment will shrink and diversify across new industries (Streng et al., 2025). There is also a growing demand for higher-skilled and technically trained workers (Dekker et al., 2024). This creates a structural challenge. If the energy transition is not spatially and socially integrated, it risks job displacement, inequality, and a disconnect between existing workers and emerging low-carbon sectors. This is not only a concern in the short term, as the energy transition is a prolonged procedure. It will also be a question in ensuring justice not only between the current workers but also between generations of workers, creating a challenge of both intra- and intergenerational justice.

At the regional scale, Rotterdam is strategically positioned as the main land interface for offshore wind and hydrogen flows from the North Sea. This gives the port the opportunity

to transform from a fossil energy gateway into a renewable energy hub. The key problem is how to implement this transition in a way that reorganises port space, repurposes oil-based infrastructures, strengthens regional integration within the North Sea energy hub, and ensures inclusive inter- and intra-generational opportunities for workers and surrounding communities.



Territorial Map

Figure 2: Territorial Map (PDOK, Copernicus)

Research Objective

Since the Russia-Ukraine war, the Port of Rotterdam has been designated the continent's leading energy hub. To achieve this, its fossil-fuel-dependent industrial cluster must undergo structural decarbonisation, whilst the associated costs and benefits must be fairly distributed across involved stakeholders (van Erp, 2017; de Langen, 2023). The port is currently the largest petrochemical processing and distribution hub in Europe. Although this cluster has now lost market viability and regulatory legitimacy, its infrastructure, workforce, and operational territories are difficult to replace (de Langen & van der Lugt, 2006; Sornn-Friese, 2024). The strategy behind the transition from oil dependence to renewable-based e-fuel production of these terminal and refinery operators in the Port of Rotterdam forms the research objective in this project. Simultaneously, this shift must be governed as a co-equal public interest in favour of the affected workforce, instead of its residual market outcome.

This objective is addressed through four interrelated dimensions. First, the port's existing value chain is assessed based on its ability to be repurposed into e-SAF, hydrogen, and electrolysis infrastructure. This lever exposes the influences of utility corridor control, concession design, and land ownership, which shape feasibility beyond technical convertability (de Langen & van der Lugt, 2006; Ismail et al., 2024). Secondly, the fossil industry experiences the most severe displacement risk, whilst this study explores how the new e-fuel industry will contribute to early-career demand, exploring the labour market transformation that the port's

02

Objectives and Research Question

current and future workforce will experience (Lempinen et al., 2025; Ninan et al., 2025). This exposes the skills gaps between the existing fossil industry and the emerging sustainable industry, demanding different knowledge domains. Based on the way hydrogen, cybersecurity, and electrified logistics are handled, career credentials and reschooling will become increasingly relevant (Sornn-Friese, 2024; van Erp, 2017). Lastly, this research exposes what education-industry dynamics would best bridge this gap upon structural alignment with employer hiring demands over voluntary aspirations (Chandra & van Hillegersberg, 2017; de Langen, 2007).

Design Objective

Through design, we aim to transform these research findings into a spatially grounded and institutionally operable vision for the Port of Rotterdam in 2100. This forms a spatial manifestation where the industrial territory is restructured from a fossil refinery hub into an e-fuels cluster consisting of mixed-use areas embedded with educational and innovation infrastructure. To accommodate this, the governance system treats the workforce transition as the precondition of industrial licensing instead of a secondary policy aspiration.

Spatially, the design specifically targets the disconnect between the port worker communities on the one hand, and the ever-growing distant labour opportunities on the other hand. By anchoring retraining infrastructure, transit links, and mixed-use redevelopments in port territories, those who are most exposed to the transition burdens

get empowered through their living and working circumstances (Daamen & Vries, 2013). This design is institutionalised through several governance instruments, from the Port Energy Transition Compact, a Skills and Labour Accord embedded in the concession design, to the Port-City Territorial Just Transition Plan. The combinations of these instruments transform the Port Authority's landlord-plus function into a lever for social conditionality, making market access for terminal operators conditional on binding workforce commitments (de Langen & van der Lugt, 2006; Carter, 2024). These institutional and spatial interventions jointly calibrate to long-term uncertainty of the energy transition whilst they establish consensus on distributional commitments and responsibilities for each actor in the port's governance system (de Langen, 2023; Carter & Drouaud, 2022).



Figure 3: Pin By FBC On 1bis | Digital Collage Art, Surreal Collage Art, Collage Illustration, n.d.

Research Question:

How can the Port of Rotterdam *shift* from an oil-based refinery toward renewable-based energy systems in a way that *secures inclusive, intergenerational employment justice*, and *strengthen its role as a North Sea energy hub*?

Sub-questions:

1. Which parts of the Port of Rotterdam's current industries are most feasible to repurpose, and why?
2. How will current and future employees be impacted by the energy transition and how can this be bridged to ensure employment security?
3. How can the port of Rotterdam be a strategic place strengthening both its local and national position?



03
Methodology

Introduction
The methodology aims to provide structure throughout the design process by elaborating on the conceptual framework and research methodology. This helps to rethink every intervention and connect it back to the core principles. Based on research and design, analyses are conducted to lead to a vision that is worked out into a strategy. It recombines all findings into a coherent project.

Conceptual framework

This conceptual framework was developed to guide the analysis of the energy transition as the central process within the project. The framework does not approach the transition as a final end-state, but rather as an ongoing transformation whose enabling conditions form the main focus of the research. The framework is structured through three analytical dimensions: physical, social, and mental. These dimensions allow the project to examine not only tangible spatial and infrastructural conditions, but also patterns of social interaction, questions of justice and inclusion, and the perceptions and narratives through which spaces are understood. Surrounding the central concept, the thick ring represents the project's definition of circularity, operationalised through the principles of slow, narrow, close, and regenerate (Konietzko et al., 2020). These principles provide the normative lens through which interventions are evaluated. The arrows identify the major pressure points in the research, highlighting the domains where tensions and opportunities are most concentrated. The gears represent the pathways through which the transition can be implemented, including themes such as renewable energy, asset repurposing, industrial symbiosis, governance and community benefits, workforce transition pathways, education, employment justice, community well-being and legitimacy, and policy and investment levers. The framework functions as both an analytical and projective tool: it structures the diagnosis of current conditions while also identifying the interrelated pathways through which a circular and just energy transition can be enabled.

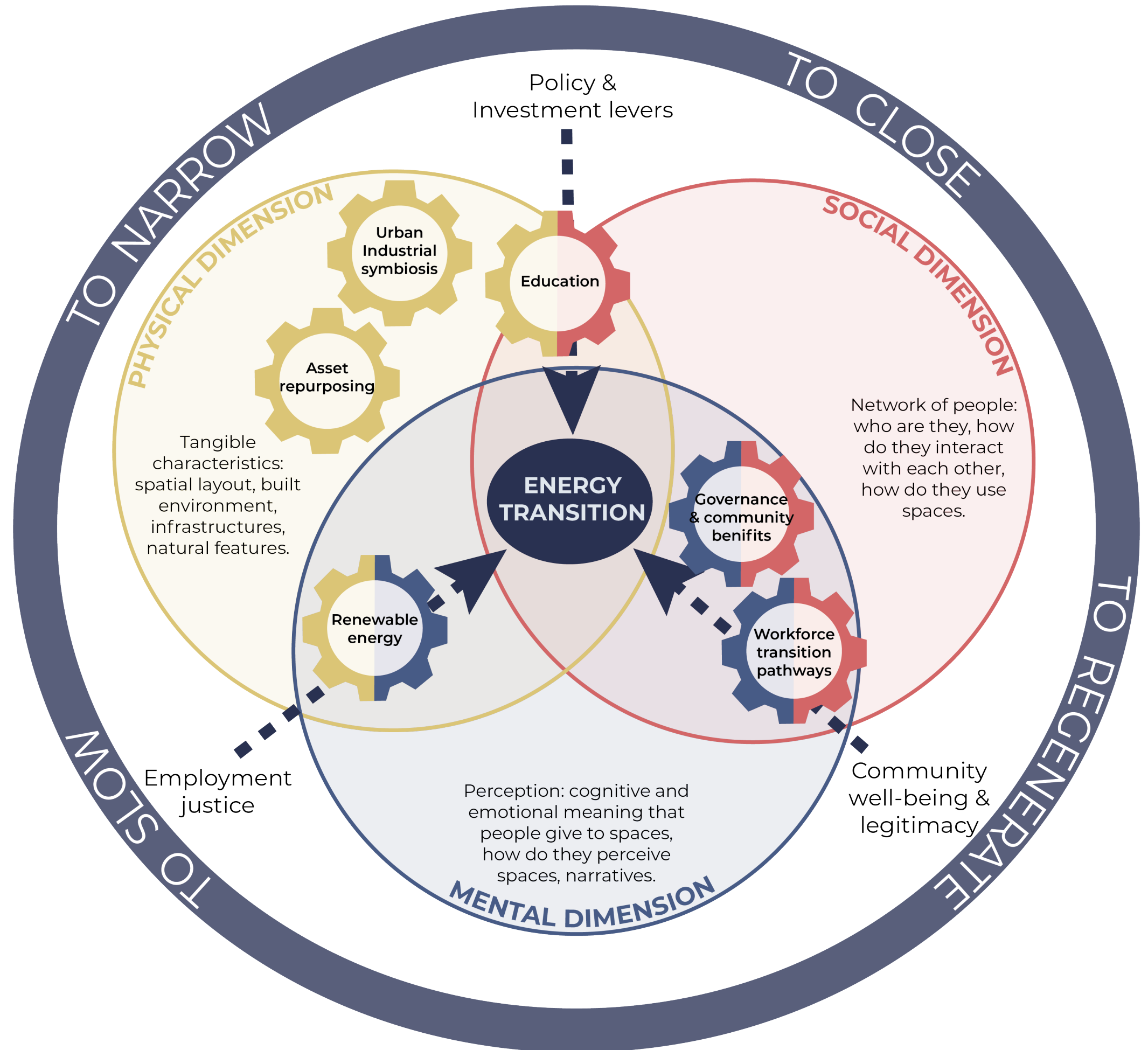


Figure 4: Conceptual Framework

Mechanism diagram

The conceptual framework makes use of gears that are connected to the three dimensions. They are tools to achieve circularity from the perspectives of employment justice, policy & investment levers and community well being & legacy throughout the dimensions in order to accommodate the energy transition in the port of Rotterdam. The definition of the gears are explained in more detail with the help of figure 5.

Education:

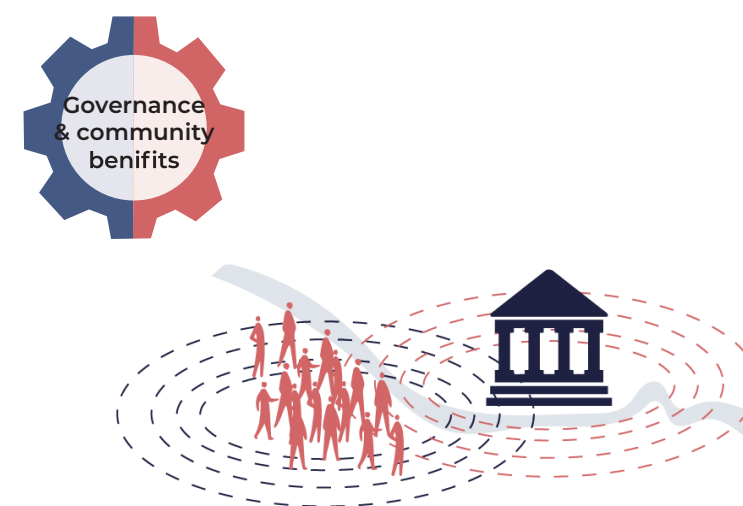
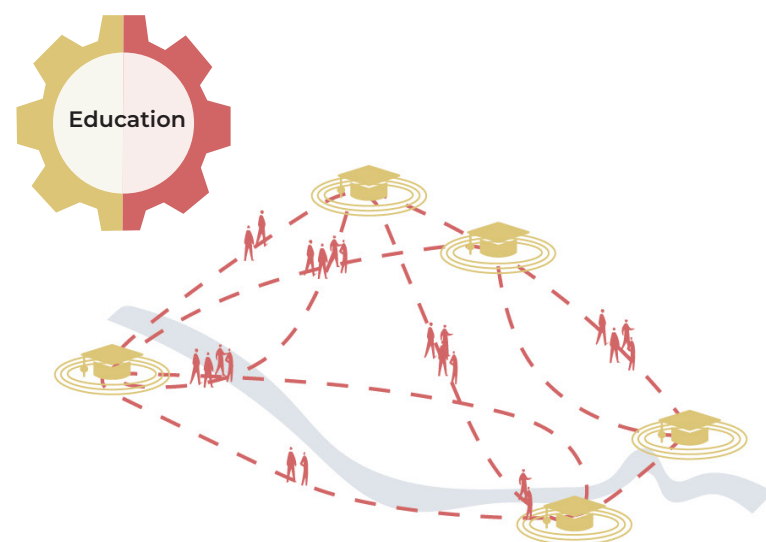
Education is a tool that can strengthen connections between institutes and companies, therefore stimulating innovation and driving a knowledge based economy. While at the same time it offers a platform for people to create a network of social and professional relationships, creating opportunities for people to educate or re-educate themselves to different sectors and subjects. For these reasons the gear is placed both in the social as physical dimension.

Renewable energy:

Renewable energy is not only about moving away from fossil fuels as a source of energy and the infrastructures needed to accommodate that, as well as the shift it requires from energy consumers to change their behaviour in their daily life. It will affect the way they use appliances, the structure of their environment and their modes of transportation. The gear is therefore placed in the physical and mental dimension.

Asset repurposing:

In order to achieve a sustainable, realistic and efficient transition it is



useful to utilise as much of the existing structures as possible. This means circling back for every intervention and decision to the 7 R's of circularity.

Urban industrial symbiosis:

This gear emphasises on the mix of functions from cities and industry sites together to integrate the working and living conditions for a closer collaboration. This will strengthen the economic independence of the region and add to a national level of economic independence. It focuses not only on local production, storage and transport from an industrial perspective, but also on the improvement of the living condition for citizens.

Governance & community benefits:

The energy transition should not only be beneficial to companies producing energies. The contribution from a government perspective to achieve a sustainable and independent economy that ensures a beneficial society and environment for people is more the focus of the strategy. This requires a close dialogue from different stakeholders with the community. This places the gear in both social and mental dimensions.

Workforce transition pathways:

In an ever changing economy, the need of required skills is also always shifting. To secure better opportunities and future perspectives for workers it is needed to accommodate easily with these changes. This requires good accessible facilities in a close range, making it both a mental and social gear. As it requires a change in social environment and thinking in solutions aided by lowered thresholds.

Figure 5: Mechanisms Diagrams

Methodology

The research process starts with the Problem field. It maps out the global challenges of climate change and reliance on fossil fuels, alongside Rotterdam’s specific situation as a growing North Sea energy hub. It also highlights the significant gap in fair employment opportunities across generations that this transition may create.

From this foundation, the Research question is formed: how can the port move toward renewable energy systems while ensuring fair job opportunities for all generations? This challenge is central to the entire research, keeping community results at the heart of every analysis and design choice. The analysis phase uses a layered approach to look at current conditions regarding spatial qualities, energy landscape, mobility, education, policies, and stakeholder interactions.

These findings directly shape the Vision 2100. This vision presents the working city as a connected energy hub, where education serves as an essential tool for providing fair opportunities across generations of port workers. The Strategy translates this vision into specific locations and timelines, with detailed focus on Maasstrand, Prumerhaven, and Heijplaat, based on principles of urban industrial collaboration.

Finally, Assessment completes the loop through evaluation and reflection on workforce transition paths and climate neutrality goals. Importantly, a cycle of iteration and feedback links all phases, ensuring that findings continuously enhance both analysis and design throughout the process.

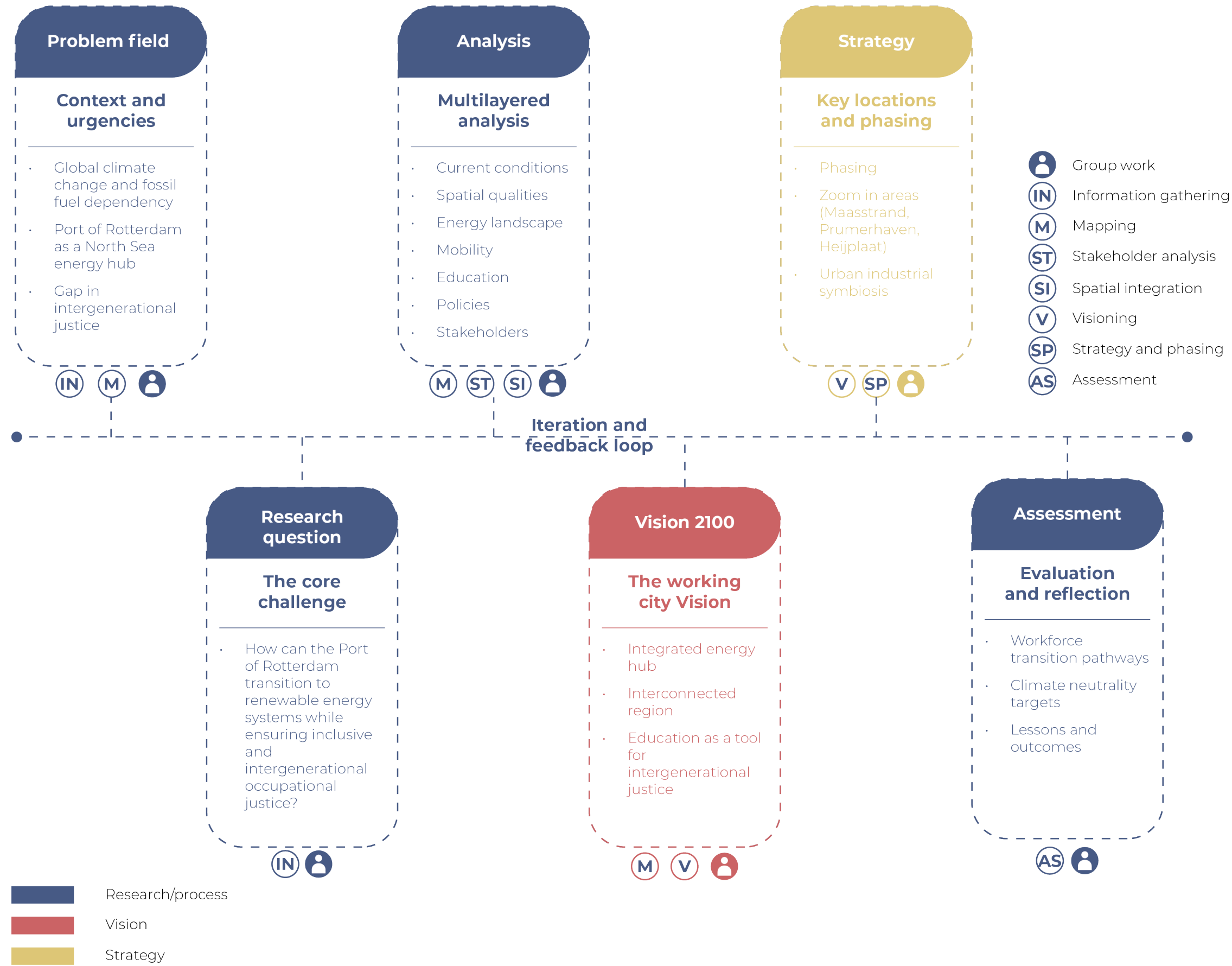


Figure 6: Methodology Framework

Our Values

The project is guided by a set of values aligned with key Sustainable Development Goals, reflecting both the environmental urgency of the energy transition and the social responsibility of the Port of Rotterdam. At its core, the project prioritises a just and inclusive transition. This is reflected in the focus on decent work and economic growth by supporting the reskilling of current workers and creating new opportunities in renewable energy sectors. It also addresses reduced inequalities by ensuring that the benefits of the transition are accessible to different social groups, including existing workers, young generations, and vulnerable communities.

Education plays a central role in this vision. By integrating new learning environments within the port, the project supports quality education and strengthens the connection between knowledge, industry, and future employment. This is closely linked to industry, innovation, and infrastructure, where existing industrial systems are not removed but transformed into more sustainable and innovative networks. The transition toward affordable and clean energy is addressed through the shift to renewable systems and decentralised energy production, allowing communities to participate more actively in energy generation.

The project also emphasises sustainable cities and communities by reconnecting the port with everyday urban life. Improved accessibility, mixed-use environments, and the introduction of public spaces aim to make the port more liveable and integrated with surrounding areas. At



Figure 7 : Sustainable Development Goals adapted from United Nations (n.d.)

the same time, climate action remains a key driver, guiding the overall transition from fossil-based systems to low-carbon energy. Issues of health and well-being are addressed through improved environmental quality, reduced emissions, and the creation of healthier living and working environments.

Finally, the project recognises that such a transition cannot happen in isolation. Partnerships for the goals are important, as the transformation of the port requires collaboration between government, industry, educational institutions, and local communities. Together, these values shape a vision of the Port of Rotterdam that is not only more sustainable, but also more inclusive, resilient, and socially grounded.

Theoretical framework

This theoretical framework structures the project through four pillars: **energy transition, inter-/intra-generational justice, community engagement, and community empowerment**. Together, these pillars define the transition not as a social, political, and ethical transformation. The framework is organised through three levels: core questions, tensions, and synthesis. The core questions identify the main issues explored in the project, such as how systems change, who benefits, who decides, and how communities can gain real influence. The tensions then highlight the conflicts embedded within these questions, including stakeholder interests, present versus future wellbeing, unequal participation, and the gap between involvement and actual power. Finally, the synthesis sections translate these tensions into a clear conceptual position. In this way, the framework shows that a just energy transition requires more than technological innovation. It depends on governance structures that distribute costs and benefits fairly, address both present and future inequalities, create meaningful forms of participation, and enable communities to exercise agency and co-produce outcomes. The framework therefore serves as an analytical lens for understanding transition as a multi-actor and justice-oriented process.

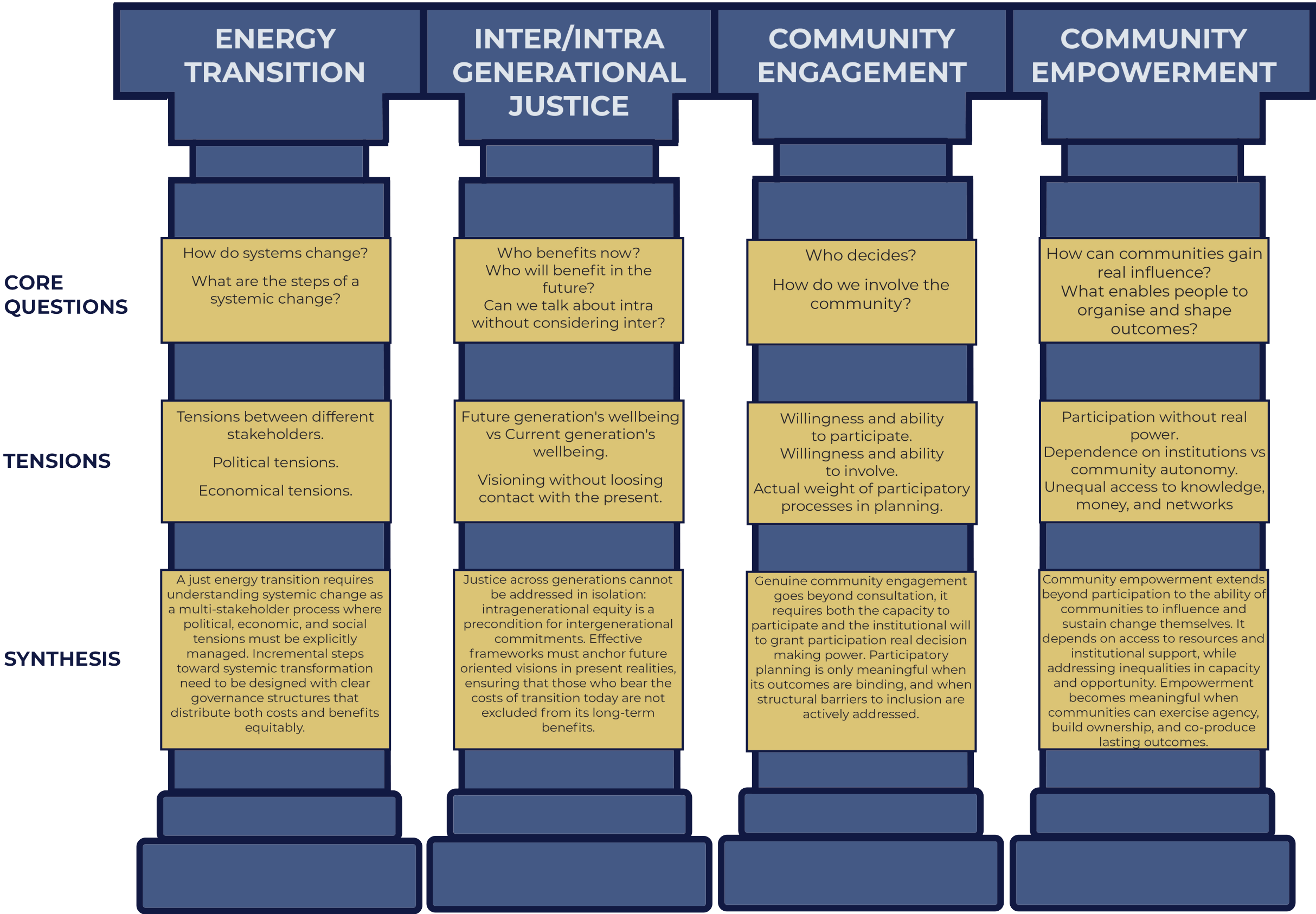


Figure 8: Theoretical Framework



04 Analysis

History of the Port Community
To understand the community of harbour workers in Rotterdam, we first must understand the roots of the harbour and its workers in the city. Rotterdam originates from the 13th century as a settlement right next to the dike (dam) of the river the Rotte. It quickly expanded and gained city rights a century later (Van de Laar, 2022). This expansion started the initial harbour activities in the city, next to the historic centre. However, it wouldn't expand to a large-scale harbour for many centuries due to the difficult sea-access (Hein, 2022). Only upon structurally mitigating the sanding effect that blocked this access to the sea, its harbour grew exponentially.

Throughout the 19th century, the Industrial Revolution in European countries would drive industrial growth. This would result in increasing demand for Rotterdam's port function, due to its hinterland (especially the German Ruhrgebiet), as well as the city itself, becoming increasingly industrialised. Rotterdam aimed to meet this demand by improving its access to the North Sea by opening the New Waterway (Nieuwe Waterweg) in 1872 (Van de Laar, 2022). The Nieuwe Waterway marked a breakthrough for the port, enabling unprecedented upscaling of its facilities through the new, reliable connection to the North Sea (Hein & Van de Laar, 2020).

Specifically on the south side of the river, the harbour would increasingly expand towards the sea: Rijnhaven (1895), Maashaven (1905), and Waalhaven (1930) (Van Meijel et al., 2008). These expansions of the port would transform the entire southern

bank of the Maas, turning it into a mixture of maritime functions and newly built neighbourhoods for its workers (Schrijnen, 2003). Through this city-making effort, Rotterdam-South specifically would amass a unique urban maritime culture (Hein & Van de Laar, 2020).

Then, during World War 2, Rotterdam and especially the city's port infrastructure got hit hard. During its reconstruction, the city envisioned the port expanding even further towards the sea (Schrijnen, 2003). This started with the construction of Botlek and Europoort in the '60s, which would become the core of the oil and petrochemical cluster in the harbour (McCarthy & Romein, 2012). With these new developments, Rotterdam surpassed the New York harbour as the biggest port in the world in 1962. From the '70s onwards, containerization in shipping transformed the harbour severely (Notteboom et al., 2021). To accommodate its growing demand and maintain its position as the biggest harbour in the world, old port neighbourhoods transformed into container terminals, whilst new container terminals were built in the Maasvlakte and the second Maasvlakte during the '80s and '00s (McCarthy & Romein, 2012). Despite these efforts, Rotterdam's position as the biggest port in the world would be overtaken in 2004 by Singapore and Shanghai. Since then, more Chinese cities have overtaken Rotterdam in the rankings. Nevertheless, the port remains the largest in Europe (Notteboom et al., 2021).



Figure 9: Nieuwe Waterweg reliably connecting Rotterdam to the North Sea (NOS, 2018)



Figure 10 : 1850 Rotterdam area (Topotijdreis, n.d.).



Figure 12: 2000 Rotterdam area (Topotijdreis, n.d.).



Figure 11: 1950 Rotterdam area (Topotijdreis, n.d.).



Figure 13: 2025 Rotterdam area (Topotijdreis, n.d.).

Rotterdam's Port Identity
The harbour economically and culturally forms Rotterdam: physical labour, day- and night-shifts, solidarity, risks, and conflict (trade unions and labour disputes) (Smit, 2013). Specifically, South is rooted in this identity, being mostly home to harbour labourers from its initial construction in the 19th century onwards (Hein & Van de Laar, 2020). This deeply rooted identification of people in Rotterdam South with the port became evident in the harbour strike of 1979, which took place in De Kuip (Feyenoord stadium) in Rotterdam South (Nationaal Archief, n.d.). This moment materialised the connectivity of the port workers' identities, rooted between the harbour, Rotterdam South, and their football club Feyenoord (in Rotterdam South) (Smit, 2013).

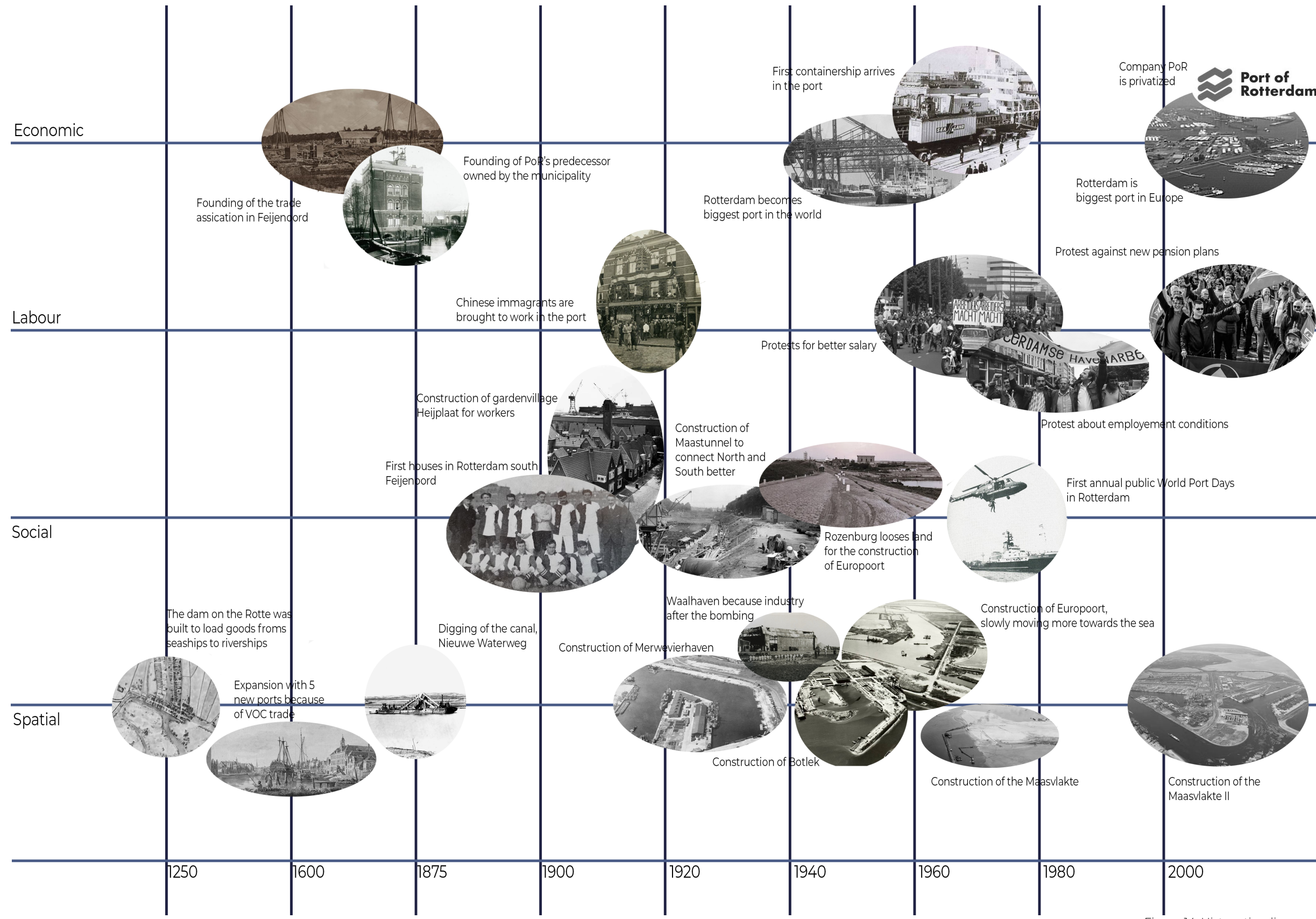


Figure 14: History timeline

South as the centre of maritime life and migration

Two specific locations in South exemplify the connection between South's culture of maritime life and its influence on the city's rich migration history. Specifically, the neighbourhood of Katendrecht would become the centre of seafaring culture (Van de Laar & Van der Schoor, 2019). The neighbourhood mixes harbour functions (warehouses) with housing and amusement targeted to harbour workers passing by (e.g. the red light district) (NTR, 2017). Moreover, the neighbourhood would become a destination for immigration, with many immigrants from all over the world arriving to work in the port (China, Cape Verde, etc.). This would transform Katendrecht into a Chinatown by the 1920s, strongly influencing South's identity as one rooted in immigration (Van de Laar & Van der Schoor, 2019).



Figure 15: 1979 harbour labourer protest in De Kuip (Nationaal Archief, n.d.).



Figure 16: Chinatown in Katendrecht, 1920s (van Meeteren, 2015).

Whilst immigration became a part of the South's identity, it would also be impacted by emigration. On the Wilhelminapier, also known as Kop van Zuid, the headquarters of the Holland America Line were positioned, forming a location for departure for thousands of migrants moving towards the "new world" of the Americas (Kermani et al., 2020). However, its transformation into Hotel New York (in 1993) elaborates on the transition of South that has occurred since then: from harbour and intense labour, to tourism, heritage, and large-scale redevelopments (McCarthy, 1999).

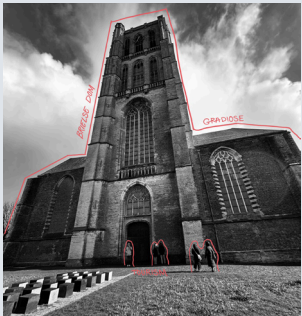
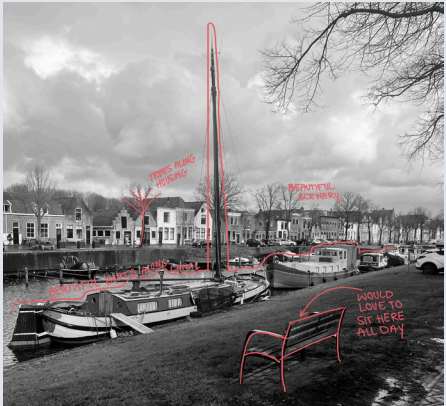


Figure 17: Flyer for the Holland-America Line, departing from Rotterdam.

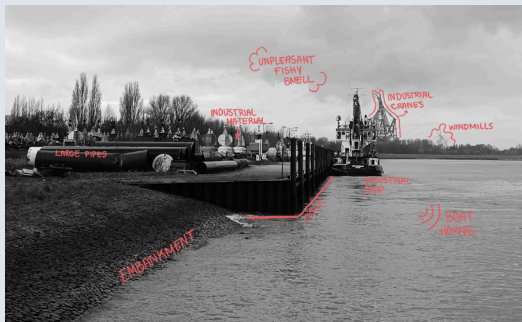
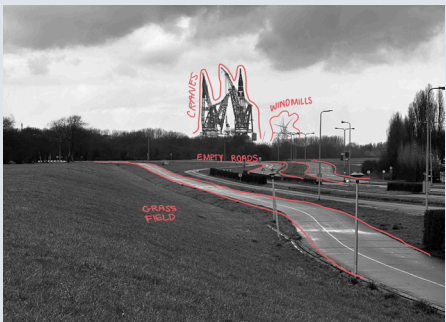
Persistent identity through changing morphology

With the port functions moving west towards the North Sea, old harbour areas, especially in Rotterdam South and West, would become available for redevelopment (McCarthy, 1999). Not only to accommodate this change, but especially to celebrate it, the Erasmusbridge was constructed in 1996. The Erasmusbridge became the symbolic and physical connection between South and the rest of the city, with a reimagined view of its river and former harbourfront (Stadsarchief Rotterdam, n.d.). The new redevelopments that have occurred since then didn't transform South's identity, but reinforced it as one of solidarity, hard work, and aspirations to write history (McCarthy & Romein, 2012).

Concretely, Rotterdam-South didn't grow alongside the port, but has grown because of it: From the construction of docks, its seafaring culture, mass migration, and later redevelopments of former harbour terrains (McCarthy, 1999). All these layers have shaped the identity of the port, its workers and the place they call home: Rotterdam-South. It's a part of people's history, economy and daily lives, which even persists in large-scale reconstructions due to its deep entrenchment within the area's collective memory (Hein & Van de Laar, 2022).



5. Brielle



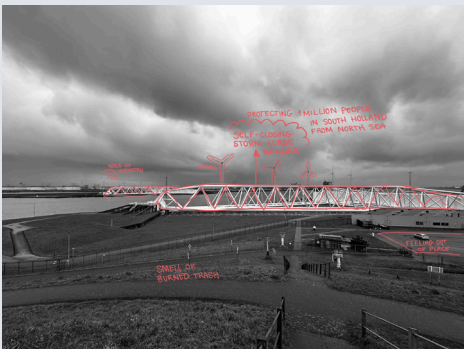
4. Rozenburg



3. Maassluis



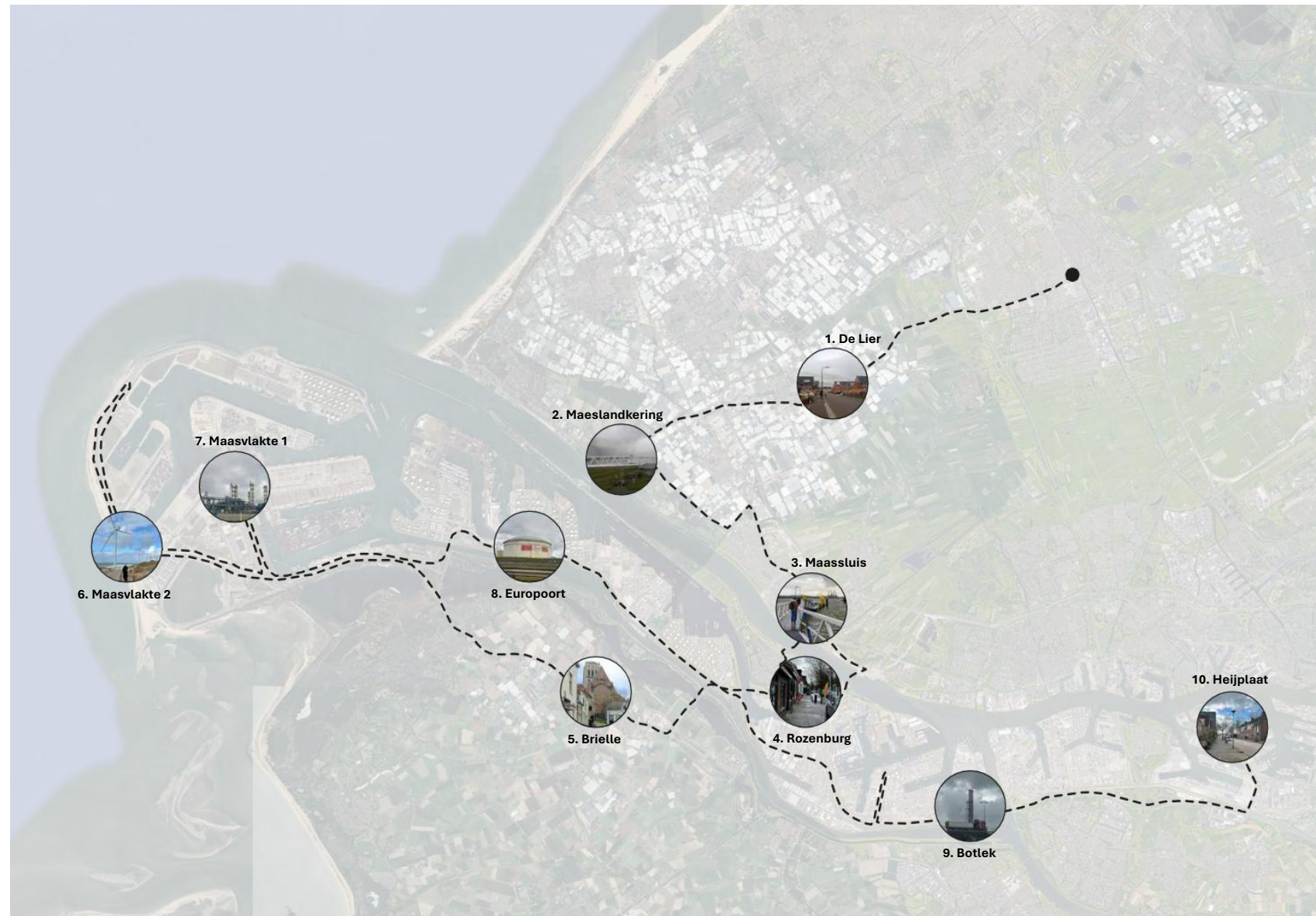
1. De Lier



2. Maaslandkering



6./7. Maasvlakte



Fieldwork route

Departing from Delft station, we drove to the Westland area to get an understanding of the transformations currently taking place. In De Lier, we stopped to walk through a suburban-style neighbourhood under construction, which used to be greenhouses. This made us realise that the Westland really is a region in transition. Next, we visited the Maeslandkering and Maassluis, getting an understanding of the area's connection to the Nieuwe Waterweg. Whilst Risti and Ruggero took the ferry to Rozenburg from here, the rest drove to the village through the new tunnel. Rozenburg represented the calm harbour village housing the port workers, whilst Brielle displayed a wealthier existence through its old town charm. We then got blown away by the beauty of the beach at Maasvlakte 2, whilst we got intimidated by the exclusionary industrial nature of Maasvlakte 1. On our way to Heijplaat, we explored the Europoort and Botlek, both displaying the industrial monofunctionality we were already expecting from the port. To end our tour on a bright note, we discovered a human-scale feeling of Heijplaat, despite the presence of active port functions. This would form our vision, favouring multifunctionality throughout the port.



8. Europoort



9. Botlek



10. Heijplaat

Industries and Employees

The Port of Rotterdam accommodates a wide range of economic activities and employment sectors, reflecting its role as a highly complex and interconnected industrial system. Rather than functioning as a single industry, the port consists of multiple sectors that operate alongside and through one another. The main sectors include terminals, offshore activities, logistics, transport, energy, services, production, maritime activities, and heavy industry, such as petrochemical industries, biofuel plants, biorefineries, and oil refineries (Port of Rotterdam, n.d.-a). Among these, heavy industry is particularly characteristic of the port and plays a major role in defining its identity. At the same time, this sector contains some of the largest polluters in the port area (Keete & Romers, 2024; Port of Rotterdam, n.d.-a; Port of Rotterdam, n.d.-b).

Together, these sectors generate substantial employment and make the port an important economic engine for the region. In total, they provide around 192,000 jobs (Streng et al., 2025). However, there are increasing concerns about a decline in job opportunities within the port. Several developments may help explain this trend. One important factor is the relocation or closure of companies and departments, with some firms moving activities outside the Netherlands due to what they perceive as high costs and complex operating conditions (Rijnmond Redactie, 2025). According to these concerns, if the government does not improve the business climate, this process

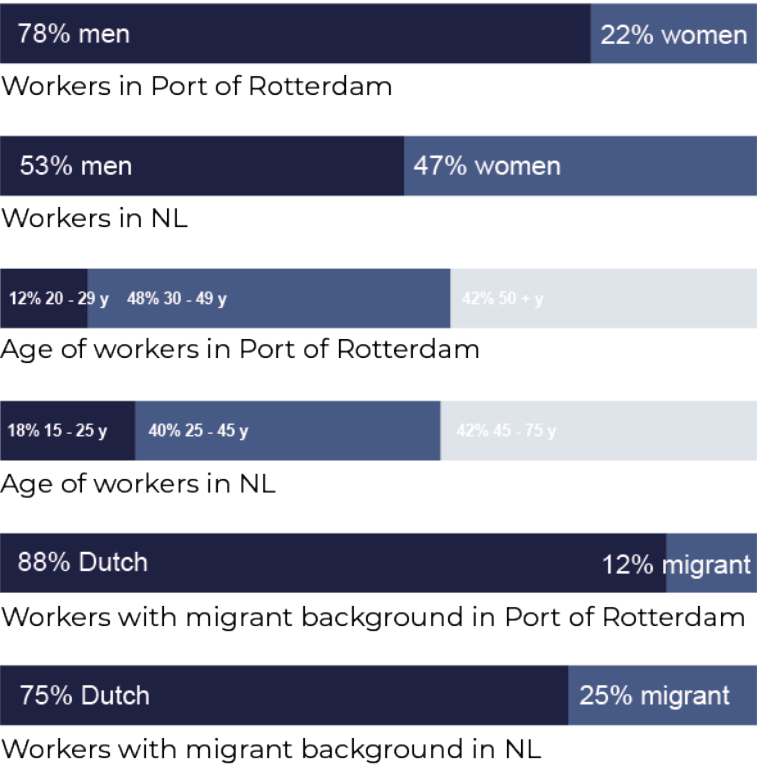


Figure 40: Community statistics

Young Port Workers

Up to 35 years & entrants

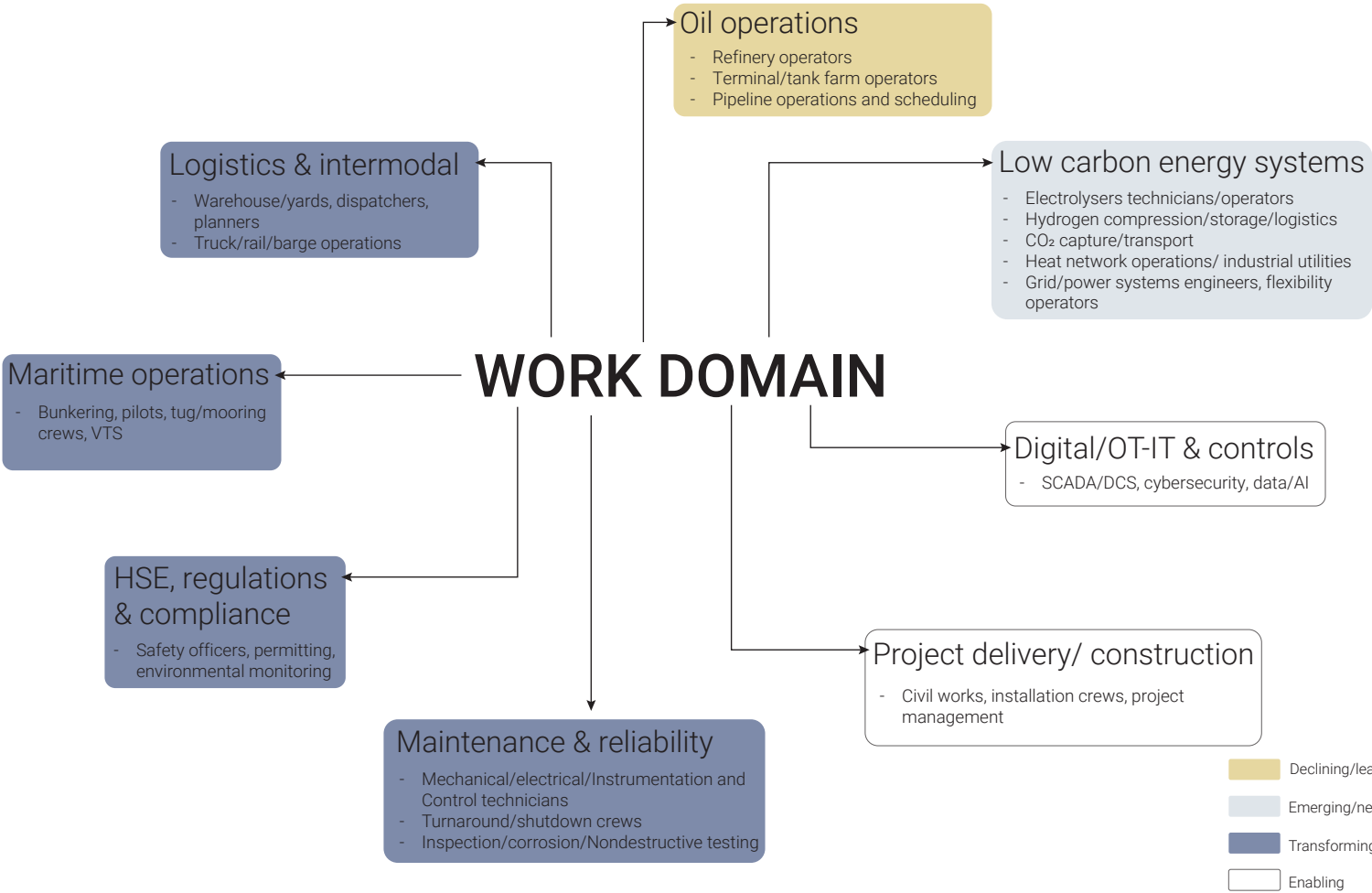


Figure 41: Work Domain chart adapted from Arbeidsmarktonderzoek HIC 2024 (Dekker et al., 2024)

may continue. The issues most frequently mentioned include grid congestion, high energy prices, limited space, nitrogen regulations, and strict legislation (Rijnmond Redactie, 2025). When companies close or relocate, this can lead to the sudden loss of many jobs at once, with direct consequences for workers and the regional economy.

A second factor influencing employment is automation. As port processes become more technologically advanced, fewer workers may be needed to perform operational tasks that were previously labour-intensive (Visscher, 2015). Although automation can improve efficiency and competitiveness, it may also contribute to a reduction in traditional job opportunities, particularly for lower- and medium-

skilled workers. At the same time, current labour market data suggest a mismatch between the educational profile of the workforce and the types of vacancies that are most difficult to fill. Most employees in the port have a practically oriented educational background, while the hardest-to-fill vacancies are often technical positions that require a more theoretical level of education (Streng et al., 2025). This points to an important challenge for the future of the port: ensuring that the workforce can adapt to changing economic and technological conditions. It also highlights the growing importance of education, retraining, and skills development in maintaining both employment and competitiveness in the port area.

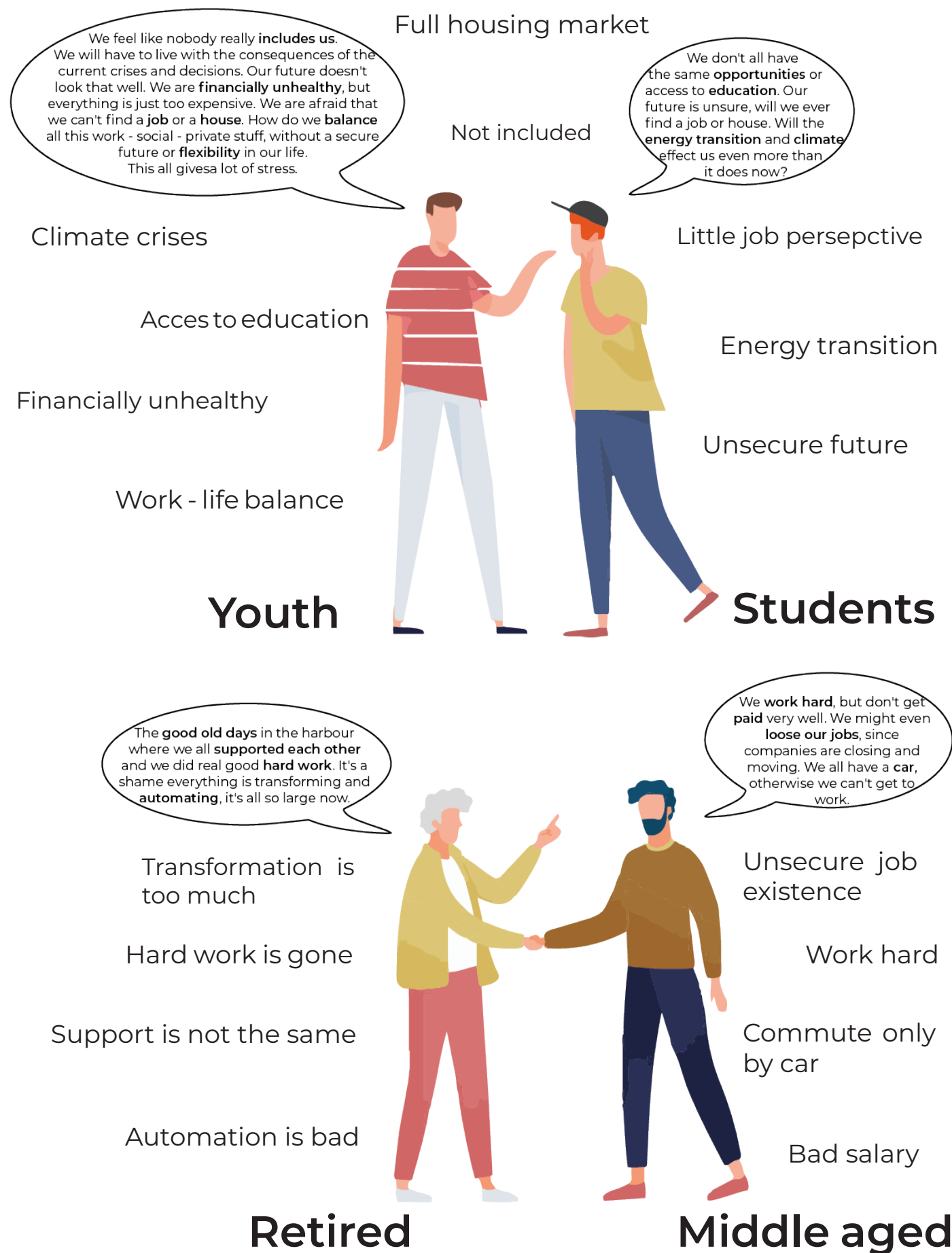


Figure 42: Community concerns

Community concerns

A media analysis was conducted to find out more about the voice of the community of workers in the port of Rotterdam and what their thoughts were about the energy transition and their future perspectives. This media analysis was done with a lot of sources ranging from newspapers to social media platforms, and then summarised with the help of the program atlas.ti. An interview was conducted with a young man working as an intern at Dura Vermeer as a BIM modeler. This one interview was not enough for qualitative research. The analyses found that workers have some critique on the energy transition if it will just mean that oil and chemistry industries move outside of Rotterdam and the EU to later on import the same products. This results in even more unsustainable practices since it adds to more transport emissions. Another concern that is related to the shift in established companies in the port caused by the energy transition is that it might cause a shrinkage in the job markets. If that is the case workers want profits to be distributed more fairly, to compensate for the shrinkage. Generally speaking, people want to move towards a greener and cleaner future, but most are only willing to make big changes if the options to stimulate such behaviour become cheaper. Then under the port workers, there is also a growing concern about the Chinese influence and dependency on the industry and technology used in the port of Rotterdam.

While conducting the media analysis, the community of port workers were divided into the following subcommunities: young workers under the age of 35, middle aged

workers ranging from 35 to 60 years old, retired or almost retired workers that used to work in the port and students with a probability of a career in the port. For each of these subcommunities a more specific media analysis was done. The results are summarised and shown in figure 42. It is found that the younger generation has more concerns about their future. This is also the group that is a minority in the port right now as the youth are only 12% of the community. However, since the energy transition will probably affect the future generation of workers the most, this report decides to focus on a strategy beneficial for the young and up and coming port workers within the energy transition of the Port of Rotterdam.

Community wishes

The concerns of the young port workers up to 35 years and entrants are translated to wishes for their future perspectives. These wishes are categorized to 6 main topics as listed in figure 43. These wishes are linked to spatial interventions that can help to achieve these wishes. With these translations it is possible to base a vision and strategy map later on for the community. The wishes and their spatial translations are related back again to the conceptual framework gears to show the relations between community's wishes and its wider implication to the energy transition in the port and the involvement of different stakeholders.

Community wishes

Spatial translation

Good work-life balance

Decent income

Accessible housing

Job oppertunities

Involvement in policy making

Minimum impact on prices



- Mixed areas to combine free time, housing and working
- Living close to work
- Accessibility to different transportation modes
- Access to education and the job market
- Educational institutes offering different levels and subjects
- Public transport around neighbourhoods
- Enough housing spread across the area
- Mixed housing options available in the area
- Educational institutes for re-schooling or retraining
- Divers companies spread across the port with lots of different positions
- Impacts and policies spatially visible, beneficial and made together
- Green, clean and healthy environment that's better for their own comfort and the climate
- Repurpose old and existing structures
- Local production and distribution
- Reusing materials and closing systems



Figure 43: Community wishes and their spatial translations

Educational Institutes

The map displays the distribution of educational facilities across the Netherlands, from universities and higher education institutions, represented by larger circles, down to primary schools and nurseries shown as smaller dots. The Randstad conurbation concentrates the densest and most diverse educational offer, with major nodes in Amsterdam, Utrecht, and Rotterdam. The port area of Rotterdam, however, reveals a significant gap: few large institutions serve the western industrial fringe, reinforcing the missing link between the port workforce and quality educational provision that the project seeks to address.

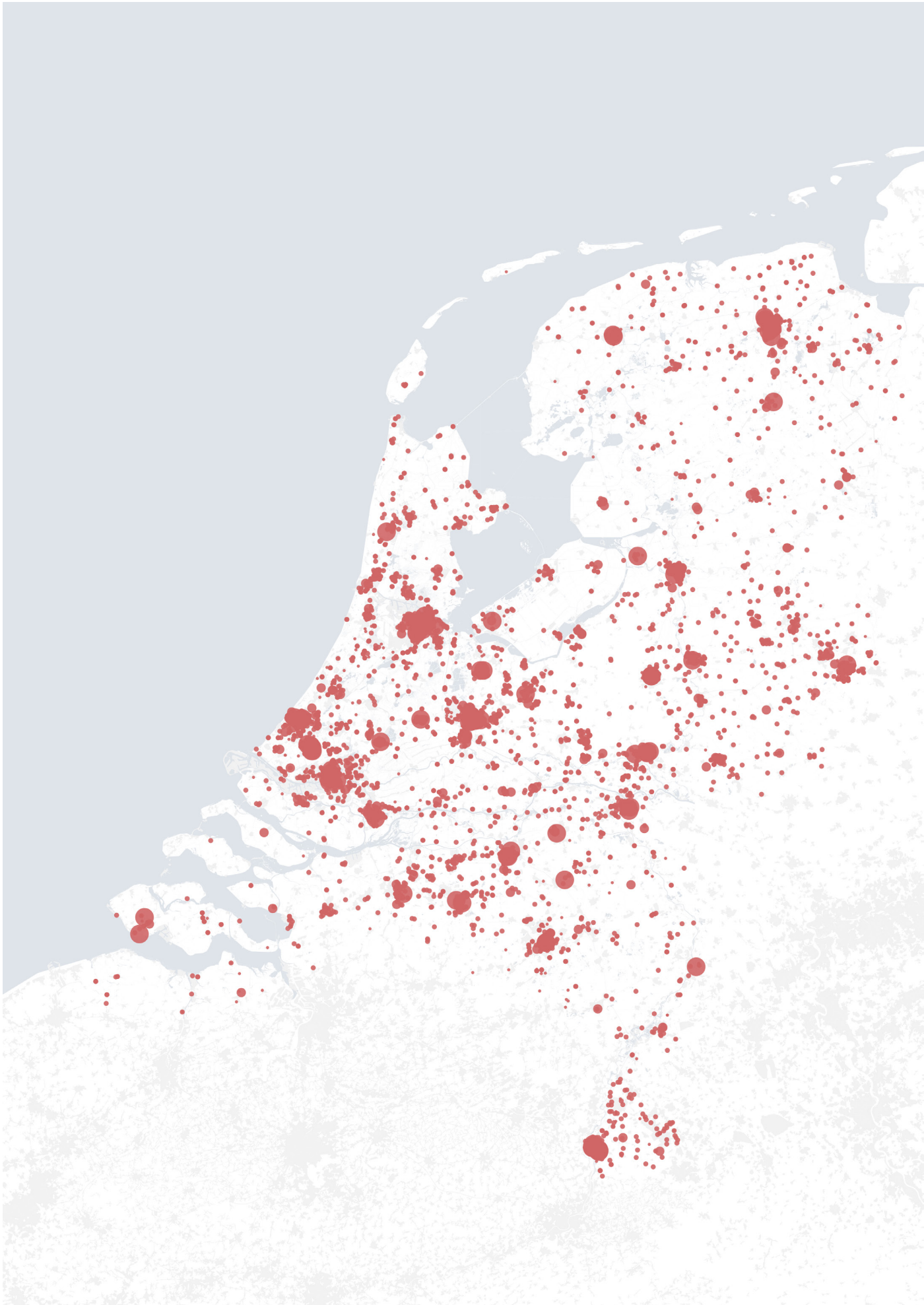
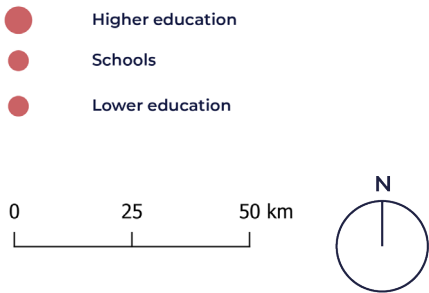


Figure 44 : Educational institutes across the Netherlands (PDOK)

Population Density

The map represents the population density across the whole country. The darkest concentrations follow the Randstad corridor (Amsterdam, The Hague, Rotterdam, Utrecht) and the major urban axes extending eastward. The port territory west of Rotterdam stands out as a conspicuous void: a vast productive landscape almost entirely devoid of residential population. This absence underscores one of the project's central arguments, that the spatial separation between where people live and where port work happens is itself a structural barrier to intergenerational justice and community belonging.

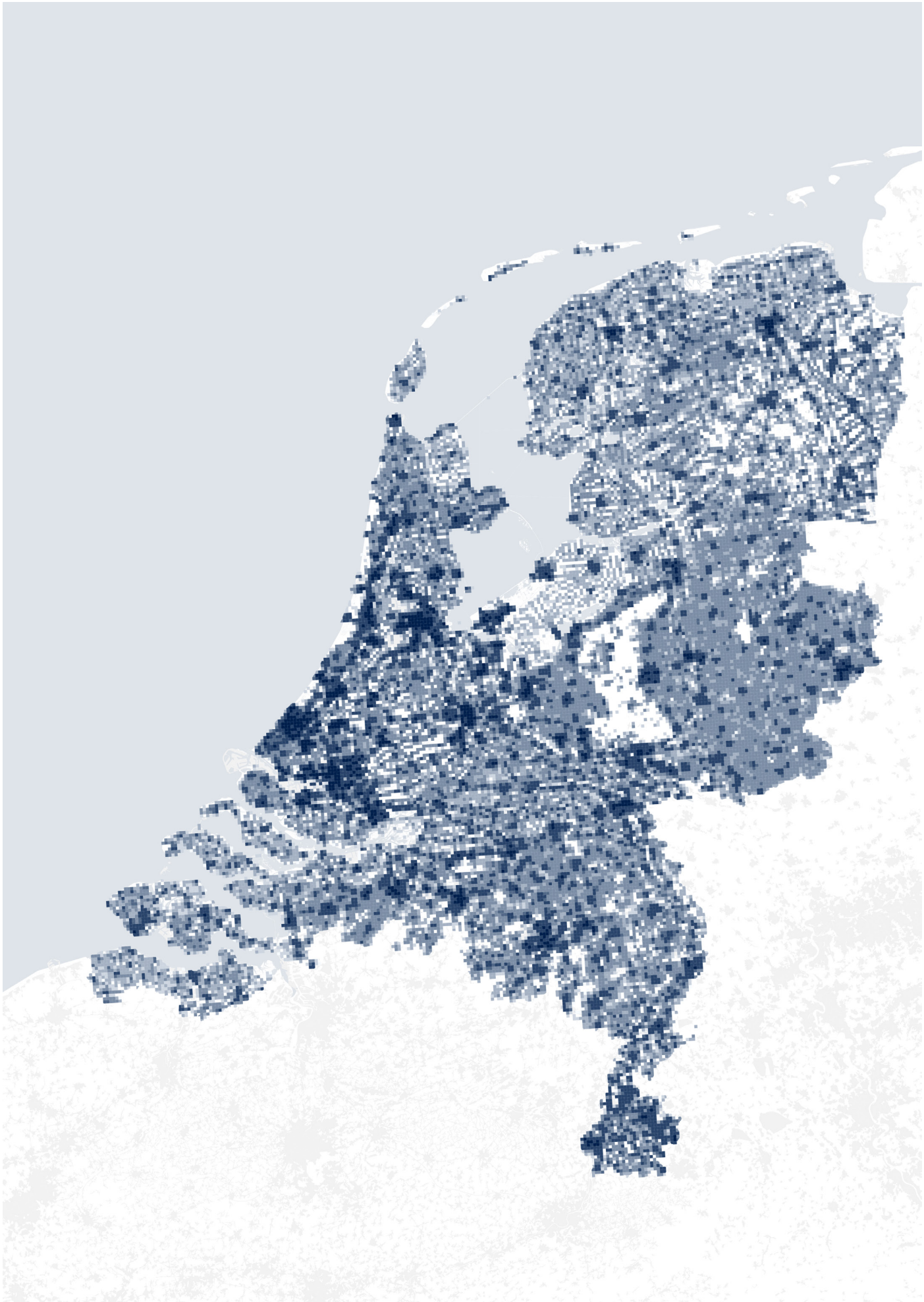
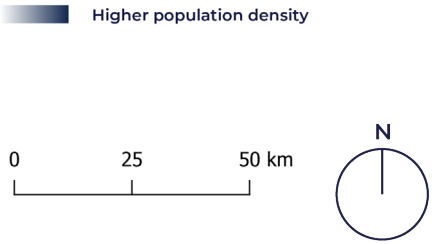


Figure 45 : Population density in The Netherlands (PDOK)

Protected Areas

The map shows Natura 2000 and other environmentally protected zones across the Netherlands. Large continuous areas of protection cover the coastal dune belt, the Wadden Sea, and significant portions of the river delta system surrounding Rotterdam. For the port territory, this layer is particularly constraining: protected wetlands and ecological corridors directly border the industrial areas, placing strict limits on spatial expansion and new development. Any vision for the port must negotiate carefully with these ecological boundaries, reinforcing the case for working within the existing productive footprint rather than expanding outward.

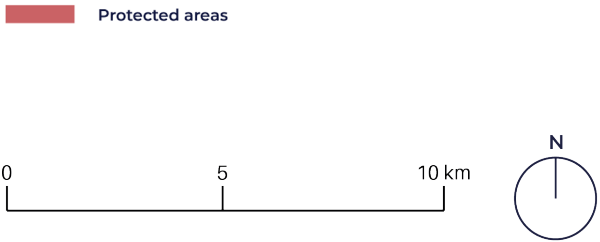


Figure 46 : Protected areas in The Netherlands (PDOK)

Sound Pollution

This map plots noise emission sources across the Netherlands, with circle size proportional to sound output intensity. The pattern is strikingly concentrated: major nodes align with Rotterdam's port infrastructure, Schiphol Airport, and the dense motorway and rail network of the Randstad. The port's western edge emerges as one of the highest emission zones in the country. This acoustic pressure is not merely an environmental indicator, but it is a quality of life barrier that makes the port territory currently hostile to residential and civic uses, and one that the vision must actively mitigate through buffer zones and green infrastructure.

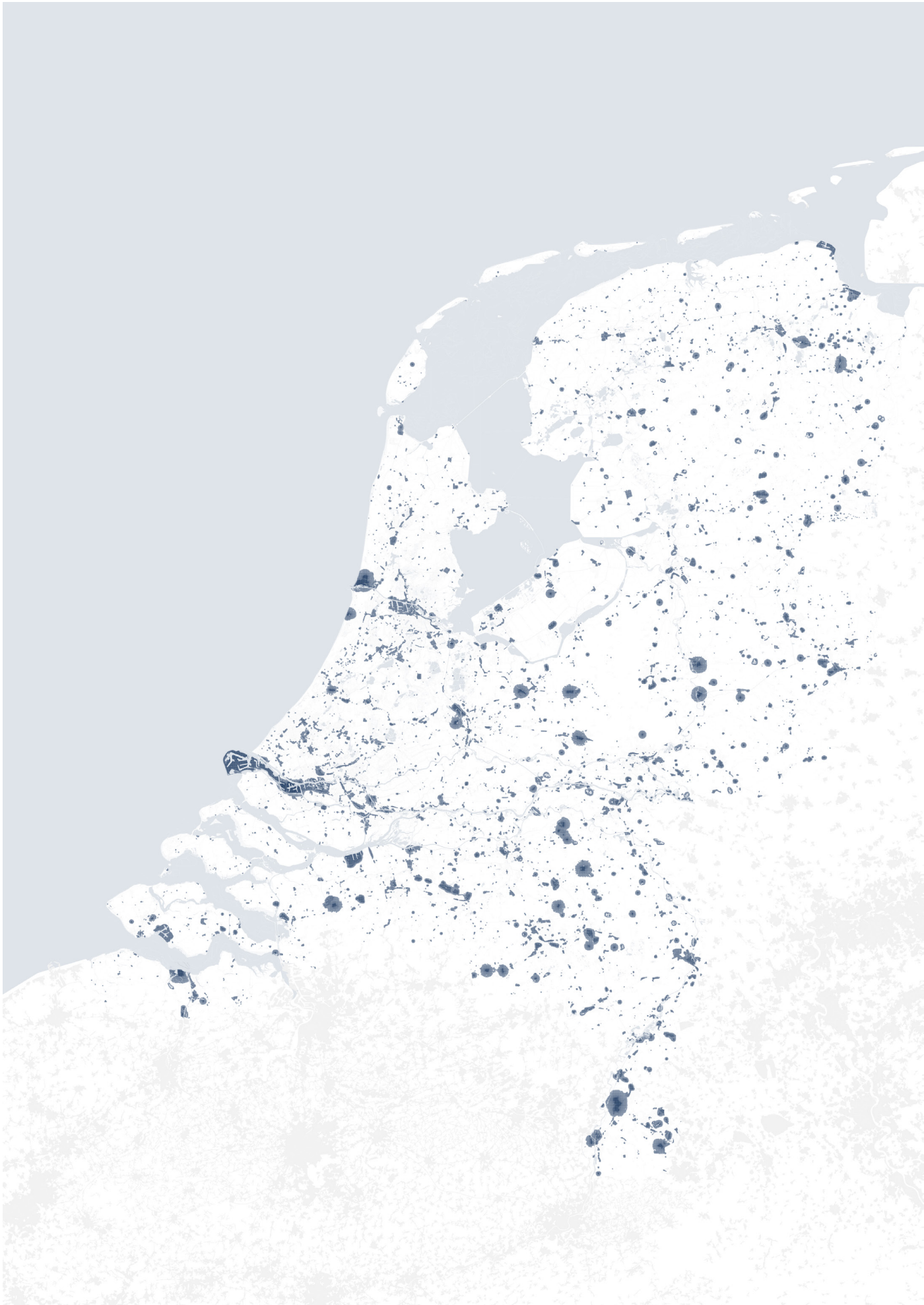
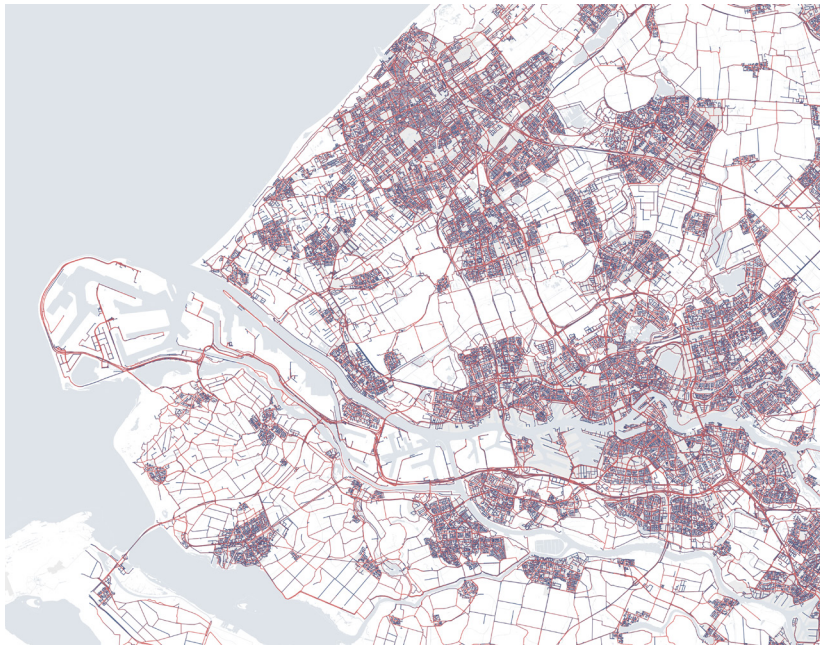


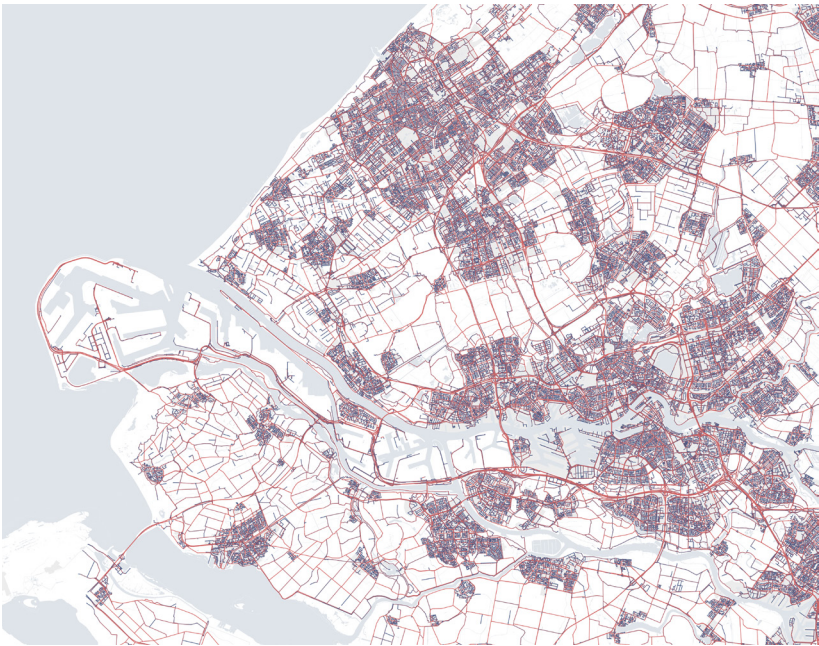
Figure 47 : Sound pollution across The Netherlands (PDOK)



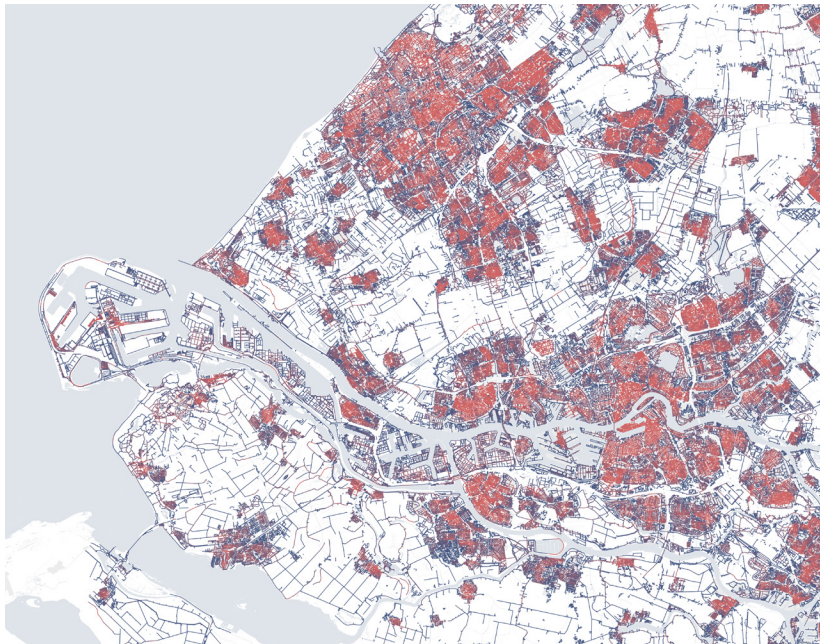
Pedestrian Angular Choice 800m



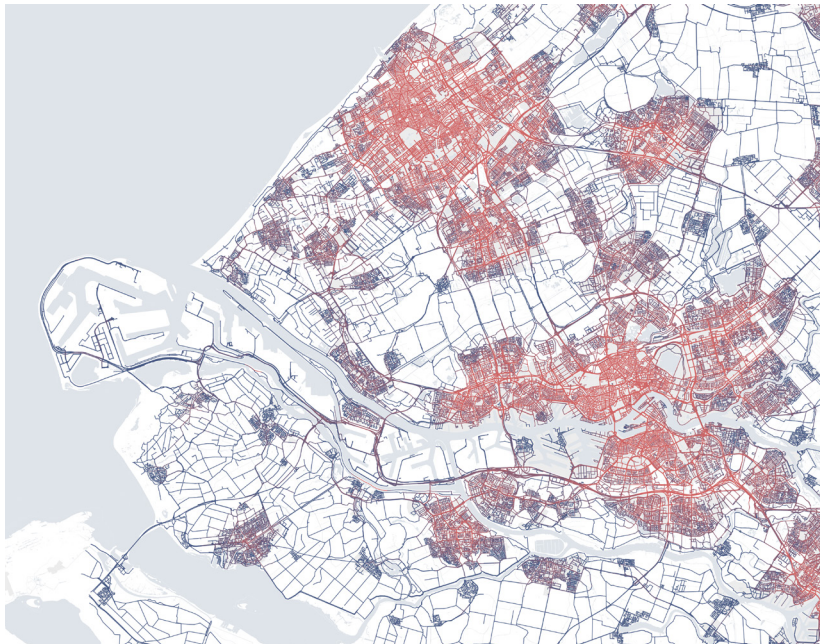
Car Angular Choice 2500m



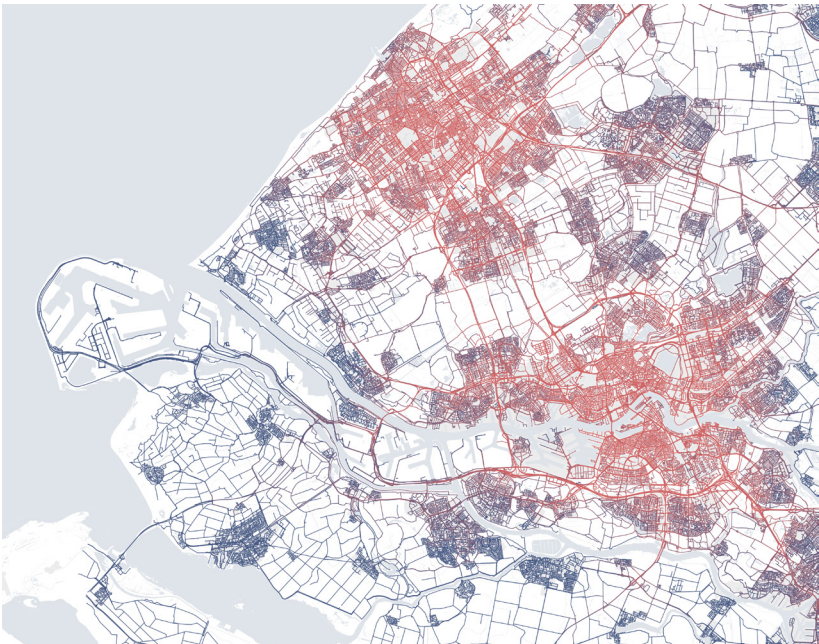
Car Angular Choice 10km



Pedestrian Angular Integration 800m



Car Angular Integration 2500m



Car Angular Integration 10km

Figure 47 : Space Syntax Analysis (PDOK)

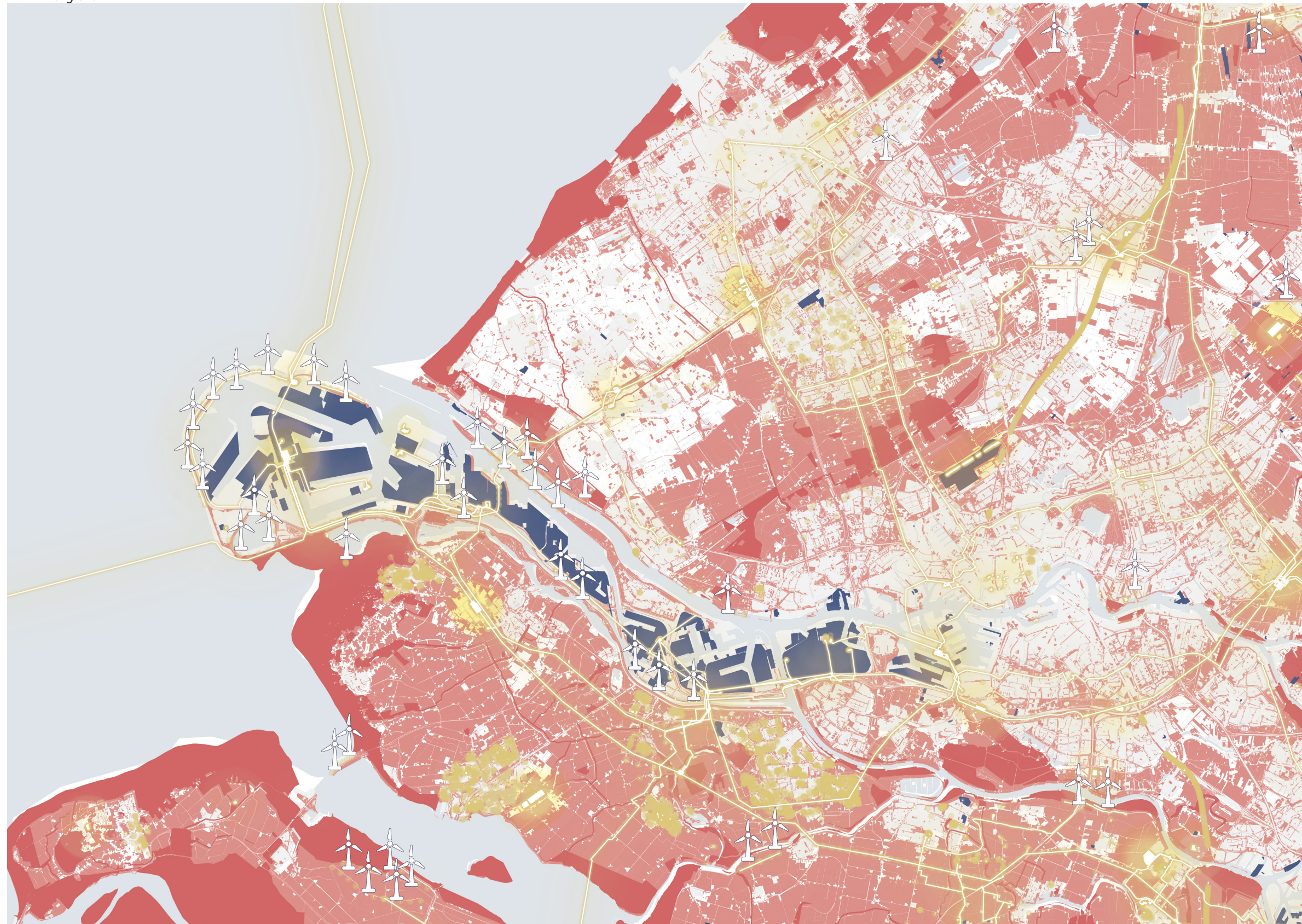
Space Syntax

The space syntax analysis distinguishes between angular choice and angular integration. Angular choice indicates how often a street segment is likely to be used as part of the shortest path

between two points. It can therefore be understood as a measure of movement potential or through-movement. Streets with high choice values are more likely to function as routes of passage within the network. Angular integration, on the other hand, describes how easily a street segment can be reached from all other segments in the system. It is therefore more closely related to accessibility, showing which streets are more spatially central or embedded within the network.

The comparison across scales reveals different spatial logics. At the 800 m scale, the analysis focuses on local accessibility and movement patterns. Here, pedestrian roads were used, since this radius better reflects everyday walking distances and neighbourhood-level connectivity. At this scale, the maps highlight local centres, fine-grain street networks, and the accessibility of places at the human scale. At the larger 2500 m and 10 km scales, car roads were used, as these distances better reflect movement across districts and the wider urban region. These scales reveal the broader structure of the network, showing which routes organise movement at the city and regional levels.

Space Syntax Analysis



Spatial Structure of the Port Landscape

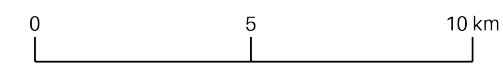
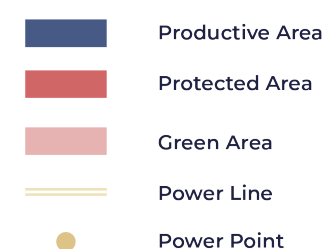
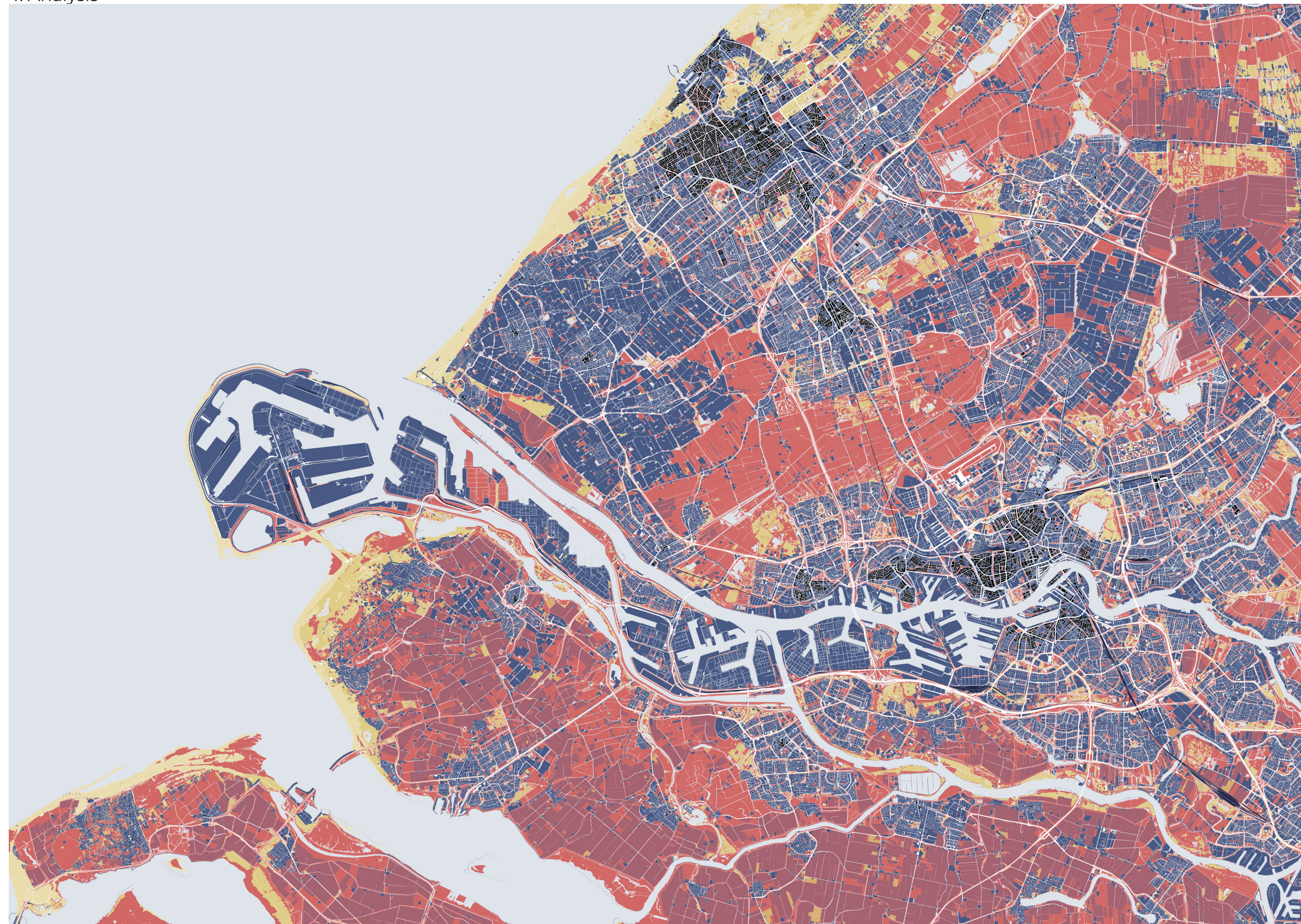


Figure 48 : Spatial Structure of the Port Landscape (PDOK, CBS 2025)

Spatial structure and footprint
This map reads the port territory through the overlapping logics of production, protection, and energy infrastructure. Three layers define the landscape: the dark navy of productive industrial areas concentrated along the Nieuwe Waterweg corridor and the Maasvlakte peninsula; the deep red of legally protected zones, Natura 2000 areas, and ecological reserves that encircle the port on virtually every side; and the softer pink of green buffer areas that mediate between the two.

What emerges is a territory under pressure from multiple directions. The productive footprint is spatially constrained: expansion toward the sea is contested, and the surrounding protected landscape leaves little room for outward growth. Wind turbines, power lines, and energy connection points are already woven into the existing industrial fabric, signalling an energy transition already underway at the infrastructure level. This analysis makes the case for working intensively within the existing footprint rather than expanding it: repurposing, densifying, and hybridising the productive landscape to accommodate new energy functions, housing, and education alongside continued port activity.



Land use

■ bebouwd gebied	■ akkerland
■ spoorbaanlichaam	■ grasland
■ aanlegsteiger	■ braakliggend
■ basaltblokken, steenglooiing	■ boomgaard
■ dodenakker	■ fruitkwekerij
■ overig	■ boomkwekerij
■ dodenakker met bos	■ bos: naaldbos

■ bos: loofbos
■ bos: griend
■ bos: gemengd bos
■ populieren
■ heide
■ duin
■ zand

0 5 10 km



Land use

The map illustrates the land use of the Rotterdam port region, classifying the territory into a gradient of types ranging from the most urbanised to the most natural. Built-up areas and infrastructure, rendered in dark tones, concentrate around Rotterdam's historic core and along major port corridors, revealing the dense, layered character of one of Europe's busiest harbour landscapes.

Moving outward, agricultural land uses dominate: arable fields, grasslands, and fallow land spread across the polders in salmon and red hues, reflecting the productive rural matrix that surrounds the urban agglomeration. Specialised cultivation (orchards, nurseries) appears scattered in warm yellow tones, marking horticultural clusters typical of the Dutch delta landscape. Woodland and semi-natural areas, forests, heathland and dunes occupy the lightest shades, emerging at the territorial margins. The map reveals a fragmented but structured mosaic, where urban expansion, port industry, and agricultural heritage coexist in proximity, shaped by centuries of water management and land reclamation.

Figure 49 : Land use (PDOK)

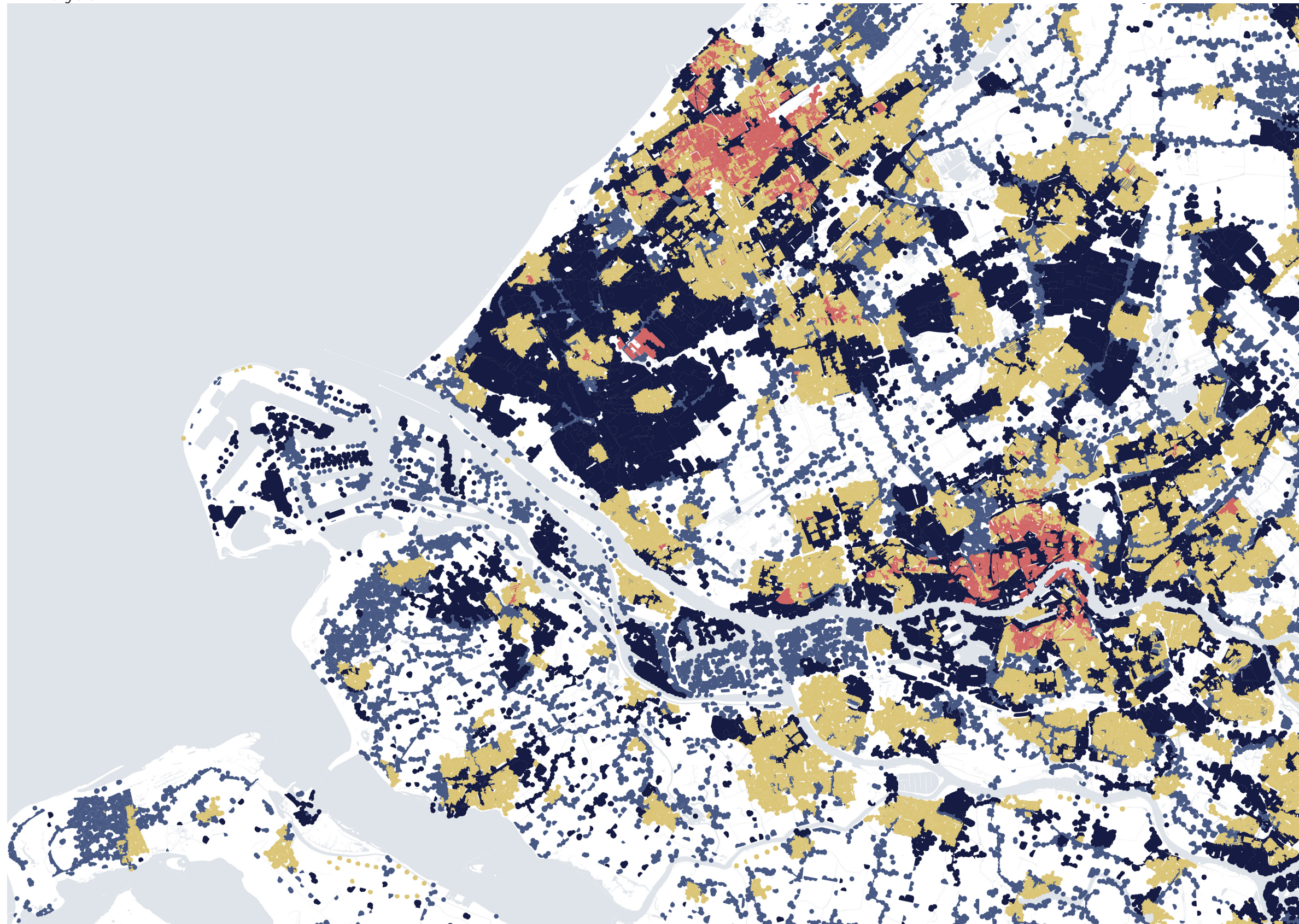


Morphological Structure

Morphological Structure

The map is inspired by the drawing realised by Bernardo Secchi and Paola Viganò (Secchi & Viganò, 2008) for the Grand Paris plan. It represents an ample range of elements, in white, that provoke urban fragmentation: they are difficult to navigate, not porous and often inaccessible. These elements bind or divide the existing city, often generating negative externalities for adjacent spaces. For this reason, the designation 'Lucifer's Territories' (Secchi & Viganò, 2008) is also applied to those spaces impacted by elements of severance or fragmentation. The most evident elements are the harbour area, characterised by large industrial clusters and energy production facilities, and the glass houses area in Westand.

Figure 50 : Morphological structure (PDOK, Urban taxonomy 2024)



Morphotopes Density

- Incoherent Large-Scale Homogeneous Fabric
- Incoherent Large-Scale Heterogeneous Fabric
- Incoherent Small-Scale Linear Fabric
- Incoherent Small-Scale Sparse Fabric
- Incoherent Small-Scale Compact Fabric
- Coherent Interconnected Fabric
- Coherent Dense Disjoint Fabric
- Coherent Dense Adjacent Fabric

0 5 10 km

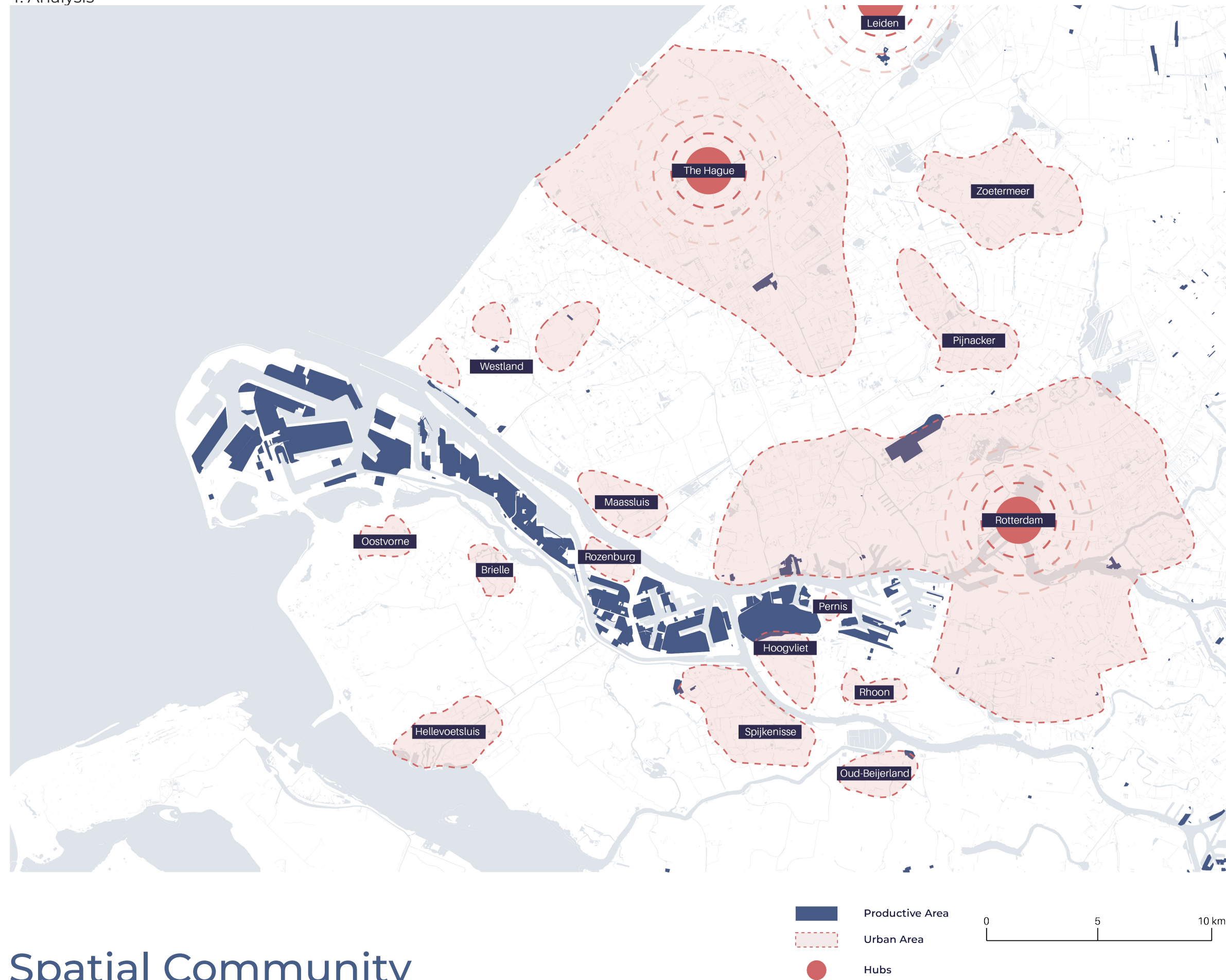


Morphotopes Density

The morphotope map of the Rotterdam port region reveals a fragmented yet readable urban landscape shaped by centuries of incremental development and large-scale industrial planning. The dominant presence of Incoherent Large-Scale Heterogeneous Fabric reflects the vast port infrastructure and logistics zones stretching across the western waterfront, where oversized warehouses and terminal buildings generate an open, utilitarian environment with little structural relationship to streets. Moving eastward toward the city centre, Coherent Dense Adjacent and Coherent Dense Disjoint Fabrics emerge as compact residential neighbourhoods consolidate around a legible street network.

The historic core of Rotterdam stands out clearly in Coherent Interconnected Fabric, despite the city's post-war reconstruction. Incoherent Large-Scale Homogeneous Fabric marks modernist housing estates and suburban expansions, scattered throughout the intermediate ring. Rural and peri-urban fringes appear in white and light grey, indicating sparse, low-density settlement patterns typical of the Dutch polder landscape. The result is a city defined by radical contrasts between industrial scale and dense urban grain.

Figure 51: Morphotopes density (Urban taxonomy 2024)

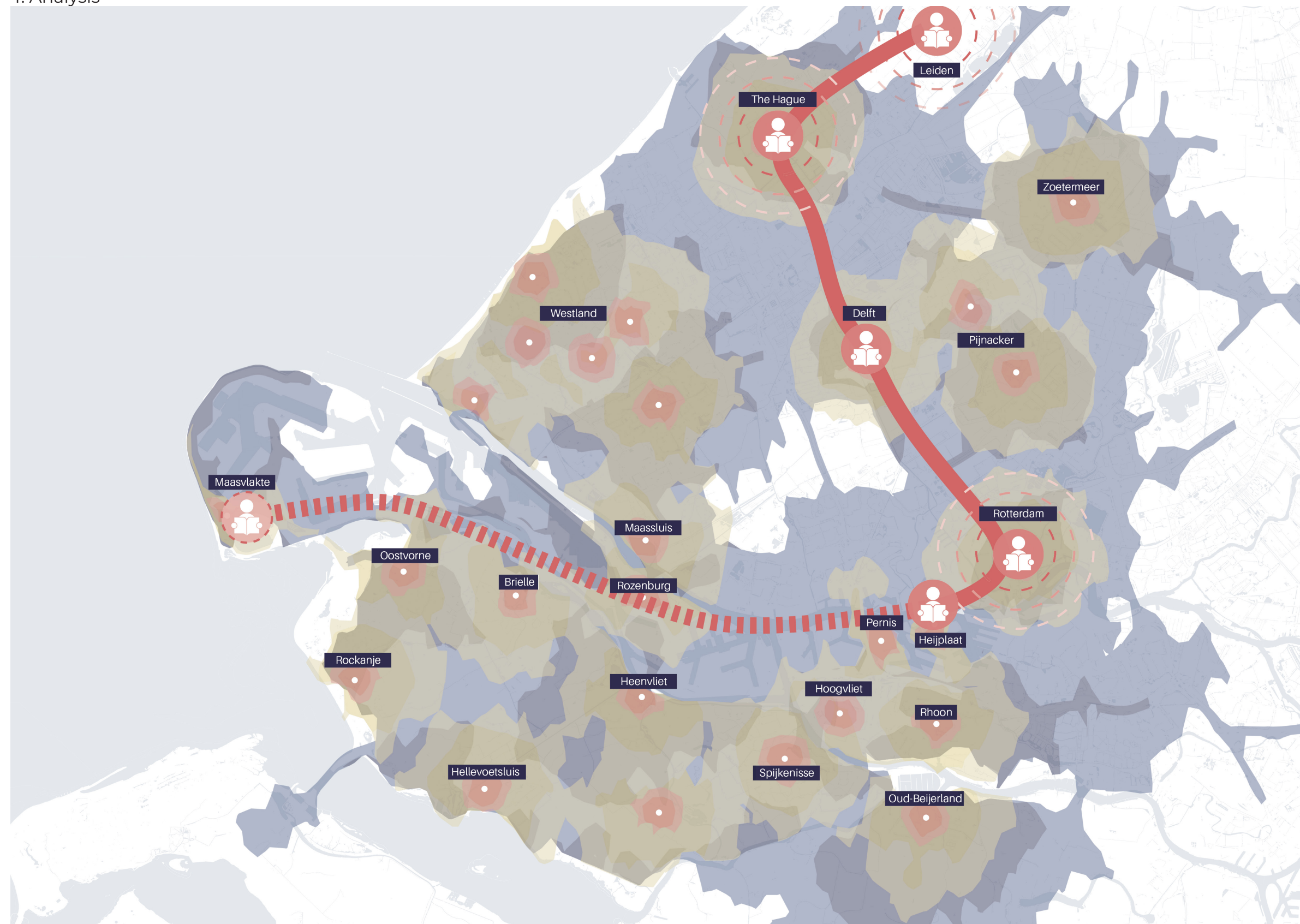


Spatial Community

Spatial community

This map shows the Port of Rotterdam as part of a wider spatial community. The productive areas of the port are embedded within a network of surrounding towns, neighbourhoods, and larger urban hubs such as Rotterdam and The Hague. It highlights that the port is not an isolated industrial territory, but part of a broader regional system in which communities are connected through work, mobility, and everyday life. The map underlines that the energy transition of the port also has a social and spatial dimension beyond the port itself.

Figure 52: Spatial Community (PDOK)



The Missing Link

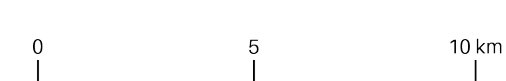
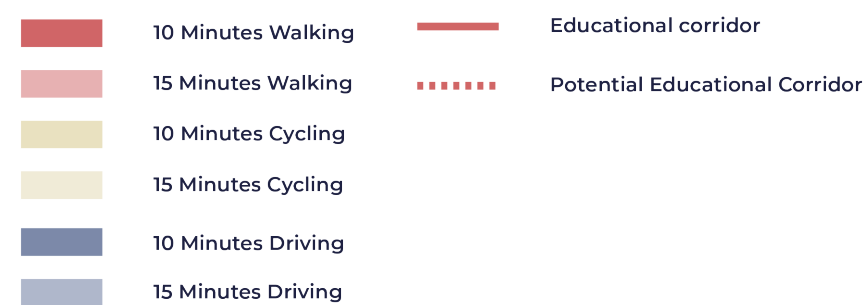


Figure 53: The missing link

The Missing Link

The map represents the missing link in the educational structure in the Port of Rotterdam region. Ranging from Leiden to Rotterdam (The Hague and Delft also play a key role), the current educational corridor is one of the key structures that shape social and physical aspects in the region. The other layer underpinned in this map is the regional connectivity: the results highlight an interconnected region, easily accessible by various modes of transportation. The missing link is the one between the educational/connective structure, which is interrupted in Rotterdam, and the port. This represents a key potential for future developments, expanding the educational corridor to the western edge of the port, making the whole region even more interconnected and cohesive.

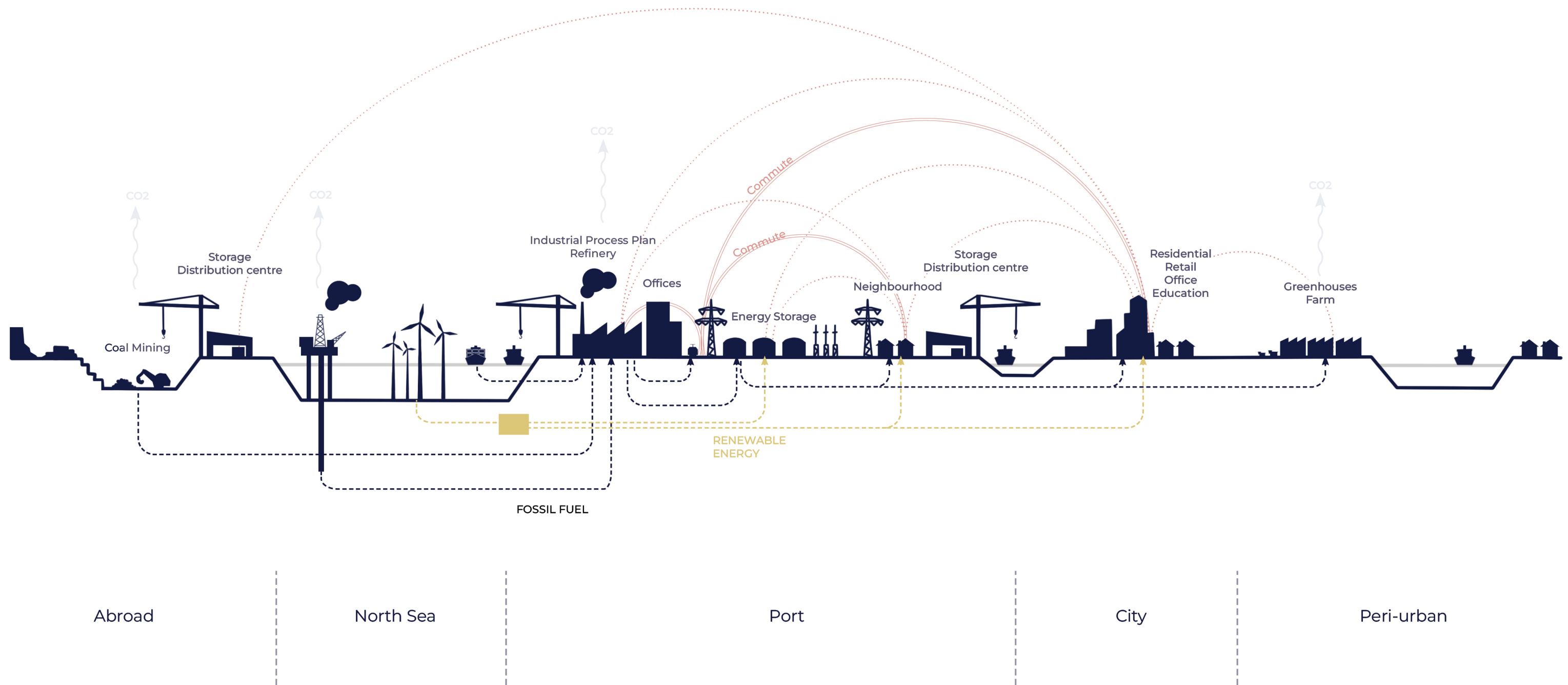


Figure 53: Current metabolic flows

Current metabolic flows

The current situation shows an energy system that is still dominated by fossil fuels and centralized flows. Energy production relies heavily on coal and other fossil resources imported from abroad, which are processed and distributed through the port as a major industrial hub. This creates a linear and centralized system where energy flows from large-scale production sites toward the city and beyond. At the same time, the spatial structure reinforces separation between the port and daily life. Workers often live far from the port area, and access relies largely on private or limited transport

options. Public transportation is not well integrated with the industrial zones, which increases dependency on cars and contributes to higher CO₂ emissions. The port functions as an isolated and highly specialized landscape, with limited accessibility and weak connections to surrounding communities.

Stakeholders

This chapter addresses the fifteen most influential stakeholders that currently shape the shift from the oil refinery industry towards renewable e-fuel in the current governance structure. In doing so, they influence the gap between declining oil-related jobs and education, reskilling, and new careers needed for young workers in the emerging low-carbon economy.

Thesestakeholdersrepresentdifferent levels of power and interest in the energy transition, and differ widely in whether they are for or against it. The adjacent graph illustrates this visually.

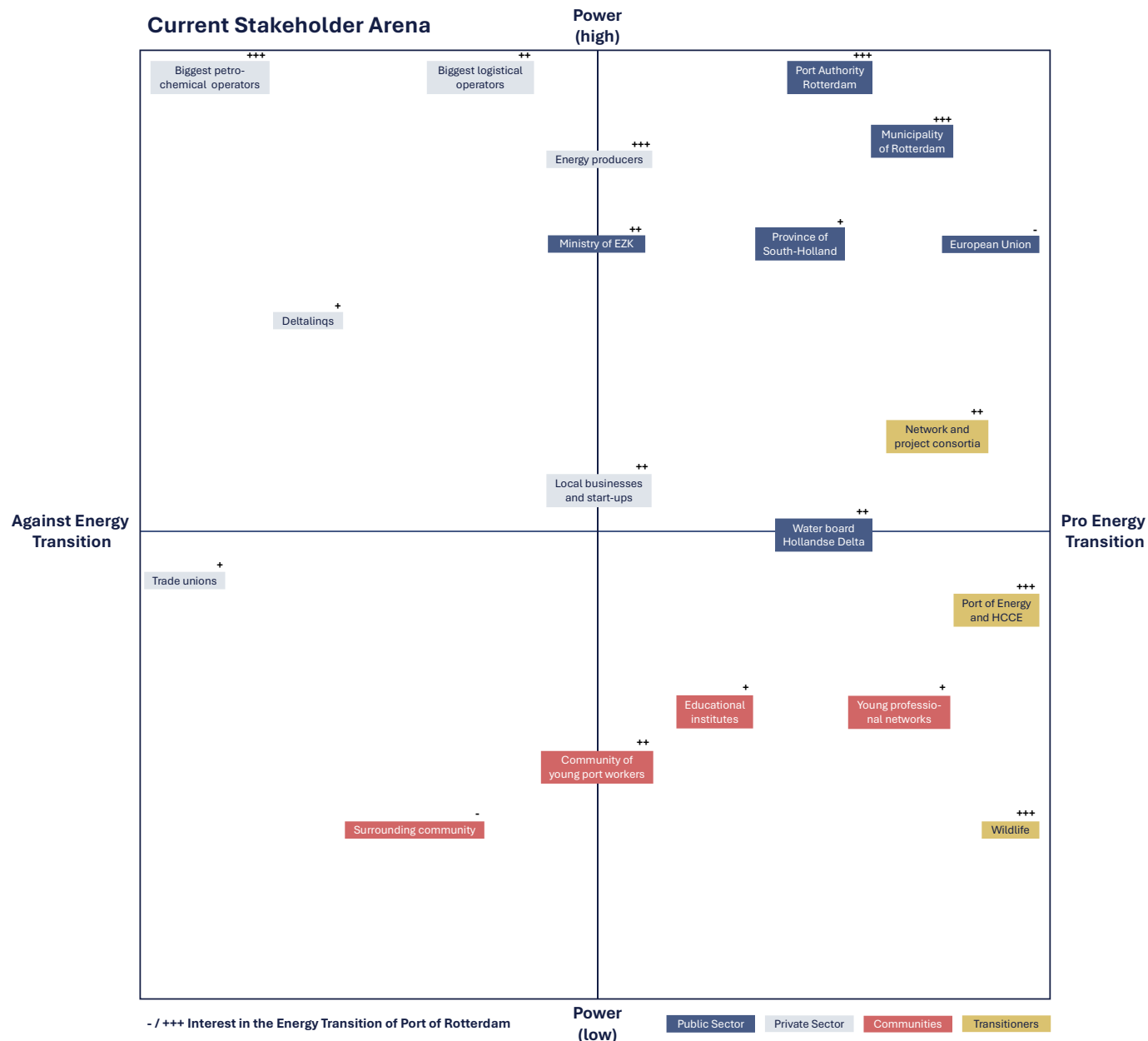


Figure 54: Current Stakeholder Arena



Figure 55: Current Stakeholder Arena Cards

Stakeholder arena

The port of Rotterdam is one of the most polluting areas in the country (Van Erp, 2017). Due to their role in the petrochemical industry, particularly here lies the potential to become the country's frontrunner in the energy transition (de Langen, 2023). To translate this into the governance-societal arena, it is especially crucial to understand who controls the port's investment decisions, infrastructure, land, permits, and labour conditions (de Langen & van der Lugt, 2007). These, namely, shape how the younger generation of port workers partake in the energy transition occurring in the port (de Langen, 2007). Framing it in this manner, the arena directly links to our chosen community and vision for the port: restructuring the industry through fastened decarbonisation via new energy infrastructures, whilst redeveloping large parts of the port into mixed-use areas that facilitate a reliable, transformed job market for the local community (Daamen & Vries, 2013).

For our individual assignment, we each addressed one of these stakeholders. These outcomes are later discussed in the strategies chapter, particularly in the subchapters conflict maps, stakeholder engagement, policies, and future governance.

The five most influential stakeholders in this transition:

Port of Rotterdam Authority (PoR)

At the institutional core of the port governance system lies the PoR, since it simultaneously is a co-author of the Port Vision, orchestrator, landlord, and infrastructural investor (de Langen, 2023). It allocates development sites, designs concessions, controls leases, and decides on infrastructural decisions, but also adheres to the public interests

set by its shareholders (de Langen & Heij, 2014). Concretely, no mixed-use transformation or energy transition is feasible without the PoR (Daamen & Vries, 2013). It specifically impacts the community of future port workers, shaping its labour geography like the type of activities retained, prioritisation of new energy infrastructures, and space being made available for new energy transition actors and workers (de Langen, 2023).

Largest terminal and industrial operators

Secondly, incumbent terminal and industrial operators like Advorio, ExxonMobil, Shell, and Air Liquide form an extremely influential actor because they hold the strongest implementation veto power. Although they do not govern the PoR formally due to the landlord model of the port, they do control the long-term leased sites and investment timing, which shapes the transition speed, or if it doesn't happen at all, by preserving persisting fossil business models (de Langen & van der Lugt, 2007). Because of this, the PoR's direct regulatory power over these actors is limited to safety and environmental issues, whilst they largely retain economic autonomy (van Erp, 2017). These companies thus matter tremendously to young and future workers, since they shape the labour opportunities of the energy transition, or dependencies on fossil fuel-based economies, or a hybrid transition rooted in CCS and transitional fuels (Notteboom et al., 2015).

Municipality of Rotterdam

The municipality is not just a stakeholder hidden inside the PoR. Also, beyond this, they're the owner of the port land, govern as a planning authority, and co-produce the Port Vision (de Langen, 2023). They are specifically relevant in the

port-city interface, facilitating mixed-use redevelopments, mixing urban quality with the employment needs of the future. This is especially important for this project, since it moves beyond industrial decarbonisation towards port territorial transformation into a mixed-use, sustainable energy cluster (Daamen & Vries, 2013). The community of future port workers is most affected by the municipality's transition policy, local accessibility, urban opportunity, and social acceptability of redevelopment (Notteboom et al., 2015).

Dutch national governments (involved ministries)

Beyond the local context, the Dutch national governments largely influence the policies which enforce the energy transition, specifically the Ministries of Economic Affairs, Infrastructure and Water Management, Interior Affairs, Agriculture, Nature, and Food Quality (de Langen, 2023). They influence a covenant partner in the Port Vision, a shareholder in PoR, and a Veto holder in tremendous funding and expansion decisions (de Langen & Heij, 2014). This shows that the national level formulates economic viability of the energy transition through co-funding, industrial policy, and a wider public interest paradigm of the port. This is particularly relevant for the younger generation because this government level is fundamental in turning "future sustainable jobs" from ambition into investment conditions (de Langen, 2023).

Trade unions

Lastly, trade unions, specifically FNV Havens and CNV, form a powerful stakeholder to empower the rights of future port workers who will experience the energy transition firsthand. Historically, unions held consistent,

strong bargaining power, frequently in dialogue with the private and public actors in the port to support the interests of its workers. However, from the 2000s onwards, the unions mostly turned into a conflict-based stakeholder rather than a consistent disruptive stakeholder (de Langen, 2007). For the energy transition, unions aim to serve the interests of workers being affected by the transition, like job security, labour conditions, retraining, intergenerational fairness, and the social credibility of the transition for current port workers (Notteboom et al., 2015). Although formally they are not extremely powerful, they form one of the most important actors for the community of future port workers, specifically (de Langen, 2007).

Why these five stakeholders?

The variety of these five stakeholders provides actual divergence without incoherence (Vieira et al., 2014). The municipality demonstrates spatial planning and mixed-use redevelopment mechanisms, with industrial incumbents representing private capital and asset lock-ins (van der Lugt et al., 2014). The ministries (part of the national government) represent overarching policies, subsidy mechanisms, and macro-level transition steering (de Langen, 2023). The unions represent social justice, labour, and lived outcomes of the energy transition for future workers (Notteboom et al., 2015). These actors precisely represent the conflictual relationship in an arena that persists in real life (de Langen, 2007). It shows that actors have differing, yet complementary competences, resources, scales, and belief systems, all strongly influencing the implementation of our proposed vision (Chandra & van Hillegersberg, 2017).

Hybrid Governance System

The Port of Rotterdam has a hybrid, layered institutional governance system rather than a single organisational hierarchy (Vieira et al., 2014). There are three governance levels within this system: the governance of the Port of Rotterdam N.V. (Port Authority Rotterdam), the governance of its wider port cluster, and the port-city relationship governance (Vieira et al., 2014; de Langen & van der Lugt, 2007; Daamen & Vries, 2013).

Port of Rotterdam N.V. (Port Authority) Corporate Governance

The institutional core of the harbour's governance system is Port of Rotterdam N.V. (PoR), established in 2004 (de Langen & Heij, 2014). Nevertheless, the municipality remains the majority shareholder, whilst the Dutch state owns the rest (de Langen, 2023). This makes the PoR governed through regular informal meetings with the Executive Board and informal General Meetings of Shareholders. The shareholders formulate the enterprise's identity, jointly approve major investments, and appoint or dismiss members of the Executive Board and Supervisory Board (de Langen, 2023). In this paradigm, the largest private actors, such as Shell, Advorio, ExxonMobil, and Air Liquide, predominantly hold structural influence, since they have less formal authority within the constitutional hierarchy that Port Authority Rotterdam trumps (de Langen & van der Lugt, 2007).

Steering of Public Interests through Public Ownership

The port's strengths are its continuous nautical safety, commercial and spatial efficiency, and sustainability

efforts in CO2 reduction. The municipality invests heavily in energy-transition infrastructure like hydrogen pipelines, shore power, heat networks, and CO2 infrastructure (de Langen, 2023). The Port Authority Rotterdam, Municipality of Rotterdam, Province South-Holland, and Ministry of Economic Affairs (EZK) specifically align with public interests. Energy producers and infrastructural operators form crucial stakeholders through their networks serving public interests, whilst project consortia materialise transition pathways through their investments (de Langen, 2023).

The Municipality as Landowner, Spatial Planner and Shareholder

The municipality has a complex role far beyond being the majority shareholder of the PoR. It is also a huge landowner, whilst simultaneously holding crucial political and planning power through its city council. In the operational agreement between both parties, the PoR must defend its port vision and corporate strategy to the municipality on a yearly basis. The port vision needs approval from both the Supervisory Board and the city council, which holds veto rights in its acceptance (de Langen, 2023). Local communities in Rotterdam South and its surrounding areas don't hold direct constitutional power, influencing the system mostly through legitimacy pressures, environmental justice claims, and public consultations in redevelopment efforts (Notteboom et al., 2015).

The Port Vision as Strategic Governance

Rotterdam is governed through a strategic arena broadly organised around this Port Vision. It forms the

joint outcome led by five partners: PoR, Deltalinq to represent the port industry, the Dutch government, the Province of South-Holland, and the Municipality of Rotterdam. The Rotterdam city council approves it, but these five partners jointly implement the set vision. Public and private actors co-produce long-term goals through a negotiated strategic governance framework (de Langen, 2023). Deltalinq forms one of the most important actors in this system, representing the private port industry within a formalised strategic compact (de Langen, 2023). On a larger level, the European Union functions as a higher-order financial and regulatory actor shaping the incentive environment around emissions regulations, funding logics, and decarbonization targets, without having direct spatial control over the region (van Erp, 2017).



Figure 56: Negotiated governance translated into Port Vision 2050 (Buitendijk, 2026).

Cluster Governance and the Landlord-Plus Model

Literature demonstrates that the Port of Rotterdam is evolving into a landlord-plus model. PoR gets most of its income from port dues and land rent by leasing it to logistics, terminal, or industrial operators (de Langen & van der Lugt, 2007). However, it doesn't just function as a landlord, but moves beyond this via investments in hinterland terminals, ICT infrastructures, port marketing, education, and research (van der Lugt et al., 2014). The PoR thus moves beyond being a land manager by taking an entrepreneurial and orchestrating role when private actors fail to do so (van der Lugt et al., 2014).

However, the largest terminal operators are not shareholders in the PoR, leaving them outside the formal public hierarchy (de Langen, 2023). Structurally, they have great influence, since the landlord model provides them with strong operational control once they lease the land (de Langen & van der Lugt, 2007). The PoR can influence matters on environmental impact and employee safety, but holds extremely limited regulatory power to regulate its economic activities. For the energy transition, this strongly affects the PoR's control over industrial sites, lease duration and potential sunk costs of investments, making them strongly reliant on these large port operators for the speed at which the energy transition occurs (de Langen, 2007).

Control over pipeline, grid, hydrogen, and energy-conversion infrastructure provides energy producers and infrastructure operators with an extremely beneficial influence strategically (de Langen, 2023). On the other hand, start-ups and local businesses are mostly part of the innovation ecology in the harbour, without owning capital, land, or leasehold power. This makes them highly dependent on land availability and institutional support from the PoR and other public actors to succeed, leaving them left with very limited influence within this system (de Langen, 2007).

Transition Consortia and Network Governance

With the energy transition, strong network governance persists (Vieira et al., 2014). Particularly, Portbase is relevant, functioning as an overarching port community system. This makes it a “Network Administrative Organisation” which holds an orchestrating role, coordinating with involved actors such as Deltalinq with their initiated Advisory Board (Chandra et al., 2017).

Within the energy transition, the HCCE and Port of Energy form similar platforms, highly influential in the network governance presence. Although not governing the port constitutionally, they form platforms which build shared visions by coordinating actors, knowledge, and transition coalitions. Project and network consortia like Power2X, Advorio, or Porthos hold similar positions. They form the delivery mechanisms within a larger framework rooted in the Port Vision and the landlord-plus model (de Langen, 2023). Young professional

networks hold no formal decision-making power but solely participate in formulating professional norms, enforcing reputational pressure, and future-oriented transition narratives. They therefore hold discursive influence by shaping the port culture for the next-generation, specifically important in a setting where innovation, legitimacy, and institutional learning matter (Notteboom et al., 2015).

Public Authority Functions

Besides developing and operating the industrial areas of the port, the PoR also safeguards its nautical order and safety. In doing so, the Harbour Master department functions under direct responsibility of the Ministry of Infrastructure and Water Management and the Mayor of Rotterdam. Its responsibilities entail ship inspections and vessel traffic management. Mandatory authority relations ensure the involvement of public interests and safety-focused regulators in the governance of the harbour (van Erp, 2017).

The Port-City Dialogue: Spatial Transformation

The governance in which the port-city dialogue persists is crucial. Rotterdam formed a specified joint arrangement called Stadshavens to transform older inner-city port areas. It forms a Project Bureau managed through a joint venture between the PoR and the development corporation of the city. This manages the transformation of former port areas into mixed-use areas, whilst institutionalising the cooperation between the urban and port stakeholders over time (Daamen & Vries, 2013).

This specifically applies to the RDM area of Heijplaat. With Stadshavens’ effort, RDM has already been redeveloped into an innovative cluster of businesses, educational institutes, and living (Daamen & Vries, 2013). For the energy transition, they form crucial actors that supply the port with a properly educated workforce, experimentation, applied research, entrepreneurship, and placemaking within transitional port territories (de Langen & van der Lugt, 2007).



Figure 57: The Port-City Dialogue as spatial reality (SkyscraperCity, 2005)

Community and Labour Interests
Several actors influence the governance paradigm without formal power through ownership of the PoR itself, such as the European Union, Water Board Hollandse Delta, natural environment and wildlife, local communities, and trade unions (van Erp, 2017). The local communities in Rijnmond thus ensure their influence through legitimacy, public contestation, license to operate, and the contestational politics of employment, pollution, and redevelopment (Notteboom et al., 2015).

Trade unions such as FNV Havens and CNV hold intermediate positions to collectively fight for community interests. Despite a strong port-wide bargaining role throughout history, the bargaining role of unions has consistently been diminished to a conflict-driven influence since the 2000s. Also in the energy transition, they're more conflict mediators with a threat of disruptive capacity than actors with institutional embeddedness for long-term strategic steering (de Langen, 2007). An extension of these is the young professional networks, which contribute to a soft governance dynamic by forming future expectations, normative pressures on the energy transition, and accompanying professional identities (Notteboom et al., 2015).

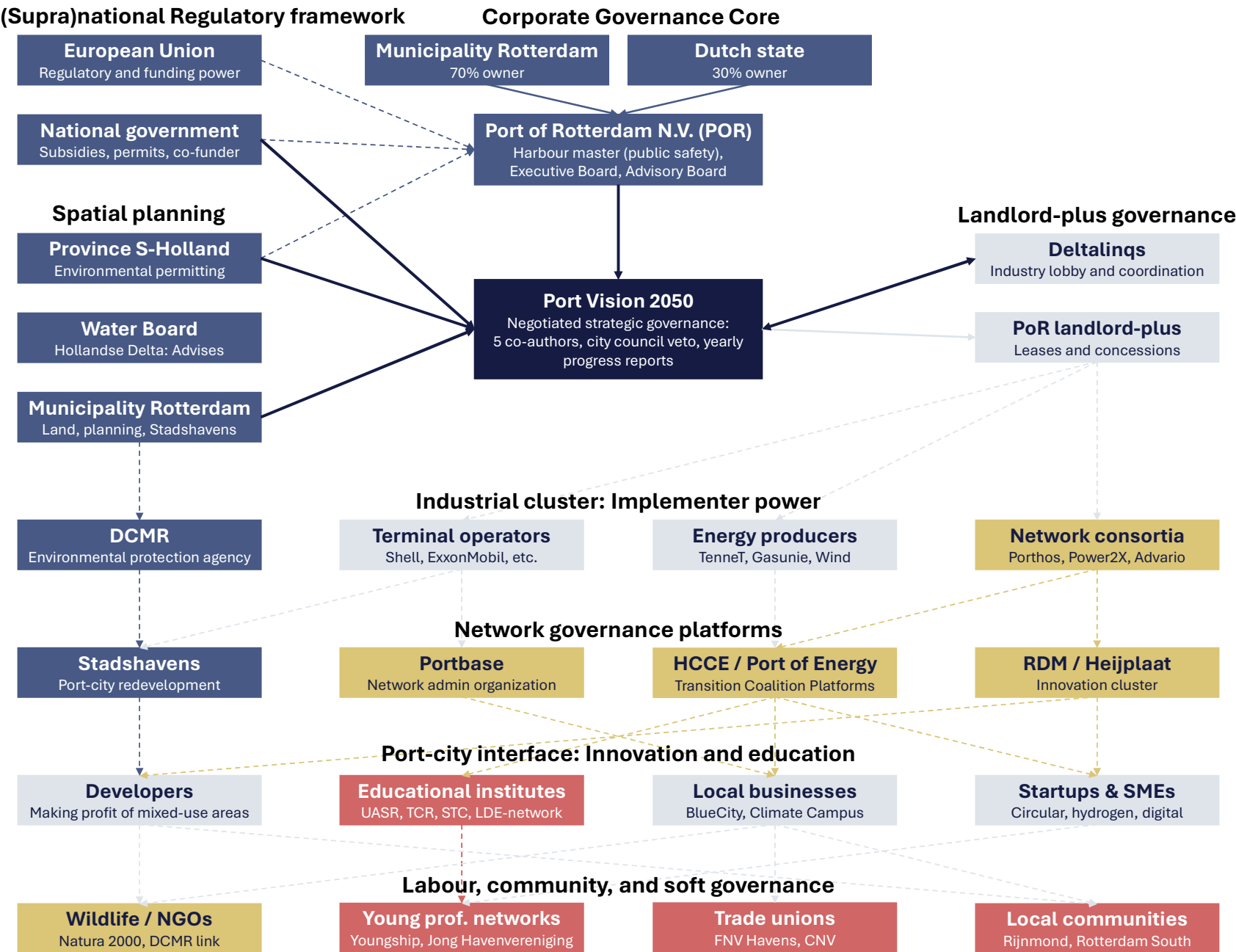


Figure 58: Current Governance Framework

Environmental and Wildlife Interests
Despite the lack of institutional power by these stakeholders, environmental law, regulatory bodies, and environmental organisations do influence port development concretely (van Erp, 2017). For the support of Maasvlakte 2 by these organisations, the PoR co-produced the vision of the area through ecological commitments (de Langen, 2007). Similarly, the Water Board Hollandse Delta is a public authority specifically focused on water quality and flood protection. It holds the power to partly shape or constrain spatial interventions that conflict with freshwater use, hydraulic safety, or water management. However, it doesn't govern its focus area strategically, making it dependent on the municipality, province, and other stakeholders (van Erp, 2017). The European Union possesses a lot of power, operating indirectly through climate regulation, ecological law, and decarbonisation obligations. The EU creates an external legal framework where climate and environmental interests form binding constraints for port development (de Langen & van der Lugt, 2007).

Conclusion
The Port of Rotterdam governance system entails a hybrid system that combines formal public ownership with informal influence from private and network actors. Even though the public shareholders and Port Authority form the institutional core, implementation power is dispersed among regulatory frameworks, consortia, and operators. Through this, practical control and strategic direction are structurally misaligned.



05 Vision

Introduction

The community's wishes for the future are formed into a vision with the help of the spatial translations. The vision statement combines the energy transition with the community's imaginaries, which will later be visualised into a spatial vision. To acknowledge the community is a diverse mix of individuals who might have slightly different ideas or struggles in life, the vision statement is broken down into 4 personas. Every persona represents a different sub-community, and together they represent the future and current generation of their subset community and its vision.

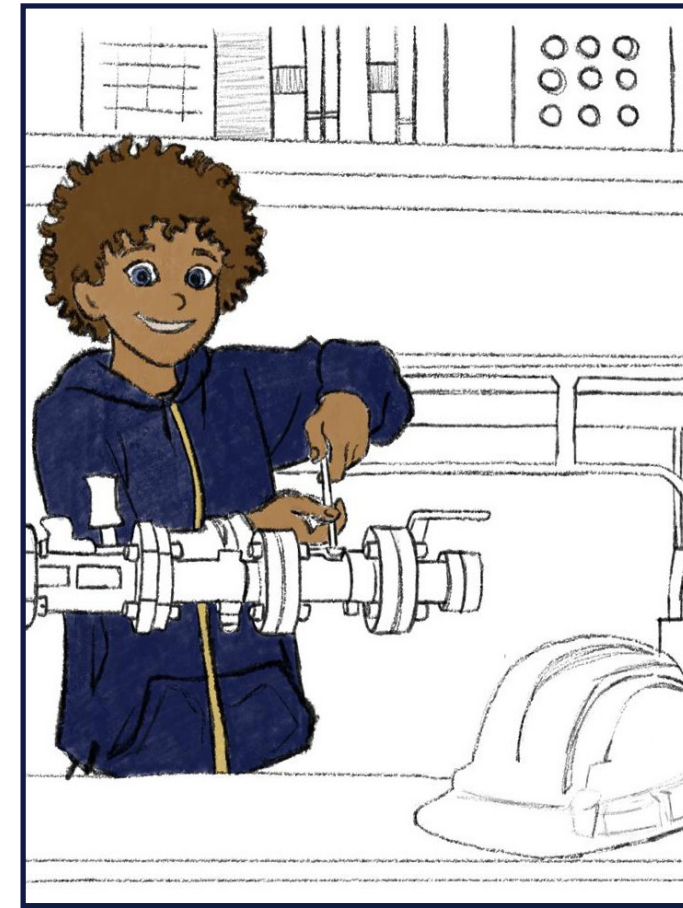
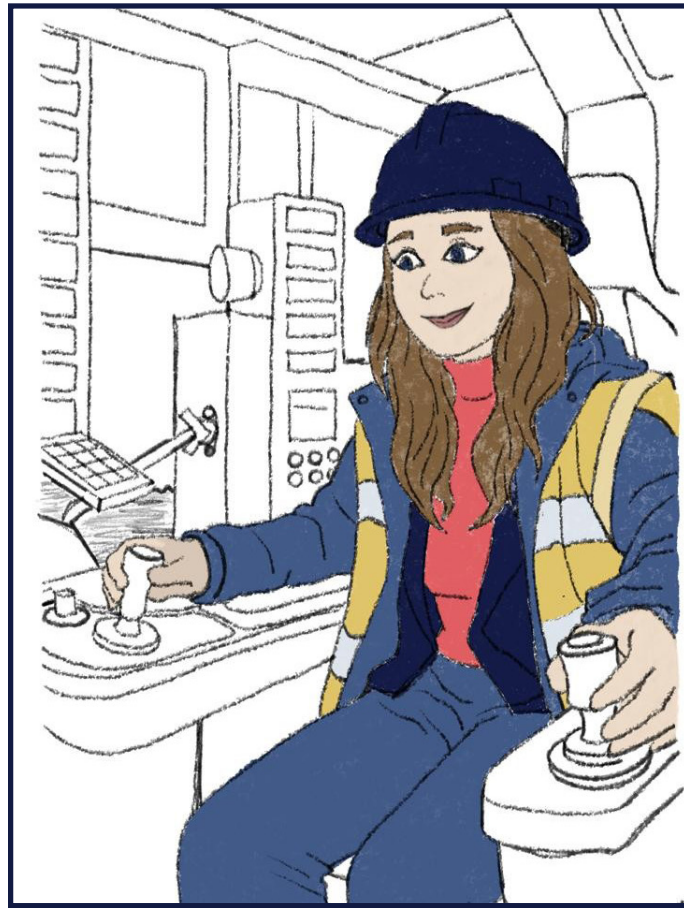


Figure 59: Community Personas

Laura

In 2100 I will be working in renewable energy in the Port of Rotterdam.

I'll be living in a clean **environment**, where I can easily access **green spaces** and amenities. There will be **equal rights**, opportunities and wages between me and my male co-workers.

Yoshi

In 2100 I will be working in renewable energy in the Port of Rotterdam.

I'll be living close to my work and be able to **travel by public transport** to it. I will also be able to afford to use renewable energy sources produced. I will have the same **opportunities** as the Dutch workers and feel included in the local community. Not only locally but regionally I will be part of a group with a strong identity.

Tim

In 2100 I will be working in renewable energy in the Port of Rotterdam.

I'll be living in an **interconnected region** with a strong identity. Renewable energy will be **affordable** for me and I'll be able to take my children to high quality education in the Port of Rotterdam so they can have a **safe and secure** future.

Pieter

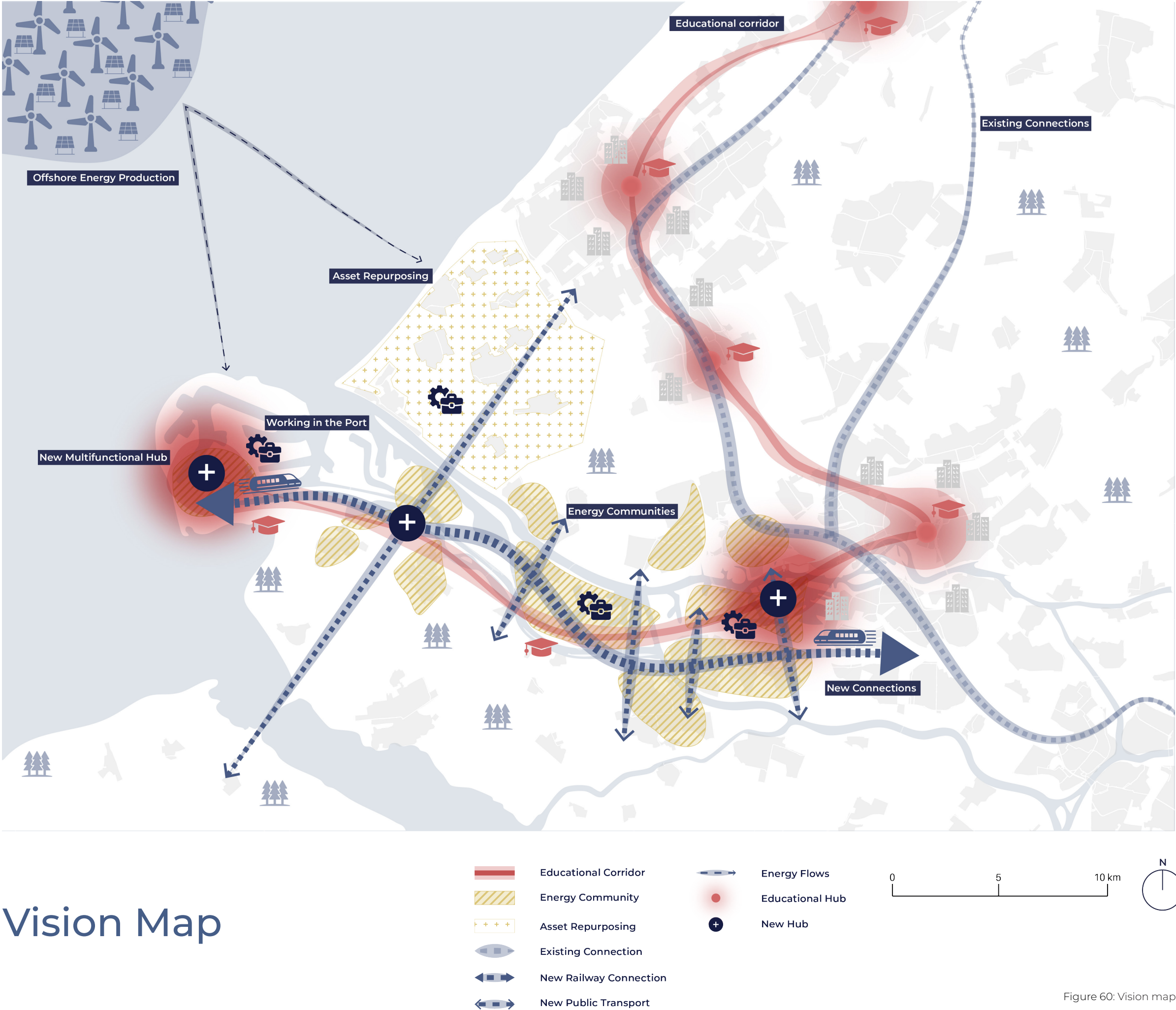
In 2100 I will be working in renewable energy in the Port of Rotterdam.

I will have been **reskilled** to work within the energy transition system and feel secure in my job. I will be able to **afford renewable energy** for my household. I will be part of one of the vibrant **local communities** that have been formed, without losing the regional identity.

The personas make the vision tangible at the **human scale**. They show how the future energy transition could shape **everyday life** through **work, housing, mobility, education, affordability, and belonging**.

Vision Statement

In 2100, the Port of Rotterdam is a renewable energy hub where everyone belongs. We live close to work, move freely by public transport, and breathe clean air in green, connected communities. Energy is affordable and locally produced. Our children access high-quality education within the port region, inheriting a safe and secure future. Rights, pay, and opportunities are equal, regardless of gender or origin, while our regional identity remains strong.



Vision Map

Vision

The 2100 vision of the Port of Rotterdam reinterprets the harbour area as an integrated industrial, energy and city cluster housing daily life, production, and education. The reorientation of the functional separation of the port is also visible in the map, with former refinery sites being transformed into new programmes of mixed use, specifically focusing on the energy transition, housing, and education. These redevelopments will be embedded in the broader regional urban fabric through public transit connections, stitching together emerging e-fuel workplaces, learning environments, and residential territories.

This transformation of the region aims to transform a previously fossil-dependent, monofunctional logistics and energy hub into a decentralised network of energy communities distributed across the region, whilst attracting offshore hydrogen and wind flows via and through the North Sea. Through this decentralisation, the vision spatially rebalances opportunities rather than displacing burdens on Rotterdam South and benefits at the Maasvlakte or elsewhere. This is done via the establishment of multifunctional hubs, educational corridors, and reskilling facilities in or near the communities that have historically endured most negative externalities from the port's industrial transformations. This actively mitigates the finding of Liu and Dąbrowski (2024), where ungoverned decarbonisation reproduces the inequalities it promises to solve.

Figure 60: Vision map

Energy Communities

An energy community stands for the local energy independence within a community and a place. They are able to produce, store and transport their own energy with minimal connections to the regional or national grid. They live close to the energy region and have jobs in the area.

Educational Corridor

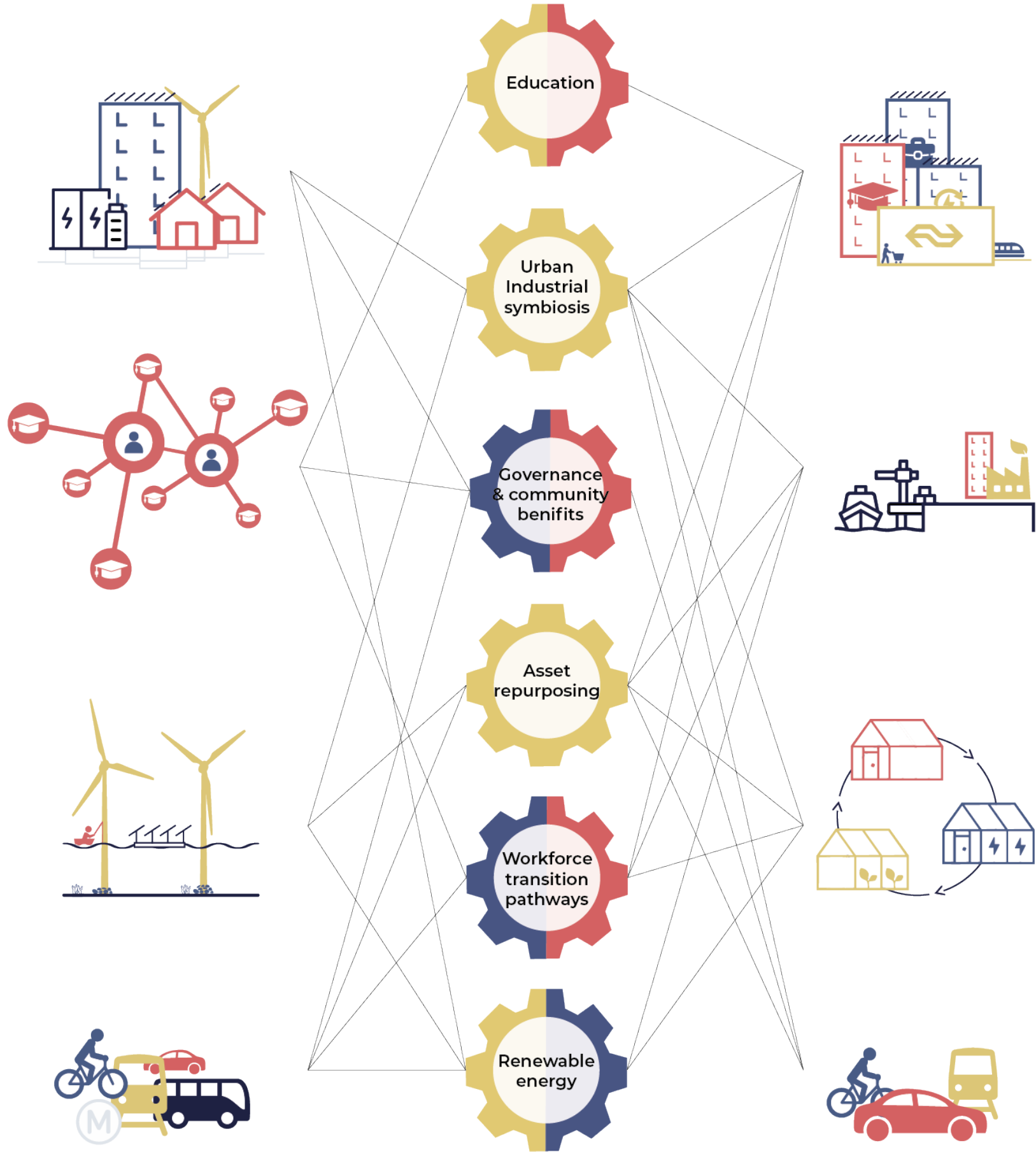
The education institutes of the area are in close collaboration with each other on knowledge and innovation, for a sustainable future. Some new locations and institutes are added to this corridor. Together they offer a wide variety of levels and subjects that are accessible to anyone wanting to educate or reskill themself.

Offshore Energy

Wind and solar energy is produced on the North Sea providing a large amount of energy to the region. These energy parks are also accommodating healthy marine life and small farming areas. This will make it a multifunctional and sustainable offshore area.

New Connections

To improve the connections within the area more and better public transport is introduced. This new infrastructure will all be situated on old and existing infrastructure to make it more feasible. This will not only make it more circular, but also promotes cleaner transportation.



Multifunctional hubs

The multifunctional hubs function as thriving centres for the community, creating lots of meeting spaces, activities and working opportunities combined with local energies. These hubs are also an intersection of different public transportation modes, making these places really accessible.

Working in the Port

Although jobs in the fossil fuel sector will disappear, a new variety of jobs will come back and take those places. There will be more different sectors in the job to work. This will make the port still a great source of work opportunities and job providers.

Asset Repurposing

Greenhouses are already partly making place for more housing. With improved efficiency in food production more greenhouses can make place for housing and for industries that will move out of the port to make space for the energy communities.

Existing Connections

The vision is based on the existing connections in the region. These connections will only be further enhanced and more intensely used. Therefore new connections are also proposed to strengthen the existing connections even more.

Figure 61: Vision Mechanics Diagram

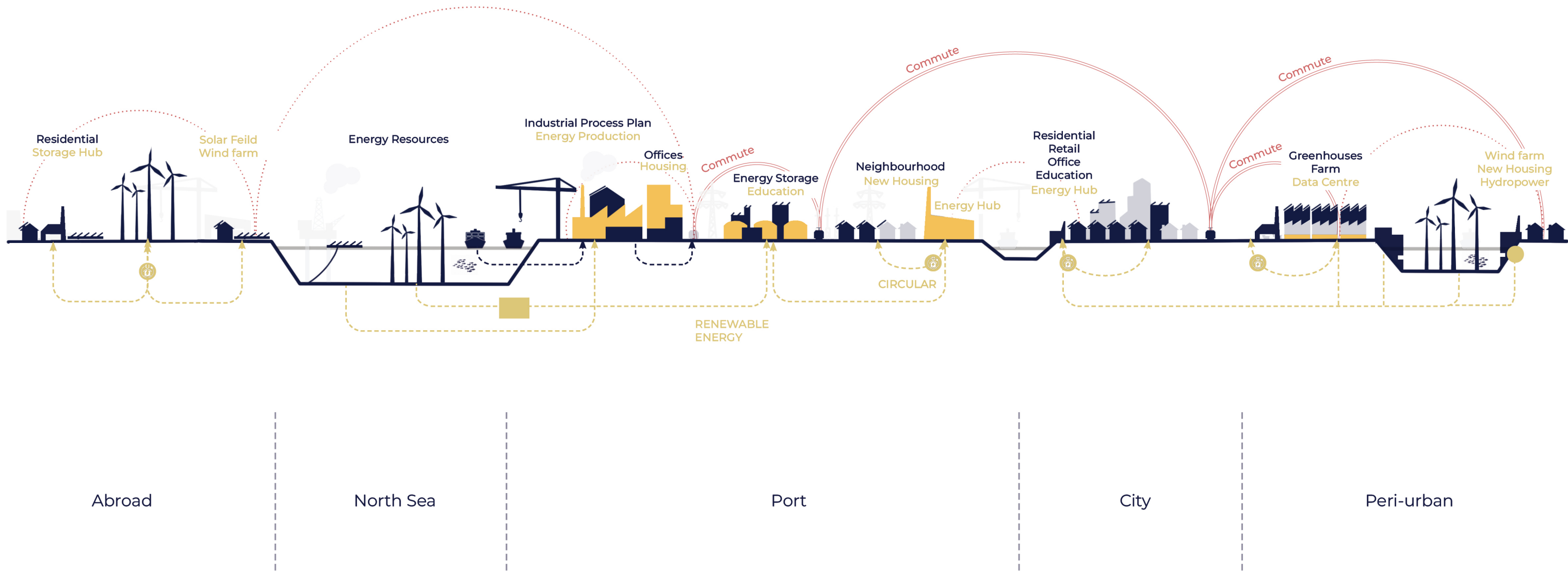


Figure 62: Future metabolic flows

Future metabolic flows

The future vision propose a transition toward a renewable and decentralized energy system. Energy production shifts from fossil fuels to renewable sources such as offshore wind, solar, and hydrogen, supported by a network of distributed energy hubs across the areas. Instead of a single centralized flow, energy is produced, stored, and shared at multiple scales, from residential scale to a much bigger scale, in the hope of allowing the neighbourhood and the communities to participate in energy transitions. This would create a more circular and resilient system in the

port of Rotterdam. At the same time, accessibility is significantly improved through the introduction of new public transportation networks that connect the port with new residential areas, education hubs, and workplaces. These connections also reduce the reliance on private transportation and lower overall emissions. The port is no longer an isolated industrial zone but has become an integrated part of the urban and regional system, where energy, mobility, and daily life are more connected.



Imaginary

The initial vision was generated using AI to explore possible futures for the Port of Rotterdam. The image was produced based on key ideas such as repurposing power plants for clean energy, converting existing oil and gas infrastructure, and adapting industrial spaces into education, commercial, and community uses. This process enabled a rapid visualization of how the port could transform while still building on its existing spatial and industrial structure. The AI-generated image functioned as an exploratory tool to frame the discussion and open up a range of spatial possibilities.

Figure 63: AI Imaginary

AI prompt:

Create an imaginary vision image of a future Port of Rotterdam. The port was previously oil-based but is now transitioning into a renewable energy hub. The scene shows how industry, education, and daily life coexist in one integrated landscape.

In the image, include a new energy transition campus designed to reskill current port workers and educate future generations. People move between learning spaces, industrial areas, and public spaces. Workers, students, and communities share the same environment. The industrial area is still active but cleaner, more open, and less intimidating. Heavy infrastructure is repurposed instead of removed.

Show key transformations:

Repurposed power plants: Former coal plants are transformed into battery energy storage systems, thermal energy storage, and possibly small modular reactors. Large solar fields and wind turbines are integrated into former industrial sites.

Converted oil and gas infrastructure: Old pipelines are reused for hydrogen transport. Deep wells are converted into geothermal energy systems. Some sites are used for carbon capture and storage.

Adaptive reuse and public integration: Old industrial buildings become mixed-use spaces, including learning hubs, cultural spaces, and community areas. Former industrial land is transformed into public parks, green corridors, and recreational spaces.

Industrial heritage structures are preserved and integrated into the new design.

Spatial atmosphere: A strong central pedestrian and cycling axis connects the campus to the port and waterfront. Green landscapes, water systems, and energy infrastructure are integrated. The port feels productive but also livable and accessible.

Style reference: Use a collage or architectural visualization style. Combine large-scale territorial perspective with human-scale activity. Show a balance between infrastructure, landscape, and everyday life.



Figure 64: AI Imaginary Critique

AI Critique

The generated image was then critically analyzed to understand its spatial logic and identify both its potentials and limitations. Key questions guided this analysis, including what types of spaces were represented, why they appeared in that form, where different activities were located, and how energy systems connected with everyday life. This critique revealed several elements that hold potential for further development. These include the role of energy hubs as central nodes of activity, the importance of green buffer zones in improving environmental quality, and the integration of public transport to connect workers, residents, and students. The image also highlights the possibility of mixed-use environments where education, research, and daily life coexist. At the same time, it lacks clarity in addressing social inclusion, worker transition, and spatial hierarchy, which emerged as critical aspects requiring further refinement.



Visionary image
Based on these insights, a new vision for the Port of Rotterdam is proposed. The port is reimagined as an inclusive and liveable environment where energy production, education, work, and everyday life are integrated. Existing industrial infrastructures are repurposed into spaces for learning, research, and community activities, while renewable energy systems such as wind and solar are embedded within the landscape. Green buffer zones soften the boundary between industrial operations and public spaces, and new waterfront areas reconnect people with the sea. This vision is illustrated through an imaginary scene of a worker and his child observing the transformed port, representing a future in which the energy transition supports not only environmental goals but also social and spatial transformation, creating a more accessible and meaningful environment for daily life.

Figure 65: Community wishes and their spatial translations

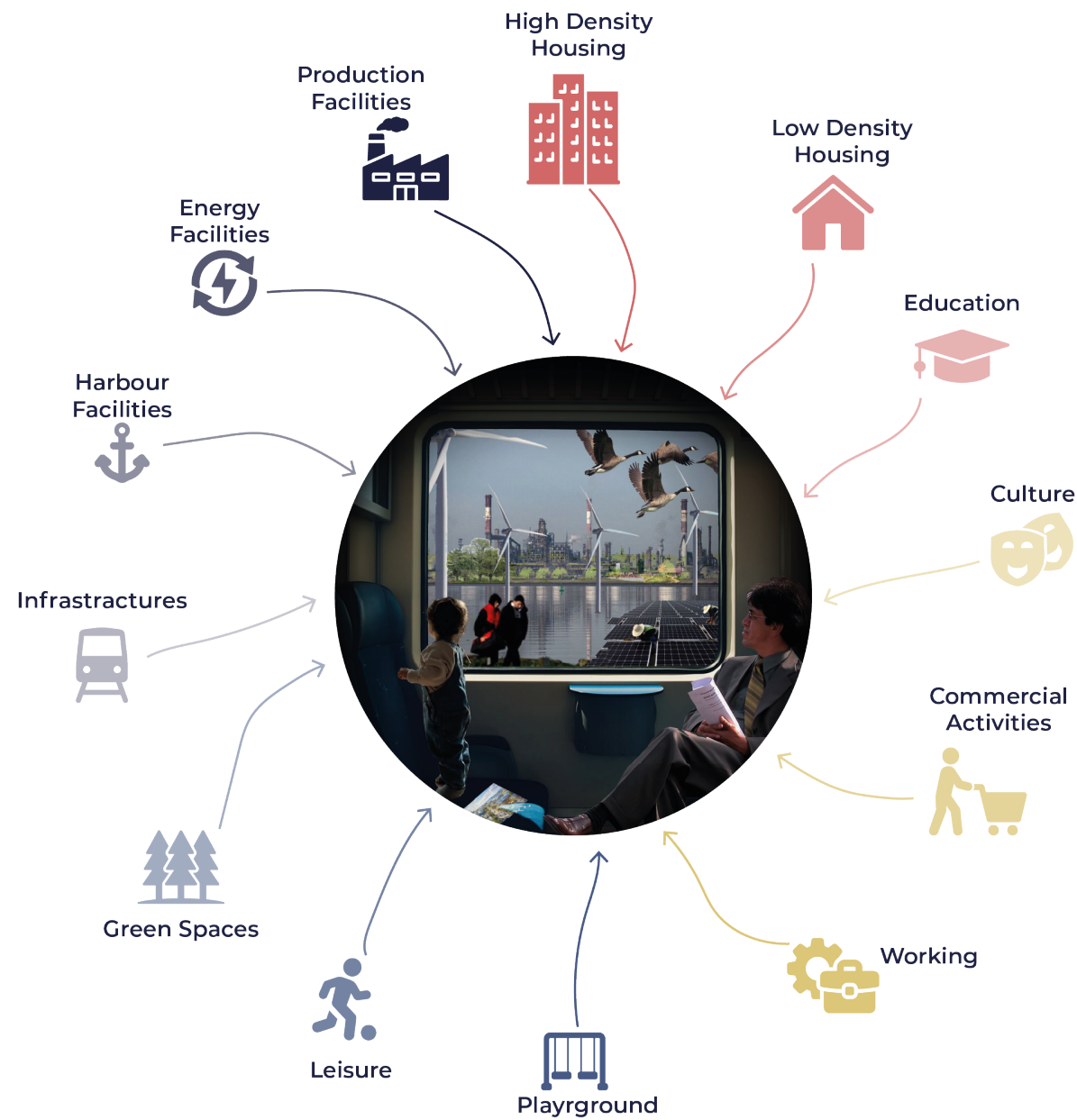


Figure 66: Barcode Icons

Envisioning land use changes
The land use barcodes give us a way to compare how the land is being used in three areas impacted by the proposed vision and how it will change from what it is like in 2026 to what it will be like in 2100. Taking as an example the Utrecht Spatial Strategy (Gemeente Utrecht, 2021), each land use barcode shows how the land is being used, making visible how the balance of uses in each area changes over time. The width of each color on the barcode shows how much of that use is in the area. Looking at 2026 things are very different. Maasvlakte is mostly used for factories, energy and shipping with no homes or

community spaces. Rozenburg has a lot of houses, it does not have many schools or cultural facilities. Heijplaat is already a neighborhood with homes and other uses and it has the most varied land use of the three. By 2100 all three areas will have a balance of uses. There will be homes in Maasstrand and Rozenburg, with a mix of big and small buildings. Schools, culture and shops will become more common in all three areas, which is what the Vision 2100 wants, a city that is nice to live in and includes everyone. Factories and energy uses will still be there, but they will take up less space and there will be more room for community relations to happen alongside work.

Work In Progress

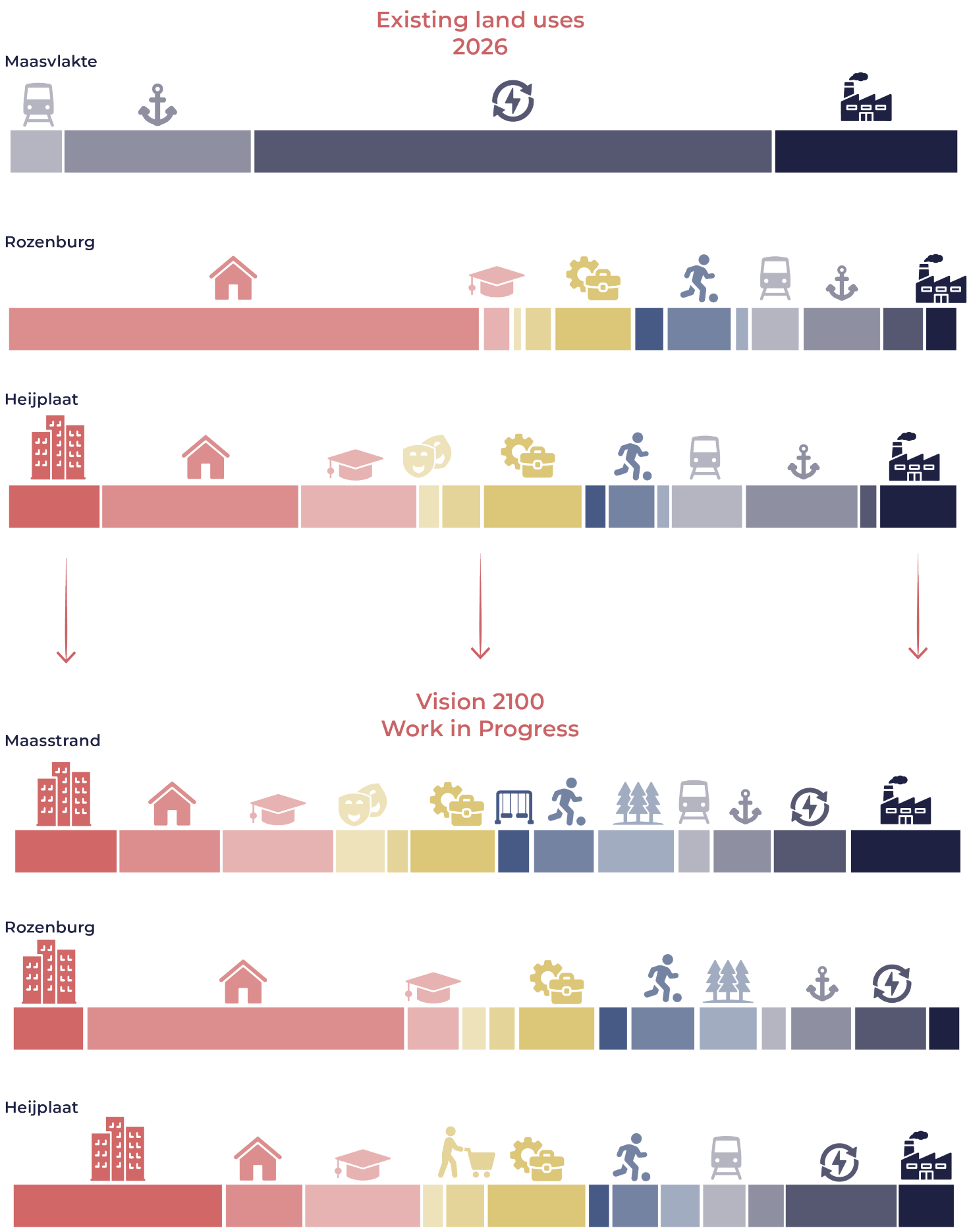


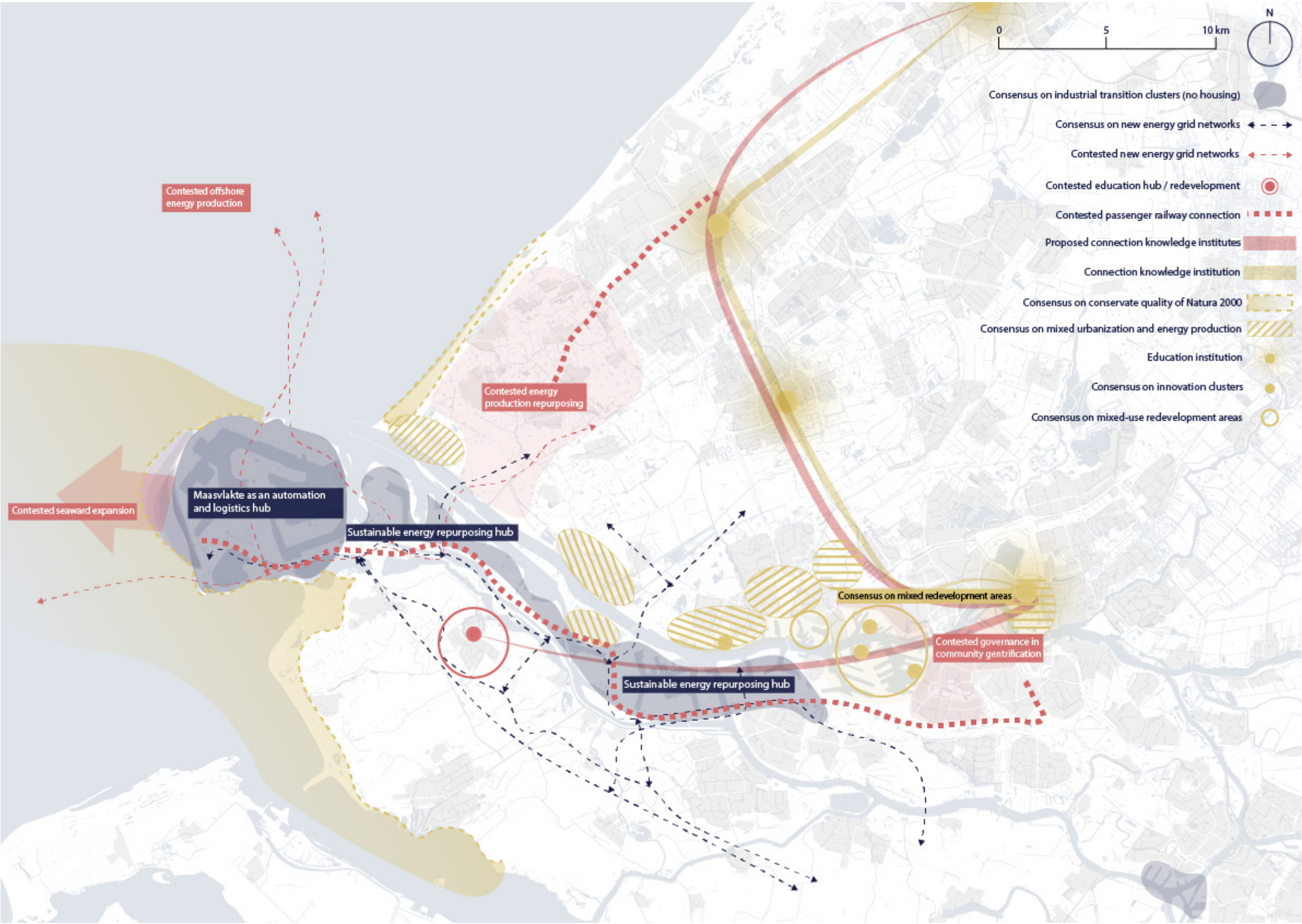
Figure 67: Current to Future Barcode Analysis

Work In Progress



06 Strategy

Introduction
To turn the vision into a strategy, the stakeholders with a great interest in the port also have to be acknowledged. The community's vision is turned into a strategy that takes the vision of the major stakeholders into consideration. To achieve this, a shift in power and governance is needed and proposed. The strategy is worked out in detail in terms of time and location, connecting it back to the conceptual framework and the mental, social, and physical dimensions. It gives room for all the different personas, bridging their vision into a structured, feasible plan.



Conflict map
Conflict map displaying points of contestation and agreement among the stakeholder arena, consisting of:

- Port of Rotterdam Authority (PoR)**
Researched by Rachel
- Largest terminal and industrial operators**
Researched by Ruggero
- Municipality of Rotterdam**
Researched by Risti
- Dutch national governments** (involved ministries)
Researched by Meike
- Trade unions**
Researched by Phill

The reconfiguration of the individual stakeholder maps displayed in the individual assignment resulted in the following recombined stakeholder conflict map.



Figure 68: Conflict map

Figure 69: Key Stakeholders

2100 Stakeholder Arena in the Energy Transition

This arena consists of the existing stakeholders, frequently shifting their roles, with their power also being contested. Then, additional stakeholders appear, specifically activated by the territorial, digital, and energy transition.

Existing Stakeholders:

The Port Authority Rotterdam: Still forms the institutional core, but gains a stronger mandate as transition coordinator. It more tightly couples concessions to skills/e-fuels outcomes (de Langen, 2023).

Local communities and municipalities: The municipality of Rotterdam gains more leverage through shareholder steering and planning influence. Communities get a way stronger, direct representation through the Compact and Skills Accord, which accommodates legitimacy and mitigates the deficit of license to operate (Daamen & Vries, 2013; de Langen, 2023).

National and provincial governments: Gain more power because financing and permitting in favour of e-fuels are dependent on national and provincial instruments. They simultaneously shape major mobility infrastructures and the Harbour Master oversight (de Langen, 2023).

The European Union: Retains high structural power via compliance contexts, which form hard boundary conditions that shape what is permissible and bankable.

Water Board Hollandse Delta: Increases its constraining power due to increasing flood resilience and water demands, becoming a binding constraint in new industrial or mixed-use zoning.

The largest terminal operators like Shell, Air Liquide, ExxonMobil, and Shell: Lose discretionary power over “business-as-usual” since concession design becomes



Figure 70: Future Stakeholder Arena Cards B

transition-conditional. Yet, they remain decisive implementers (Van der Lugt et al., 2014). They will get involved in energy transition and real estate investment opportunities to remain invested and bounded into the region, providing consistent labour opportunities.

Deltalinqs: Although power does not change, it remains a key intermediary, more formally ingrainning its role as the translator of employer demands into the Educational Board and Skills Accord (rather than merely being an informal lobbying body) (de Langen, 2023).

Energy producers and infrastructure operators: Will gain power as e-fuels increasingly depend on the grid. They become structural holders of bottlenecks, needing to be integrated into the broader Repurposing Programme.

Trade unions like FNV: Deliberately regain influence via the Labour and Skills Accord. They thus move from reactive conflict-solving impacts to continuous, co-governing transition impacts.

Network and project consortia like Power2X and Porthos: These will remain delivery vehicles that get conditional power on alignment through employment criteria and Compact e-fuels.

Start-ups and local businesses: Increasingly get access to land and procurements in a future rooted in energy transition. However, structurally, they are still weak. The only way to improve their power would be through incubator zoning and concession access provided by the PoR.

HCCE and Port of Energy: Still function as convening platforms, whose role becomes increasingly important in futures of workforce programmes and e-fuels pathways. However, transforming their soft power into implementation power depends on portfolio governance. Young professional networks like Jong

Havenvereniging, Youngship, or STC students:Attainsa stronger advisory role, specifically when it comes to legitimacy, hiring standards and fairness between generations in the Skills Accord.

Educational institutes like the University of Applied Sciences Rotterdam, the Technical College Rotterdam, and the Shipping and Transport College: Through the Transition Education Board and the port educational clusters, these educational institutes get a more formal governing role, although their power stays limited.

Wildlife and the natural environment: Gains actual veto power because the incremental changes in space and industry cause environmental issues which must be worked out through early compensation, accommodation and co-design of the region to mitigate future conflicts (Carter & Drouaud, 2022; Daamen & Vries, 2013).

New Stakeholders

Municipality of Westland: Greenhouses in the Westland get partially transformed into energy infrastructures, making it a central territorial actor. This “territorial interdependency” needs a new governing space across jurisdictions, partially filled in by the municipality, but also partially by MRDH and Province South-Holland.

Municipality of The Hague: Becomes a central collaborator in the expansion of the transit corridor, connecting workers in The Hague to the port.

MRDH (Metropoolregio Rotterdam Den Haag): Due to the expansive scale of the vision, MRDH becomes a fundamental coordinating authority that facilitates overarching regional public transit strategies and multi-municipal alignment. This is crucial when passenger mobility interferes with freight priorities.

RET (Rotterdamse Elektrische Tram):

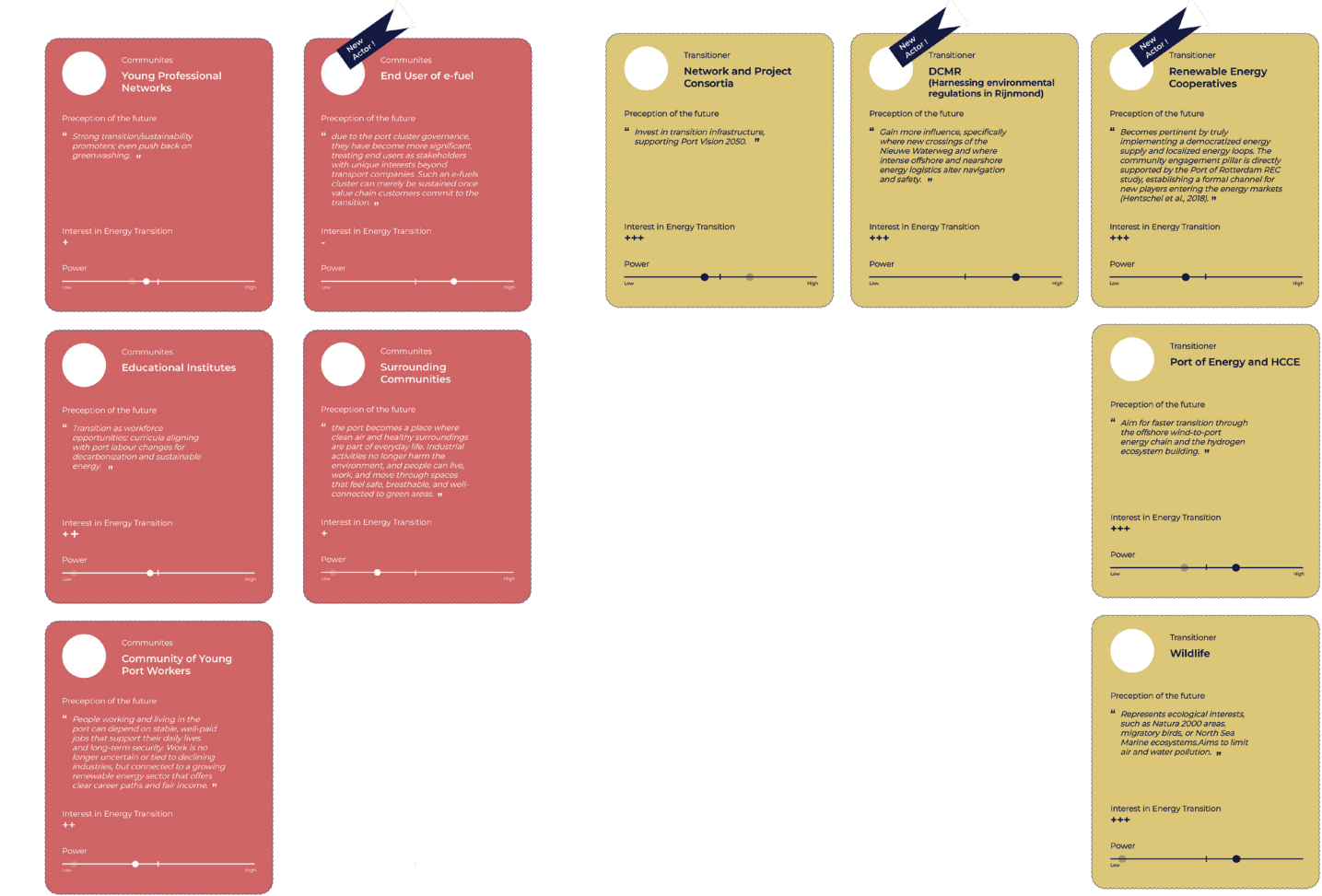


Figure 71: Future Stakeholder Arena Cards B

Forms an actor that implements the metro conversion and operational ridership, making the port more accessible. In turn, this improves the chances of young workers getting jobs in the new e-fuel cluster.

Prorail: By aligning existing rail into new ways, but also constructing new infrastructure, Prorail becomes influential in the transformation of the region. The feasibility of this transformation depends on how well it can manage the rail corridors and ensure their safety.

Rijkswaterstaat and port-waterway authorities: Gain more influence, specifically where new crossings of the Nieuwe Waterweg and where intense offshore and nearshore energy logistics alter navigation and safety.

DCMR (harnessing environmental regulations in Rijnmond): Gains influence in a timeframe of mass e-fuel

conversions, since environmental regulations and inspections determine its outcomes. The DCMR is currently involved in the governance of industrial risk and cybersecurity, but will expand its influence to the management of e-fuel conversions.

Portbase: Forms a specialized governance actor focusing on the transition of data infrastructures. This is necessary to harden cybersecurity and mandate its expansions (Chandra & Van Hillegersberg, 2017).

National Cyber Security Centre (NCSC) and cybersecurity networks: A port that clusters around e-fuels infrastructures needs digital industrial control. From the Rotterdam case example, it is evident that “voluntary governance” is inadequate here when training and accountability are absent. This actor thus gains more influence (van Erp, 2017).

Investors/lenders: The capital intensity of e-fuels infrastructures relies on bankability, becoming more visibly regulated. Here, harbour stakeholder frameworks specifically include finance as a stakeholder category that influences investment capacity.

Real estate developers: Don’t get more powerful, but will be more involved in the redevelopment of certain areas of the port. These redevelopments will form economically fruitful opportunities for the developers, especially when transit links to surrounding areas are improved. Projects will become feasible with the financial backing and commitment of the largest terminal operators investing in the port of the future, seeking consistent returns in tumultuous times.

End users of e-fuels and logistics services: due to the port cluster governance, they have become more significant, treating end users as stakeholders with unique interests beyond transport companies. Such an e-fuels cluster can merely be sustained once value chain customers commit to the transition.

Renewable Energy Cooperatives: Becomes pertinent by truly implementing a democratized energy supply and localized energy loops. The community engagement pillar is directly supported by the Port of Rotterdam REC study, establishing a formal channel for new players entering the energy markets (Hentschel et al., 2018).

From Landlord Port to Territorial Transition Authority

Shifting governance must be interpreted as a reallocation problem. To achieve this, the port must be understood as a hybrid institutional system, with a corporatised public port authority that functions as a landlord to a heterogeneous cluster within a complex port-city interface (de Langen, 2023).

The institutional core remains

The Port of Rotterdam N.V. (PoR) remains the constitutional core (de Langen & Van der Lugt, 2017). Its governance influence explicitly combines commercial agility with public steering (de Langen & Heij, 2014). In the energy transition, the PoR contests land reallocation in a landlord model where incumbents have great lease power and hold sunk costs (de Langen & Van der Lugt, 2006). Simultaneously, the Rotterdam case evidence and cluster governance theory show that port transition governance is extremely conflictual, from environment-economy to frequent land-use trade-offs (de Langen, 2007).

Repurposing and workforce transition as one task

The transition from oil to sustainable energy sources must not be governed through the idea of technology first, jobs later, since choices made in the repurposing alter labour demand, training relevance, and risk profiles. The governance structure should therefore align with the transition portfolio that couples energy infrastructure, asset repurposing, and a just transition pipeline for early career workers. This aligns with the territorial ecological transition governance, where ports extend

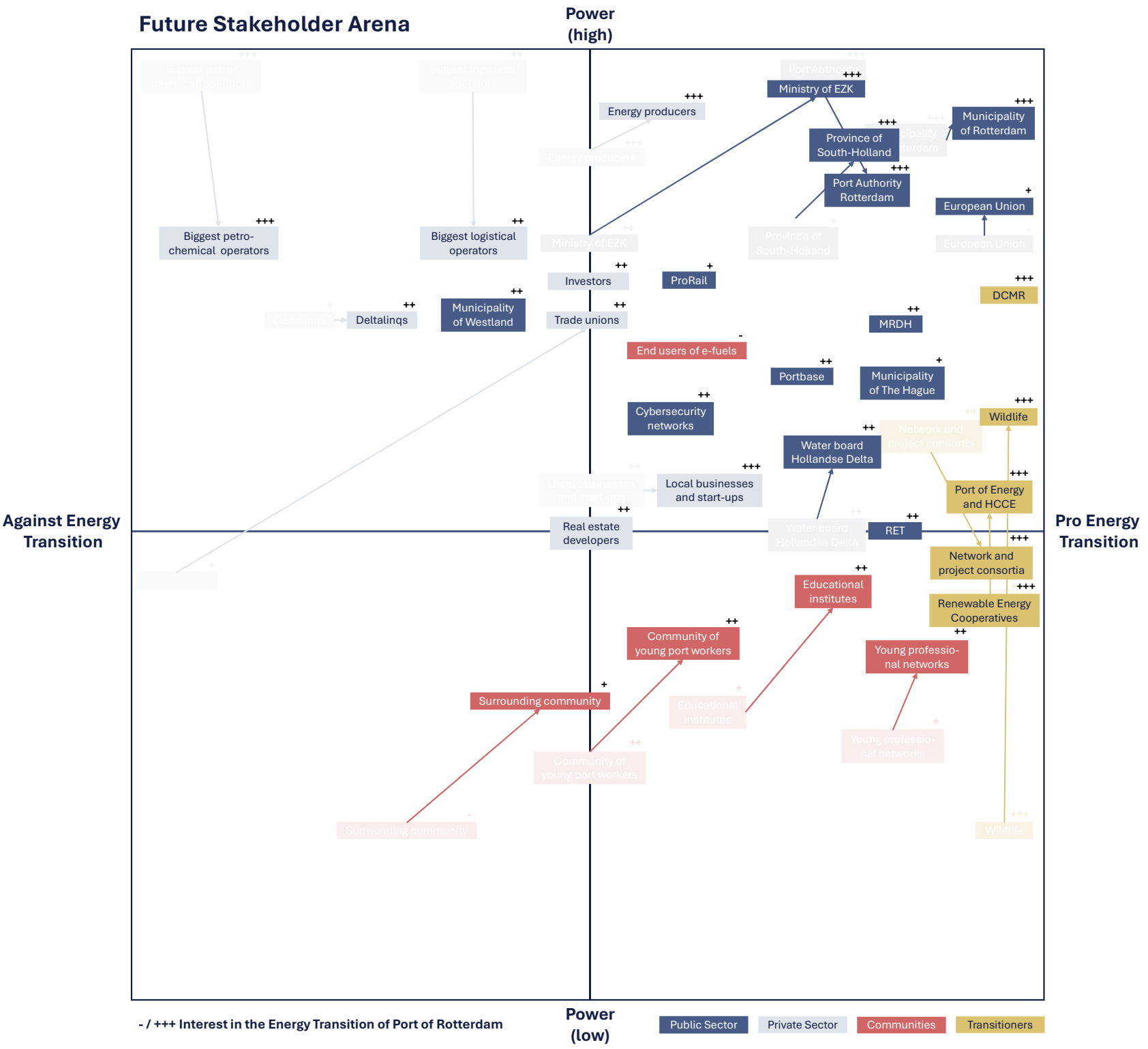


Figure 72: Future stakeholder arena

public action through governing specific interdependencies across jurisdictions and land-sea gradients (Carter & Drouaud, 2022).

Which oil value chain resources must repurpose?

In its future governance structure, the Port E-Fuels Repurposing Programme will be anchored into the PoR's existing landlord-plus model (Van der Lugt et al., 2014). This programme will solve coordination failures and bottlenecks through a mandate to prioritise governance-tractable repurposing targets like utility and pipeline corridors, terminal interfaces, and port power/heat infrastructures, which can be repurposed into e-fuel infrastructure chains (de Langen, 2023).

In doing so, port authorities act as e-fuel chain enabling intermediaries through policy formation, coordination, and concession design (Ismail et al., 2024; Sornn-Friese, 2024). On the other hand, minimally tractable aspects consist of those heavily embedded into persistent capital structures and proprietary refinery business models where PoR's influence is mostly limited to safety/environmental requirements and lease conditions (de Langen, 2007). Only if public co-investment or concession regimes alter incentives will the practical veto power of incumbents be minimised (de Langen & Van der Lugt, 2006).

Which oil-related functions decline and repurpose?

With oil-chain contraction, governance must take into account the disproportionate diminishing of routine operational roles, whilst economic growth in e-fuels will

increase demand for system operators, safety compliance personnel, digital control functions, and process monitors (Ninan et al., 2025; Sornn-Friese, 2024).

Training, hiring commitments and timeliness should thus be institutionally bound instead of these being left to the private sector under their lease responsibilities (de Langen, 2007). The future governance structure must thus institutionalise a Port Skills and Labour Accord, rooted in active unions, with special emphasis on youth/entrant engagement. This subsequently restores union influence to levels before the 2000s shift to a fragmented, conflict-driven unionisation of worker rights, lacking a platform for joint issues.

Necessary credentials for the created skill gaps

With the energy transition, higher compliance demands at the port-city interface are required through a stronger dependence on digital systems. This implies that the skill gaps are addressed through a multi-domain transition, intertwining process knowledge, digital competence, cyber resilience, and safety (Sorn-Friese, 2024). When the e-fuel system becomes part of the safety regime, it will get better embedded in training and compliance instead of becoming optional IT hygiene (van Erp, 2017).

Simultaneously, the distributional choices within the governance of the ecological transition risk getting depoliticised through certification or monitoring regimes, if utilised as solely technical efficiency tools. To empower early-career workers, safety regimes and credentials must be transparent and negotiated within

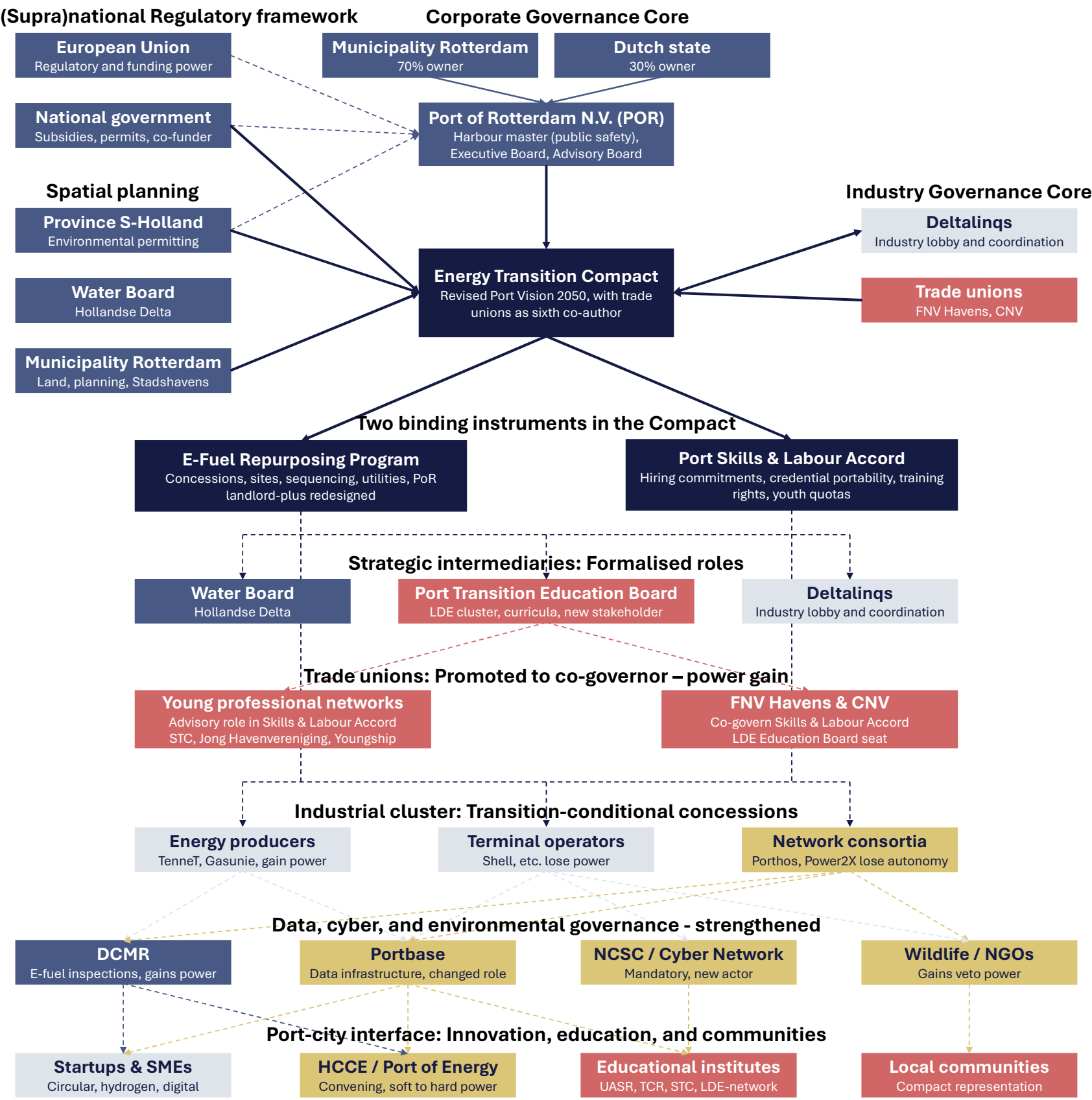


Figure 73: 2100 Governance: The constitutional and strategic core

transition institutions (Education Board, Labour & Skills Accord), not imposed after implementation (Carter, 2024; Carter & Drouaud, 2022).

Education-industry collaboration to bridge the gaps

With the new Europoort interchange node and the integration of new institutes in the LDE collaboration framework, this collaborative agreement should be governed as transition infrastructure. A new Port Transition Education Board (existing within the broader Port Transition Compact) consistently aligns curricula, apprenticeships, micro-credentials, and applied research portfolios with employer demands and e-fuel project pipelines. This makes the governance rationale deliberate cluster theory, showing that without intermediaries and enforceable collective-action arrangements, skills pipelines drift away from actual hiring needs (de Langen, 2007; Chandra & Van Hillegersberg, 2017).

Idealised future governance structure aligned with the energy transition

In order to achieve this transition, a set of new governing spaces must be layered into existing corporate/shareholder governance. This is done through various initiatives.

1. Port Energy Transition Compact

Emphasis must be given to incorporating the Port E-Fuels Transition Compact that binds land repurposing, e-fuel-focused industrial transformation, and youth labour transition into one collective pipeline. To achieve this, negotiated strategy frameworks contribute to stabilising multi-actor implementation, in line with preceding Rotterdam examples (de Langen, 2023). This would redesign

the framework into a labour transition and e-fuels becoming the core, instead of a secondary sustainability chapter (Hentschel et al., 2018).

2. Repurpose Program & Syncing skills and Labour

The E-Fuel Repurposing Programme: a project portfolio mechanism entailing concessions, sites, utilities, and sequencing.
The Port Skills and Labour Accord: a just transition mechanism consisting of youth representation, training rights, hiring commitments, and portability of credentials.

3. Port-City-Hinterland Governance

The vision for the energy transition in the port inflicts territories far beyond the port boundaries, including Rotterdam-South-Maasvlakte metro conversion, Westland greenhouse transformation, and The Hague-Westland-Port transit corridor. This makes the port a territorial actor within the existing “extended governance” where policy decisions get connected to building governing spaces across jurisdictions (Carter & Drouaud, 2022; Van der Lugt et al., 2014). This means that the governance structure must include the Province of South-Holland, MRDH, and RET as part of its mobility spine. This tackles conflicts between passenger transport investments and freight/port interests, rather than being mitigated by assuming alignment.

4. Data and Network Governance

The network governance assets of the Rotterdam Port Authority depend on interoperable energy data and logistics. Portbase’s governance model consists of a Management, Supervisory, and Advisory Board (Chandra & Van Hillegersberg, 2017).

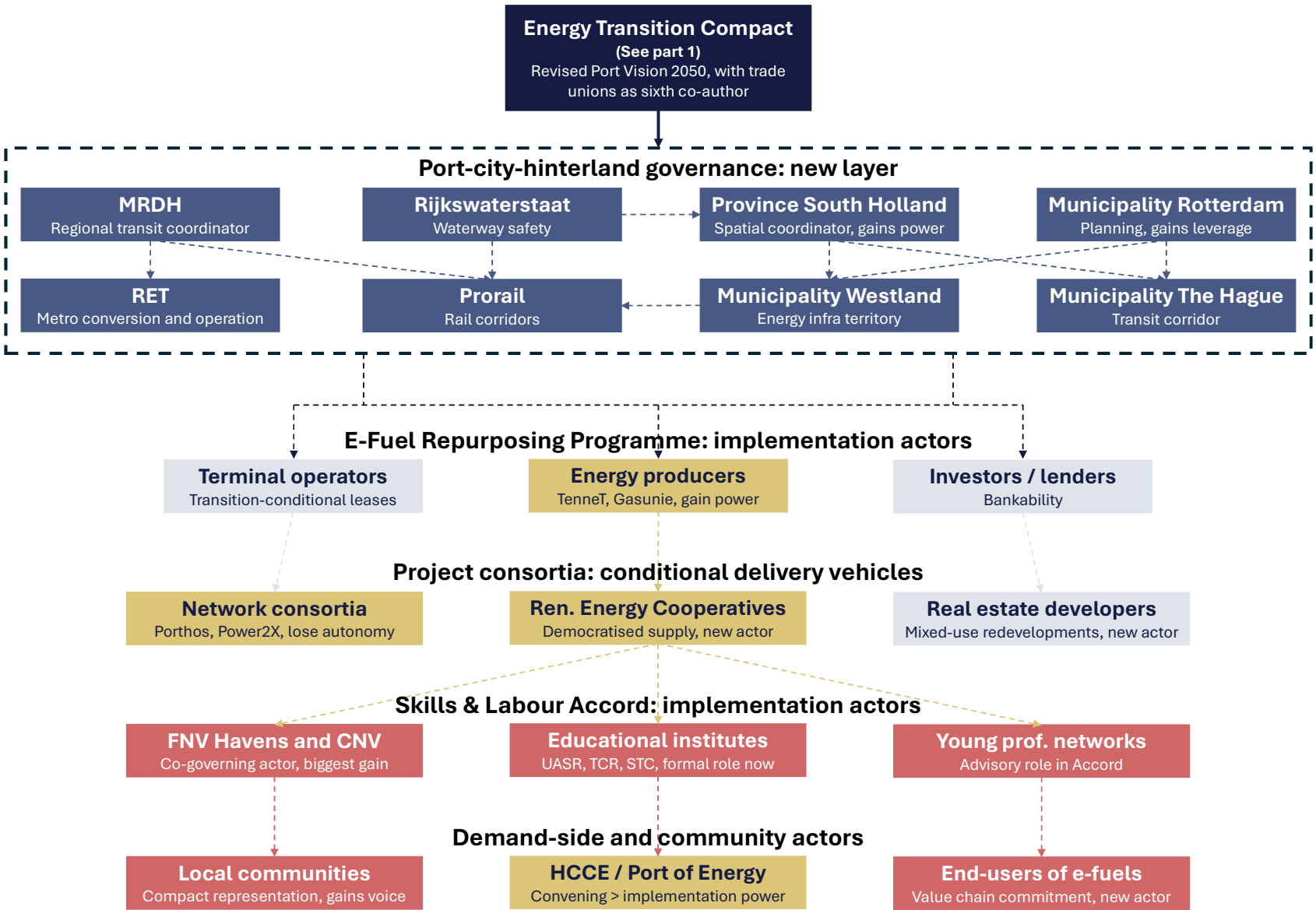


Figure 74: 2100 Governance: Territorial expansion and new actors

However, this demands the extension of this data governance into new energy value chains, whilst being hardened against cybersecurity gaps in the existing petrochemical cluster (van Erp, 2017).

5. Water and Environmental Governance

The legitimacy of governance structures is only achievable through deliberate inclusion of water and natural constraints as governing objects capable of reshaping or blocking projects. Historically, Rotterdam has always done this via

joint visioning and compensations, exemplifying the exact institutional design which must be replicated for e-fuels repurposing and mixed-use territorial conversions (Carter, 2024; Daamen & Vries, 2013; Ninan et al., 2025).

Reshuffling of power balances

There are several actors that either gain or lose substantial influence in the new governance model. The instruments that most affect this power are the corporatised public ownership model with shareholder steering, the landlord concession

redesign, and the formulation of new governance systems like the Compact, Repurposing Programme and Skills Accord. This translates into the following concrete power shifts:

Actors with the biggest gains in power

1. Operators of energy production and infrastructures, such as TenneT and Gasunie: Access to hydrogen and grid infrastructure become binding constraints where e-fuels industrialisation depends on (Ramos & Yilmaz, 2022; Sornn-Friese, 2024).

2. Trade unions, such as CNV and FNV Havens: The Skills Accords reinterprets the role of trade unions, reinforcing continuous bargaining and steering influence on port policies, rather than being reactive conflict mediators.

3. MRDH, RET, Westland, The Hague: due to the territorial expansion of energy-based port functions and associated mobility extensions, these actors become fundamental to the feasibility of the vision, whereas they previously had limited influence (Carter, 2024; Carter & Drouaud, 2022).

4. Portbase and data governance actors: With the intensification of energy infrastructures and e-fuels logistics, systems must be interoperable and trusted, especially because cybersecurity threats become more prevalent, but also more existential (Chandra & Van Hillegersberg, 2017; Van Erp, 2017).

5. Educational institutes and training pipelines, such as LDE: With growing demand for an educated workforce, skills pipelines become a formal dependency for the legitimacy and viability of projects, not peripheral to the CSR topic.

6. Environmental stakeholders, empowered via legal proxies: Large port transformations and energy conversions facilitate the usage of procedural veto potential when their concerns are not addressed properly (Carter, 2024; Carter & Drouaud, 2022; Daamen & Vries, 2013).

Actors with the biggest loss in power

1. Incumbent oil-chain refinery or terminal operators such as ExxonMobil, Shell, etc.: These stakeholders lose “lease-enabled discretion” when concessions are rewritten. New concessions will impose strict transition-conditionality, such as workforce transition duties, repurposing obligations, and timelines, to meet governmental targets of the energy transition (de Langen, 2023). To soften the financial blow of the transition, they’ll be involved in investment opportunities into areal transformations, increasing their power relatively to no investment involvement.

2. Port of Rotterdam: Loses discretion as a management organisation, even though it gains more influence through institutional mandates. Its loss in power is caused by the partial re-politicisation of the Port Authority’s entrepreneurial autonomy, consistent with the tension between public interest control and corporatisation/autonomy (de Langen, 2023; de Langen & Heij, 2014).

Solely project-focused consortia: These lose autonomy due to their delivery mechanism inside a single portfolio governed by the Compact, rather than using isolated project logics to define the transition agenda.

Conclusion

The adaptation of the governance structure includes public ownership steering, institutionalised governing spaces, and landlord concession design that facilitate conflict rather than ignore it (de Langen, 2007; de Langen & Heij, 2014). The Labour and Skills Accord restores the consistent influence of workers in the port through unions and youth participation (de Langen, 2023; de Langen & Van der Lugt, 2017). Furthermore, instead of voluntary “new governance”, skill gaps are treated as multi-domain dimensions such as safety, process, digital, and cyber, governed with stronger accountability (Sornn-Friesse, 2024; Van Erp, 2017). Finally, education forms a cornerstone for the harbour transition, being embedded in territorial transition governance via the LDE-Port education cluster, which structurally couples employee and project pipelines to employer demands

Stakeholder engagement strategy

The proposed 2100 governance architecture restructures power among stakeholders in ways to achieve the idealised just energy transition. Specifically three stakeholders demand targeted engagement: the largest terminal operators that lose lease-enabled power; the energy and grid infrastructure operators gaining structural power, making the success of the new governance system dependent on their participation; and national governments whose power in permitting and funding will shape the financial viability of the Compact.

Largest terminal operators (Air Liquide, Shell, Advorio, ExxonMobil)

The most prominent losers of discretionary influence in the port governance model are the large industrial and terminal operators, specifically those focused on the fossil industry. Through multi-decade leases, they held near-veto power over transition timelines (de Langen & van der Lugt, 2006). Newly implemented Transition Conditionality Clauses mitigate this power through lease renewals, binding just transition compliance architecture (de Langen, 2023).

Policies that lead with regulatory obligations are less durable than those that distribute economic benefits to incumbent actors early on, before imposing compliance costs (Meckling et al., 2015). Two instruments sequence incentives before compliance. First, with the allocation of repurposing sites, displaced terminal operators must be granted priority investment rights into these mixed-use redevelopments following the Stadhavens governance model, into redevelopment projects (Daamen & Vries, 2013). This transforms the financial and territorial loss into a

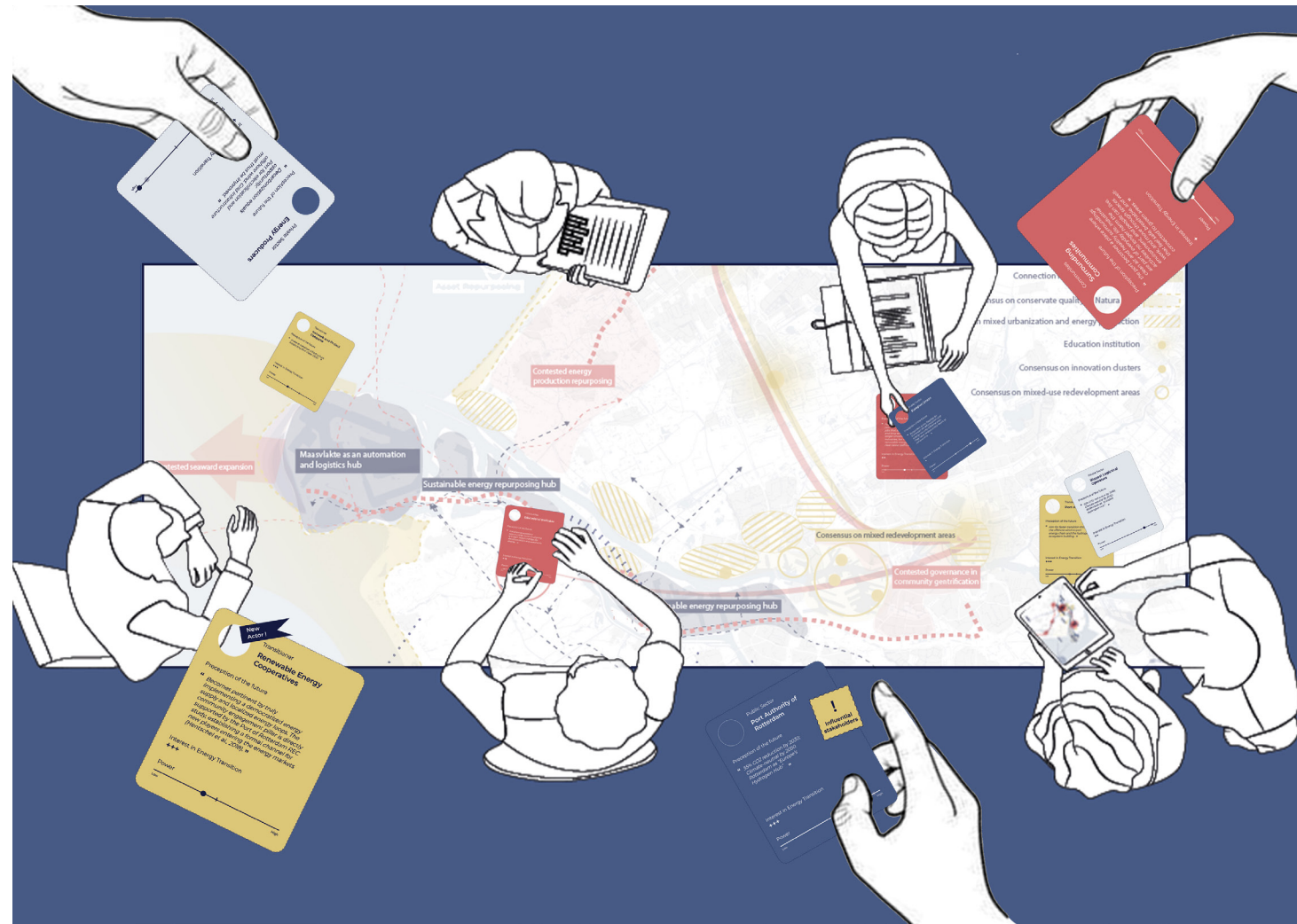


Figure 75: Stakeholder Engagement

financially attractive green infrastructure and real estate opportunity. Additionally, operators who voluntarily progress the energy transition ahead of lease commitments should be granted preferential concession terms.

Energy and grid infrastructure operators (Gasunie, TenneT)

Contrarily, grid infrastructure operators and energy producers risk becoming bottlenecks in the 2100 governance model if they are not properly engaged, especially through an ever more fundamental energy transition. Gasunie and TenneT both determine if the E-Fuels Repurposing Programme is able to materialise in actuality (Ramons & Yilmaz, 2022; Sornn-Friese, 2024).

This is achieved through two governance instruments. Initially through the Repurposing Programme which structures long-term offtake agreements co-signed by the Port Authority, Ministry of Economic and Climate Affairs, and Deltalinqs. These agreements ensure revenue stability for grid investments by Gasunie and TenneT. This gives these two operators a direct financial incentive to connect infrastructure investment timelines with the Compact timeline through the Connecting Europe Facility funding and associated permitting. Secondly, TenneT is fully state-owned, making the Ministries of Infrastructure and Water Management, and Economic and Climate Affairs hold political control over strategic investment priorities. This

exemplifies that TenneT's alignment with the national government's commitment to the Compact is functionally compelled rather than just encouraged.

National government (Ministry of Economic and Climate Affairs, and the Province of South Holland)

The central and provincial governments involved form the institutional enablers that financially and spatially legitimise the Compact. In both MIEK editions, which shape Rotterdam-Moerdijk CES projects as nationally strategic, the Ministry of Economic and Climate Affairs already forms the co-author. Additionally, the Port Authority is 30% owned by the Dutch state, making mitigating risks in the transition both a national industrial policy and an asset protection strategy (de Langen & Heij, 2014). Through the Omgevingswet, the Province attains environmental permitting authority, accelerating or blocking e-fuel infrastructure projects in the cluster.

The societal, European wide importance of the Compact's success makes it extend far beyond the port's balance sheet, with the governments holding an economic and reputational stake. National co-investment is structured through the MIEK's annual programme cycle, which frequently commits funding to e-fuel projects. This integrates the investment pipelines behind the Compact through consecutive MIEK editions that institutionalise national co-financing without needing additional legislation. Through PTJTP co-design and permitting authority, the Province is engaged, building it into the Territorial Just Transition Plan's governance structure from the start.

From Enabling to Transformative Instruments

In the 2100 governance vision, trade unions become co-governing actors. This provides co-determination rights for FNV Havens and CNV regarding concession conditionality, automation timing, retraining, and the spatial justice gap between Botlek-Europoort displacement zones and new e-fuel employment clusters (Lempinen et al., 2025).

Part 1: Existing Policies that Enable the 2100 Port Governance Vision

1. The EU Just Transition Fund and REPowerEU Framework (originally 2021-2027, but extensions every five years)

The Just Transition Fund (JTF) is embedded in the broader European Green Deal (European Commission, 2021). The fund specifically addresses the social costs that decarbonisation carries in territories dependent on fossil-fuels, providing co-funding for SME diversification, worker retraining, and community reinvestment (Sanz-Hernandéz, 2024). Due to its petrochemical dependency, the Port of Rotterdam qualifies as a JTF territory (European Commission, 2021). The JTF is particularly relevant to the 2100 governance model due to its conditionality architecture, since funding is only provided when social partners like trade unions are involved in the design and management of Territorial Just Transition Plans. This creates a formal legal hook for FNV Havens and CNV to formally co-create the retraining infrastructure in Rotterdam. As part of the 2100 governance model, JTF co-funding can capitalise the Port Skills and Labour Accord's retraining infrastructure.



Figure 76: Energy and hydrogen infrastructure in the Rotterdam Port (Kilgore, n.d.)

2. The Dutch Klimaatakkoord and Meerjarenprogramma Infrastructuur Energie en Klimaat (MIEK, annual revision since 2021)

The Rotterdam-Moerdijk Cluster Energy Strategy (CES) is operationalised within the national policy framework consisting of the 2019 Climate Agreement (Klimaatakkoord) and its annual MIEK implementation programme (Ministry of Common Affairs, 2022). The MIEK forms the policy framework that the Port E-Fuels Repurposing Programme depends on. In its 2023 edition, the CES Rotterdam-Moerdijk includes a hortatory skills and workforce chapter. This fails to form enforceable commitments for operators or provide timeline obligations (Sornn-Friese, 2023). The MIEK provides the initiating funding framework. The MIEK's coordination function between the Port Authority, Ministry

of Economic Affairs and Climate, and Province of South Holland forms the exact governance tier that can activate the national government's role in the 2100 Compact.

3. The Omgevingswet (2024) and the Programme Energiehoofdstructuur (PEH)

The underlying Programme Energiehoofdstructuur (PEH) forms the most influential spatial governance lever. As part of the Omgevingswet, the Province's Omgevingsvisie designates the port-industrial zone as a priority zone for energy transition redevelopments. The PEH builds on this by assigning specific spatial reservations for high-voltage connections, H2 pipelines, CO2 infrastructure, and electrolyser sites as nationally significant infrastructure. This creates legal protection for the physical assets that

the E-Fuels Repurposing Programme depends on (de Langen & van der Lugt, 2006).

The Omgevingswet specifically contributes to the spatial anchoring of cross-jurisdictional governance, needed for the proposed 2100 governance framework (Carter & Drouaud, 2022). The Province of South Holland can determine transition zones, whilst the municipality binds mixed-use redevelopments in its omgevingsplan, and the PEH connects them through instating the national energy corridors. The public participation requirements create limited co-governance for unions (Notteboom et al., 2015).

Part 2: Three New Policy Instruments which Fill the Constitutive Gaps

4. The Port Skills and Labour Accord: Transition Conditionality in Concession Design (proposed: 2035>)

The JTF demands union inclusion, and the CES formulates workforce displacement as a governance concern. However, neither instrument formally binds terminal operators to retraining agreements, co-determined hiring timelines, or accepting union governance rights over the pace of occupational transition (de Langen, 2007).

Spain's 2021 Climate Change and Energy Transition Law enforced Just Transition Agreements as enforceable co-governance tools that bind governments, operators, and trade unions to shared commitments through a dedicated independent body, the Instituto para la Transición Justa. Yet, there remains a structural ceiling, since prior government-industry dialogues set the transition timelines in the JTAs before the tripartite forum convened. This

meant that union participation was limited to the agenda already closed (Sanz-Hernández, 2024). Spatial binding was treated as a design preference, with retraining facilities in Teruel and Asturias being completely disconnected from the concentrated job market in Madrid and Barcelona.

The initiated Port Skills and Labour Accord is based on the Spanish JTA while addressing structural limitations through three specific concession governance design choices. The policy initiative is rooted in the Dutch Havenbeheersreglement (Port Management Decree) and concession conditions imposed by the Port Authority, making Transition Conditionality Clauses obligated in lease renewals. Operators must submit five-year workforce transition plans, co-signed by the unions, to renew their leases. Through spatial binding, retraining facilities must be located within the affected communities or within a 30-minute public transit ride from Rotterdam South, Slinge.

Because unions are just involved in conflict-driven CAO negotiations, the big industrial terminal operators retain veto power over transition timelines due to their multi-decade leases, leaving workforce commitments advisory over actual adoption (de Langen & van der Lugt, 2006). The new Accord uses a governance lever at the level of the concession instrument itself by directly binding operators as a condition of their operational legitimacy on port territory (de Langen, 2007; Vachon et al., 2016). Policy design and negotiations run from 2028 to 2034. From 2032 onwards, the prototyped leases are being transformed through the newly



Figure 77: Spatial mismatch between jobs and the port communities (Topotijdreis, n.d.).



Figure 78: Automated container terminals in Hamburg (HHLA, n.d.)

revised Havenbeheersreglement. It is fully adopted by 2035, and all major leases have become transition-conditional by 2050.

5.A Port-City Territorial Just Transition Plan: A Binding Multi-Municipal Governance Instrument (proposed: 2040-2070)

The Skills and Labour Accord leaves territorial transition dimensions unresolved. The Omgevingswet provides spatial planning instruments at municipal and provincial levels, and the CES covers the Rotterdam-Moerdijk cluster. However, these instruments don't produce binding decisions, distributing the burden of the transition. Communities bearing displacement costs get underrepresented, while new employment clusters reap the benefits. Areas like Charlois, Hoogvliet, and Heijplaat house many workers, yet are spatially disconnected from the e-fuel employment cluster, which increasingly moves from nearby Botlek and Europoort to the distant Maasvlakte.

Relevant is the Port of La Rochelle. The Port of Energy and HCCE are functioning as soft-power platforms building the relational capital (De Langen, 2023). Nevertheless, by making participation conditional on a shared narrative, La Rochelle depoliticises the conflict that the just transition governance should accommodate (Carter, 2024). Productive conflict must not be suppressed by consensus requirements, but should be institutionalised.

The proposed Port-City Territorial Just Transition Plan (PTJTP) includes a distributional justice

map. Procedurally, the PTJTP meets quarterly, with an agenda co-set by communities and unions, not by the Port Authority. An independent chair reports to the city council of Rotterdam, not to the Port Authority. To tackle the structurally disproportionate transition burden that worker communities around Rotterdam-South endure, the proposed policy binds pollution, noise, and remediation standards for communities nearby repurposing zones.

Port communities are left without direct power, making it impossible to bind investment commitments to their participation input (Notteboom et al., 2015). Trade unions thus lack consultative rights in Stadhavens redevelopment processes (Daamen & Vries, 2013). The PTJTP policy framework addresses these shortcomings by creating a binding spatial governance instrument which provides co-creating rights to unions and their communities, shaping how transition burdens and benefits are distributed. The formation of the policy framework was initiated by port-wide strikes in 2031 and 2033, demanding fairer distribution of transition burdens and benefits. Formal negotiations started in 2035, with full adoption in 2040, consolidating with the Port Vision revision of that year.

6. A Rotterdam Port-City Automation Governance Protocol (proposed: 2035>)

2024 strikes and negotiations at the Hutchison Delta 2 terminal demonstrate that displacement is not speculative but accelerates in process (Lempinen et al., 2025). Hamburg's case forms an excellent

automation co-governance example here. Its SEH (2023) forms a cluster coordination platform facilitated through joint grid planning and shared infrastructure (Sornn-Friese, 2024). Nevertheless, the SEH is still underdelivering due to the lack of community governance architecture, timeline delivery commitments, or formal union representation. This results in the systematic exclusion of social conditionally separating just transition infrastructure from enabling architecture (Sornn-Friese, 2024).

The Rotterdam Port-City Automation Governance Protocol builds on Hamburg's coordination logic while institutionalising union co-determination and timeline accountability that the SEH omits. This establishes a joint impact assessment process where FNV Havens and CNV participate with equal agenda-setting rights. This is achieved through the Workforce Adaptation Fund, which specifically funds retraining and early-career induction pathways, financed on a per-TEU basis among automated terminal operators. This directly operationalises spatial justice as per Liu and Dąbrowski (2024), bridging the gap between transition burdens and benefits, here applied to automation in the port.

Through this Protocol, automation pacing becomes a co-governed subject. This transforms the previously managerial prerogative into a governance mechanism that provides structural co-governance rights to unions. The union strikes in 2031 and 2033 resulted in real CAO negotiations from 2031 onwards, making the Workforce Adaptation Fund fully operational by 2034, with full adoption in the CAOs by 2035.

Conclusion:

How these Policies Recombine to Achieve the 2100 Governance Model
The three proposed policy frameworks complement these policies to fill the constitutive gaps. JTF's partnership language is repositioned into binding operator obligations through the Transition Conditionality Clause (TCC). This is extended through the Port-City Territorial Just Transition Plan (PTJTP), which binds the distributional justice to spatial planning. Finally, the Automation Governance Protocol (RPAG) ensures technological displacement is incorporated in energy-transition architecture (Lempinen et al., 2025).

Strategic framework

To translate the community’s vision to a spatial strategy, the conceptual framework is used to transform the vision and wishes of the community into interventions and spatial conceptions. Therefore this strategic framework is set up to be able to set up the strategy and how to work the strategy out in more detail. This means that most interventions would be comparable with the spatial translations of the community’s wishes earlier in this report. Only in this strategic framework the necessary interventions to tackle climate change and reach the EU climate goals, as said in the introduction of the report, are included as well. These implementations of the strategy are not happening simultaneously and are phased out over time to reach the end goal in 2100. The explicit phasing is explained in more detail after the strategy map is introduced. To work out the strategy, there is chosen for a detailed zoom in on three locations all according to this strategic framework with their own phasing and timeline.

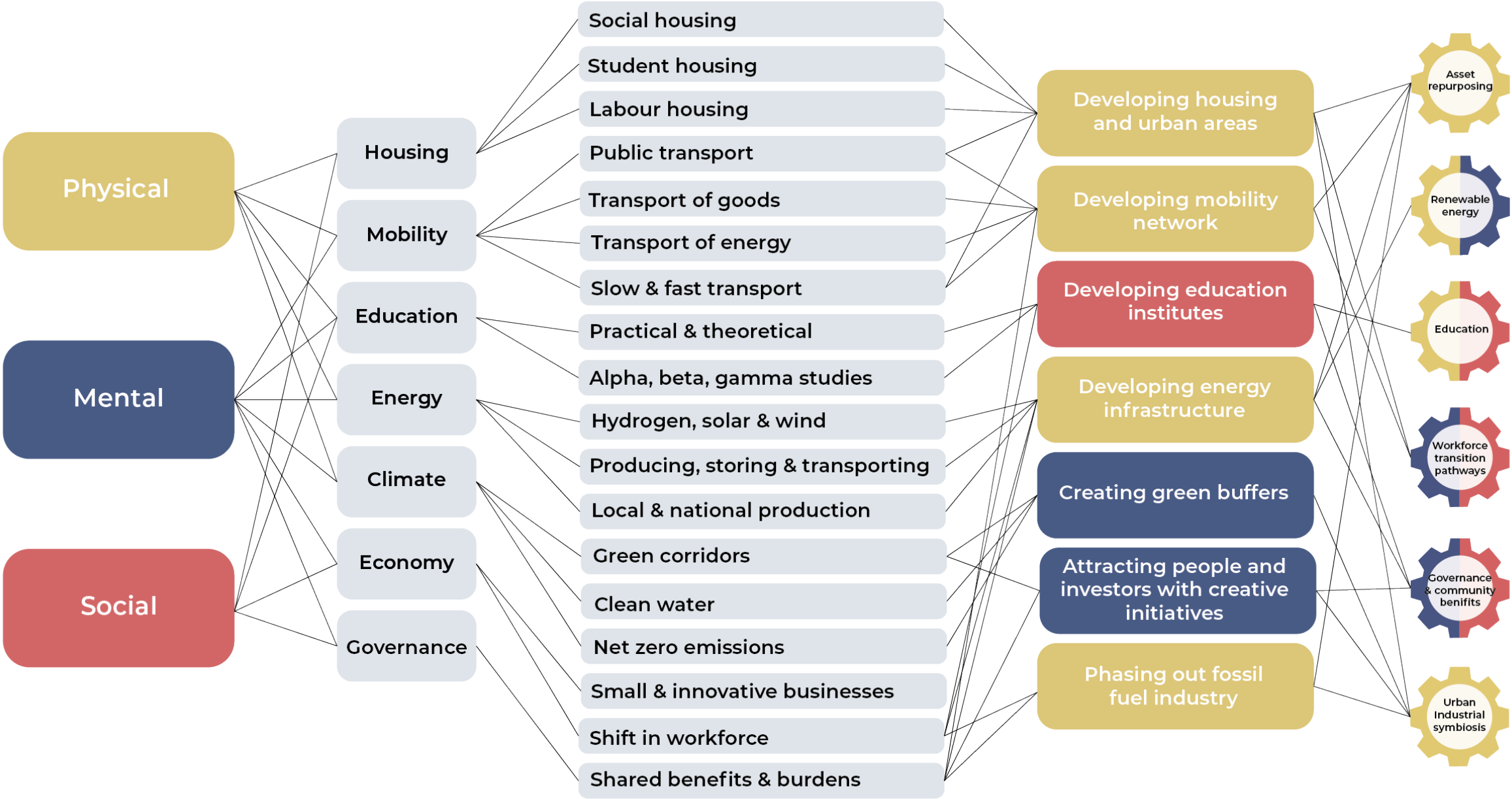
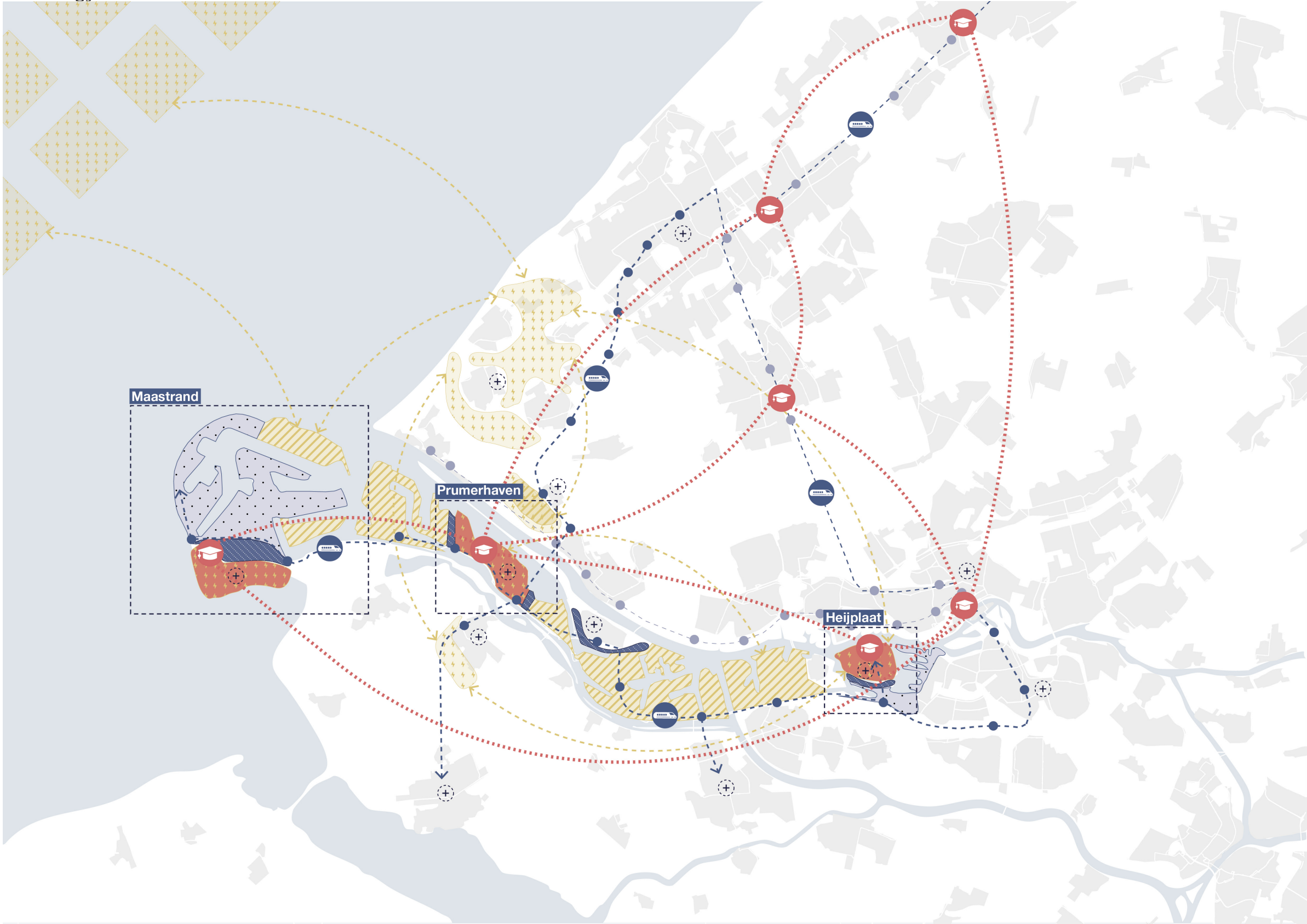


Figure 79: Strategic Framework



Strategy Map

- | | | | | | |
|---|---------------------------|---|--------------------|---|---------------------|
|  | New housing development |  | Energy flow |  | Existing stop |
|  | Energy assets repurposing |  | Possible extension |  | New job opportunity |
|  | Asset Repurposing |  | New trainline | | |
|  | Logistics area |  | Existing trainline | | |
|  | Buffer |  | Existing metroline | | |
|  | Educational network |  | New stop | | |

Work In Progress

Work In Progress

Strategy Map

Where the 2100 vision illustrates the idealised future, the strategy (map) territorially grounds the governance architecture to realise this future. The three chosen focal areas follow this feasible governance logic. Heijplaat, Prumerhaven, and Maastrand are the sites where the existing infrastructure corridors and the Port Authority's landlord-plus model can realistically adapt concession conditions and investments within the proposed timeline. The strategy map visualises this through the binding instruments fundamental to the Port Energy Transition Compact. The E-Fuel Repurposing Programme couples transition conditionality to land access through concession design. This allows for ordered phasing of the repurposing of energy and industrial infrastructure. The Port Skills and Labour Accord embeds the geographical proximity between the port workers' living environments and their new educational and employment facilities. The strategy also expands the Rotterdam port cluster towards the Westland through greenhouse transformations, and the The Hague-Westland-Brielle transit corridor coordinated by the MRDH. This exemplifies the need for port governance to move far beyond existing administrative boundaries, treating industrial repurposing, mobility, and education as spatial interdependencies rather than sectoral silos.

Figure 80: Strategy map



Figure 81: Phasing Maps

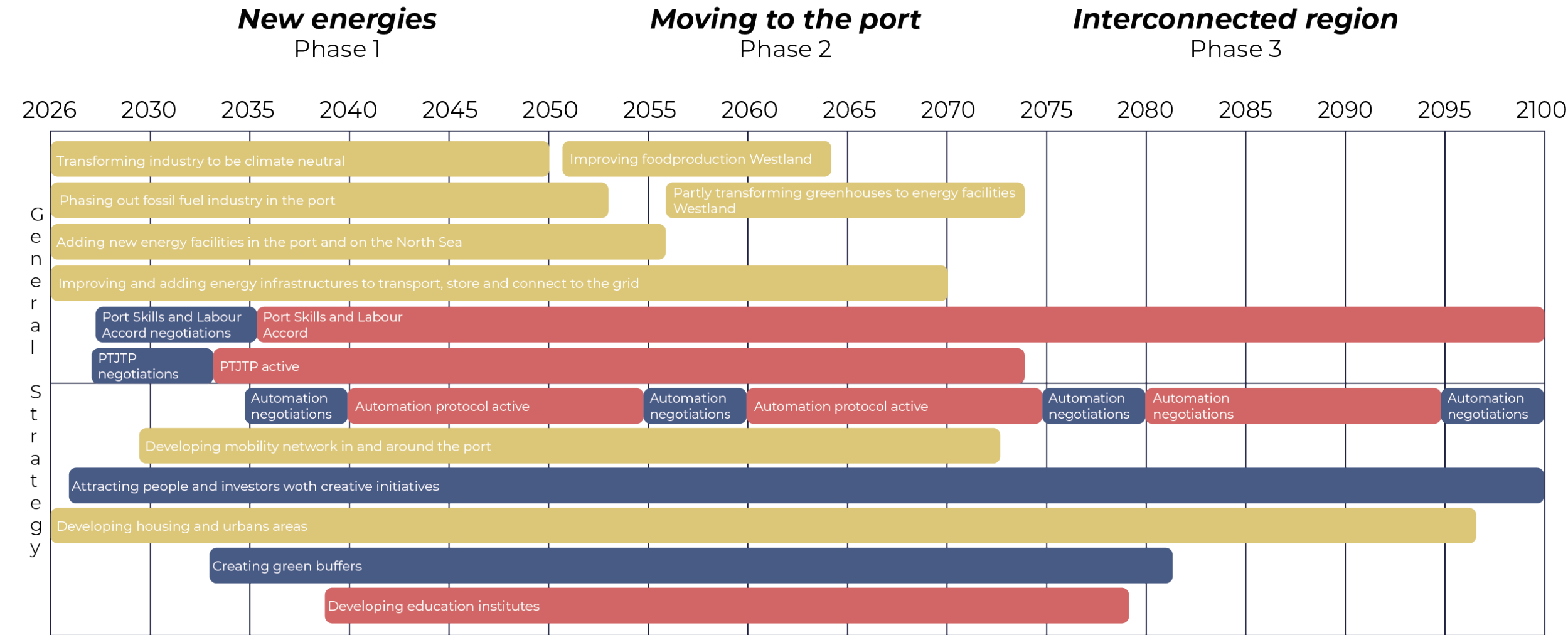
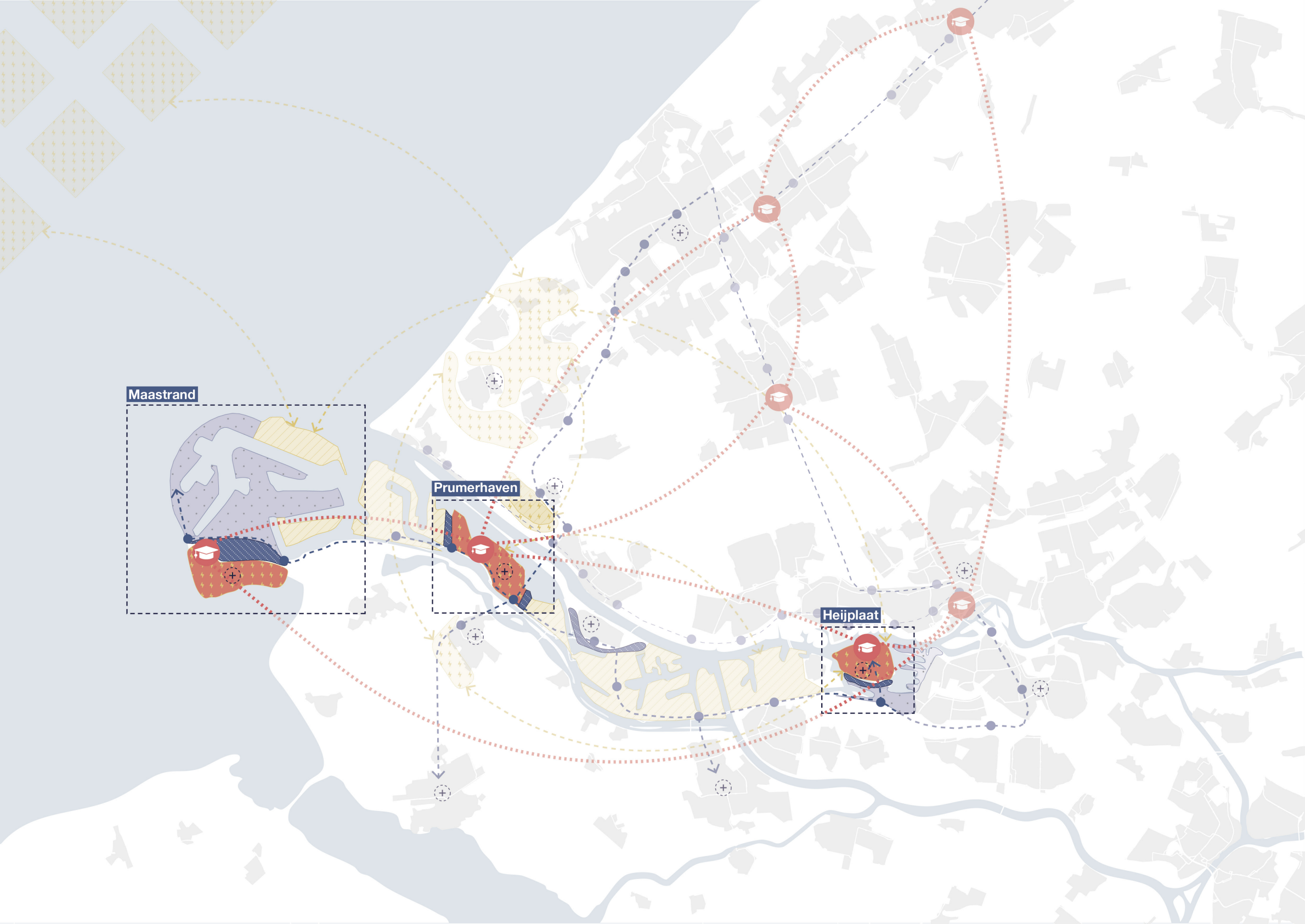


Figure 82: General phasing timeline

Phasing

The phasing strategy facilitates a gradual transition toward a renewable energy future in the Port of Rotterdam. By 2030, the focus is on asset repurposing and initial renewable energy pilots. The 2050 milestone targets full climate neutrality, scaling the hydrogen hub while implementing inclusive workforce transition pathways. By 2100, the vision is fully realised through urban-industrial symbiosis, green buffers, and sea-oriented liveable areas. This staged approach in priority zones allows for iterative adaptation, balancing long-term industrial productivity with intergenerational equity and environmental regeneration to ensure the port's resilience.



Choice for Focus Locations
The strategy was redacted at the scale of the Port of Rotterdam region, but, to function and be implemented properly, it needed some zoom-in locations to experiment with phasing spatial solutions. The chosen areas are Heijplaat, Prumerhaven and Maastrand; each of these locations has its own spatial qualities and reasoning behind its development, which will be further explained.

Heijplaat was chosen for its pioneering approach to urban development in a harbour area, integrating education, housing and production. It can function as an experimental ground and best practice for future interventions in similar areas.

Prumerhaven is a brand new development in an area now used for energy production and storage: this location was chosen for its convenient position at the intersection of the two new trainlines. It will function as an important education and transportation hub, creating a livable town immersed in the harbour landscape.

Masstrand is the key transformation in the strategy, completely changing the spatial and perceptive aspects of Maasvlakte. It was chosen for its current key role in the port, and it will serve as the main educational hub in the harbour, bridging the gap in the education corridor ranging from Leiden to Rotterdam and creating a new attractive centrality.

Focus Locations

- New housing development

Energy assets repurposing

Asset Repurposing

Logistics area

Buffer

Educational network
- Energy flow

Possible extension

New trainline

Existing trainline

Existing metroline

New stop
- Existing stop

New job opportunity

Figure 83: Focus locations

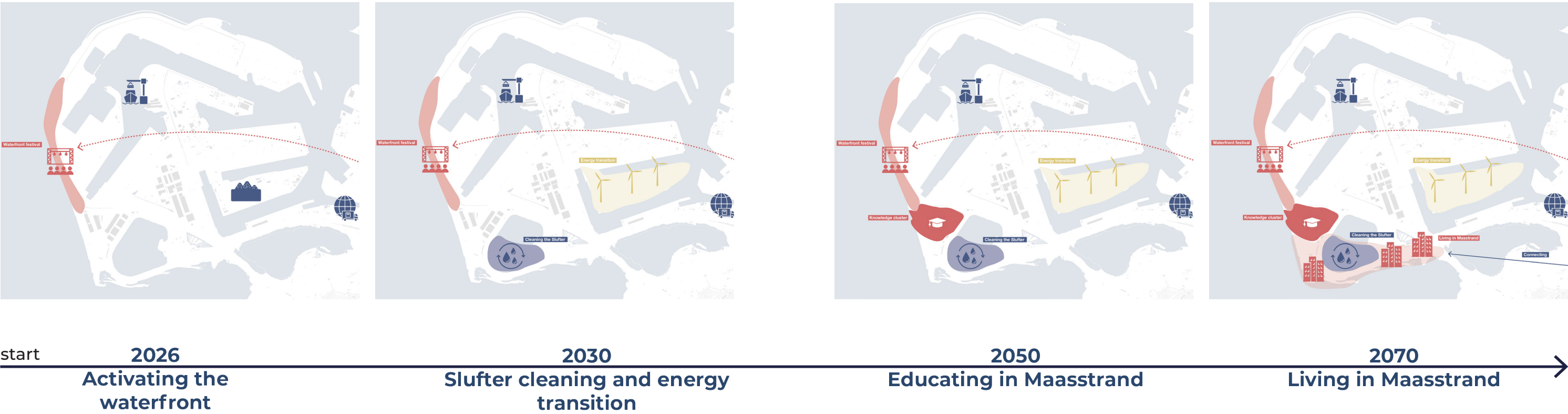


Figure 84: Maasstrand phasing

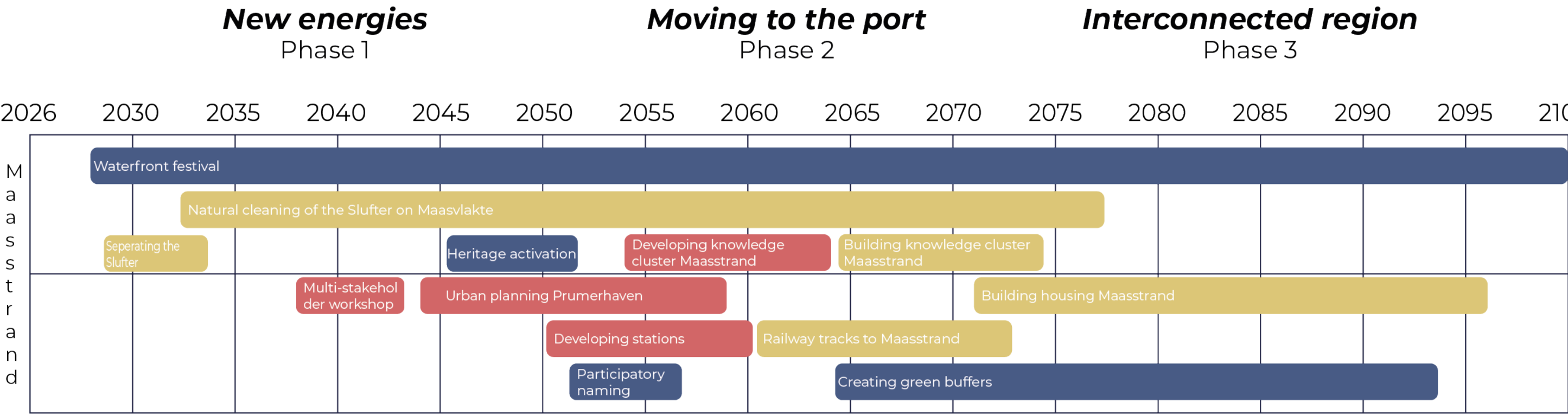


Figure 85: Maasstrand phasing timeline

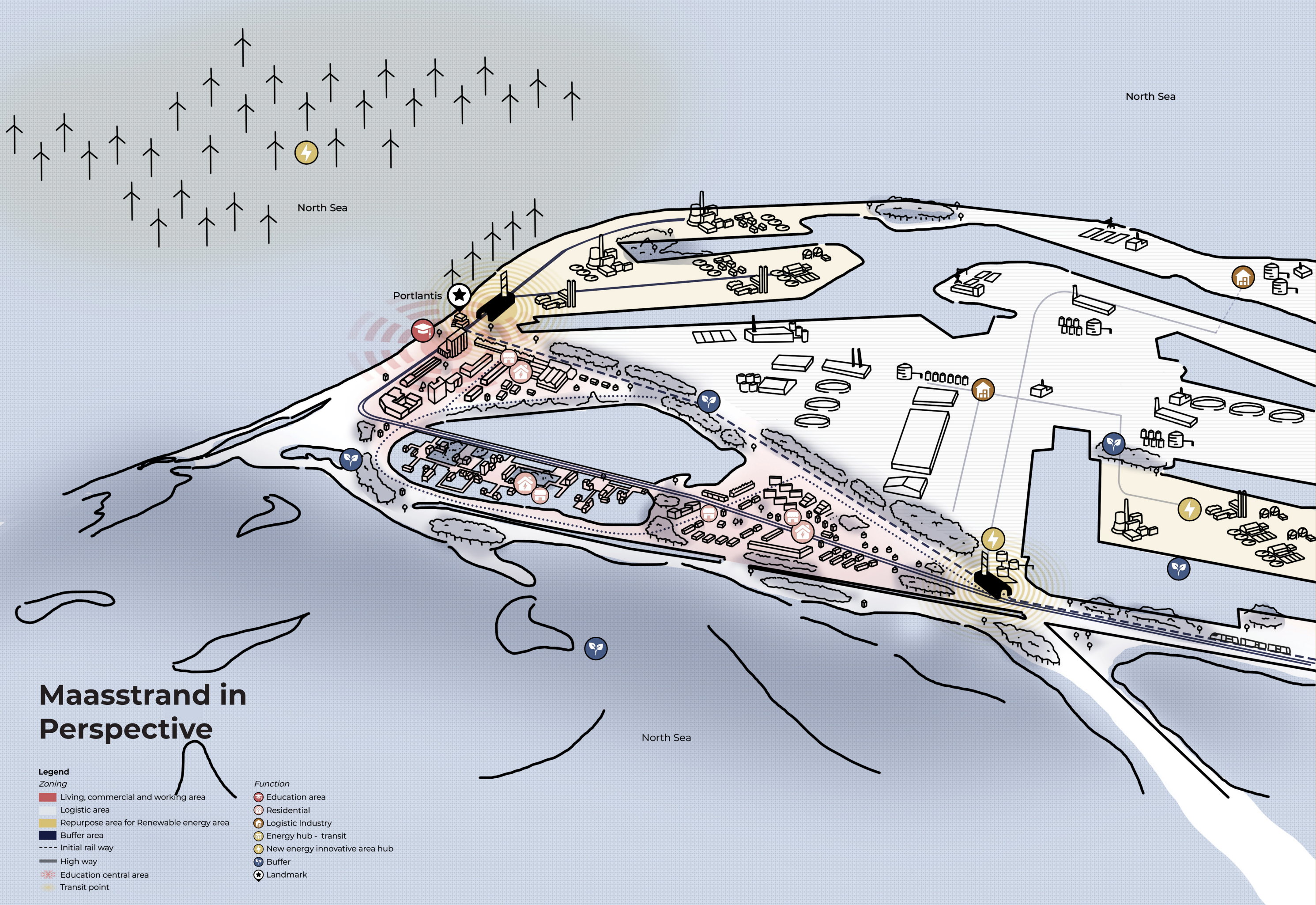




Figure 86: Maasvlakte A

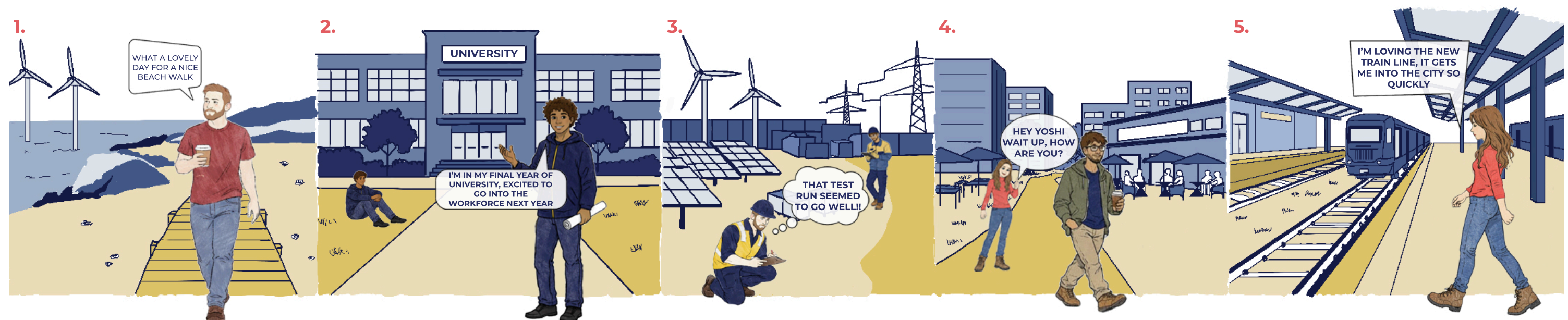


Figure 88: Maasvlakte B

Figure 87: Riverstone Centrale
Rotterdam Maasvlakte haven
Rotterdam (Gundlach, n.d.)

Figure 89: Maasvlakte C

Current state of surface



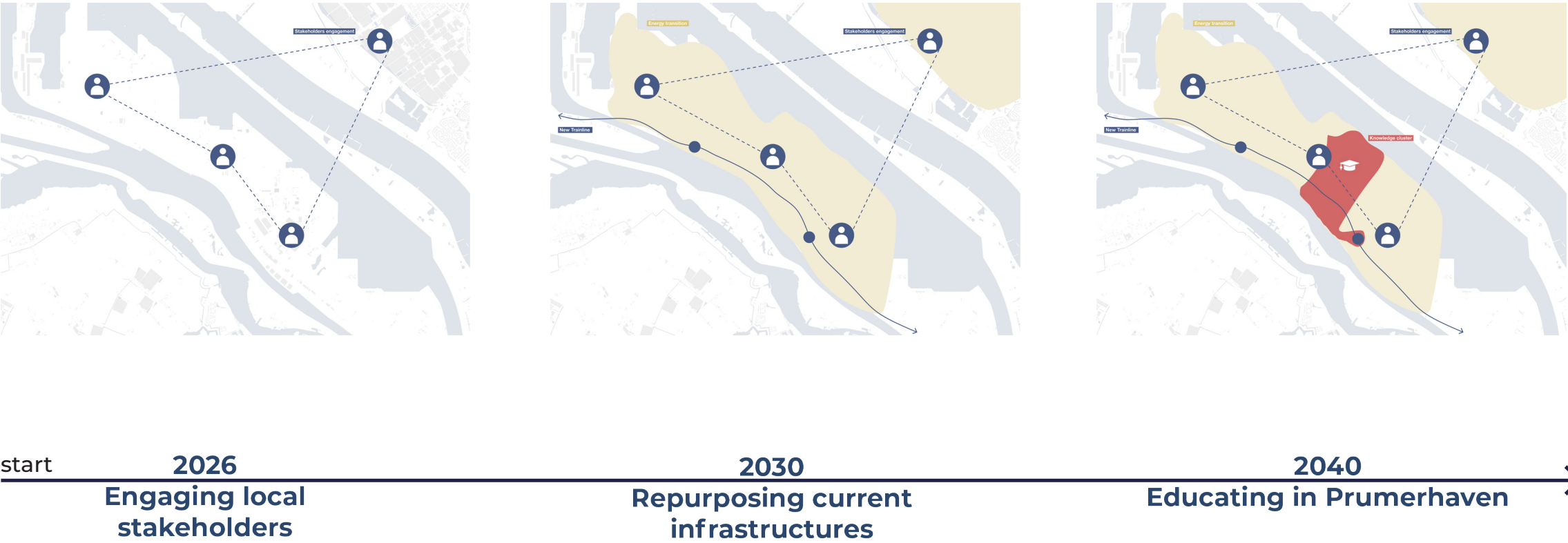


Figure 90: Prumerhaven phasing

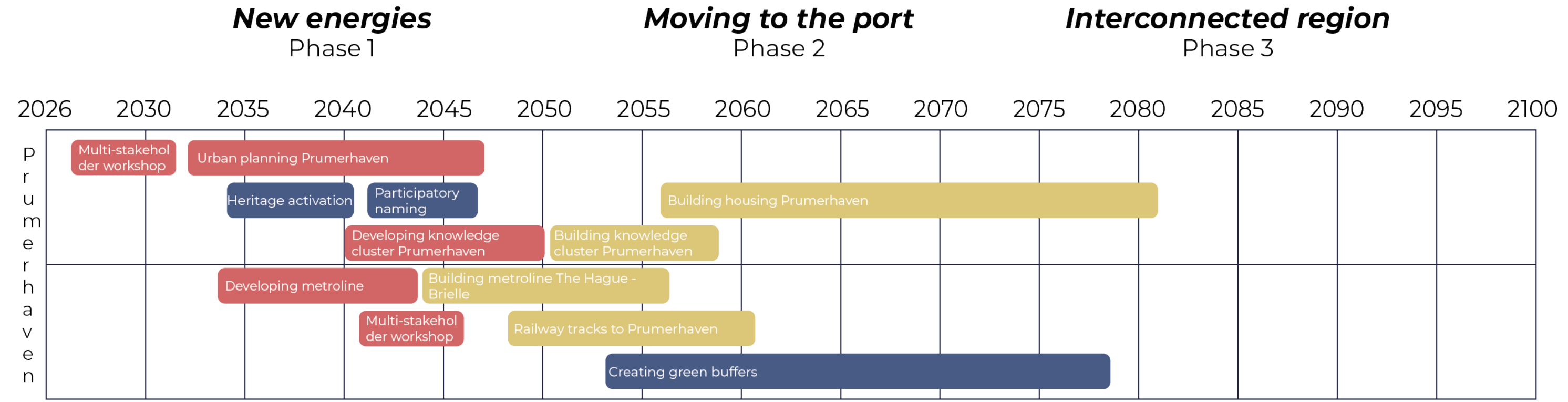
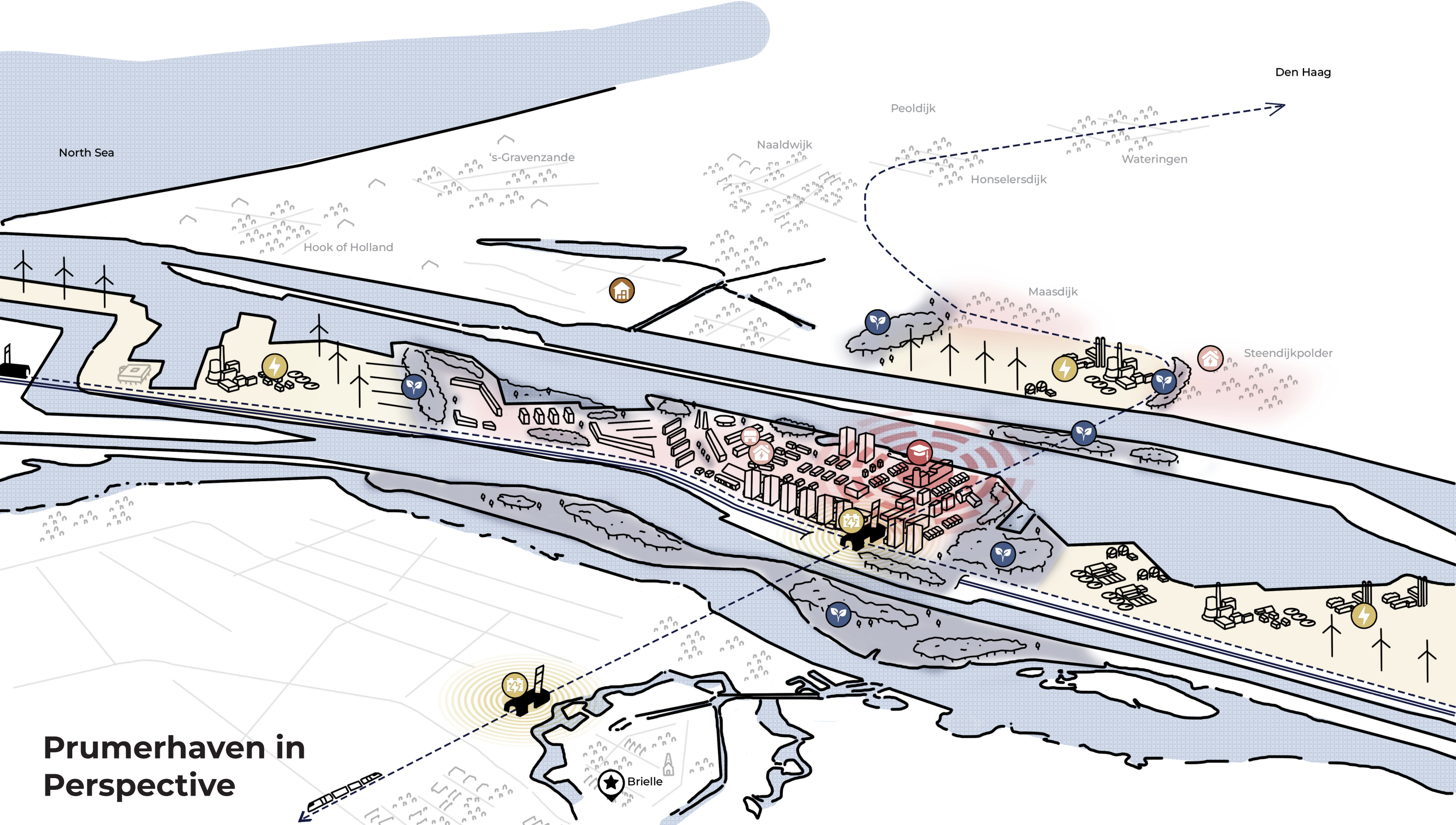


Figure 91: Prumerhaven phasing timeline



Prumerhaven in Perspective

- Legend**

Zoning

 - Living, commercial and working area
 - Logistic area
 - Repurpose area for Renewable energy area
 - Buffer area
 - Initial rail way
 - High way
 - Education central area
 - Transit point
- Function**

 - Education area
 - Residential
 - Logistic Industry
 - Energy hub - transit
 - New energy innovative area hub
 - Buffer
 - Landmark



Figure 92: Europoort A



Figure 94: Europoort B

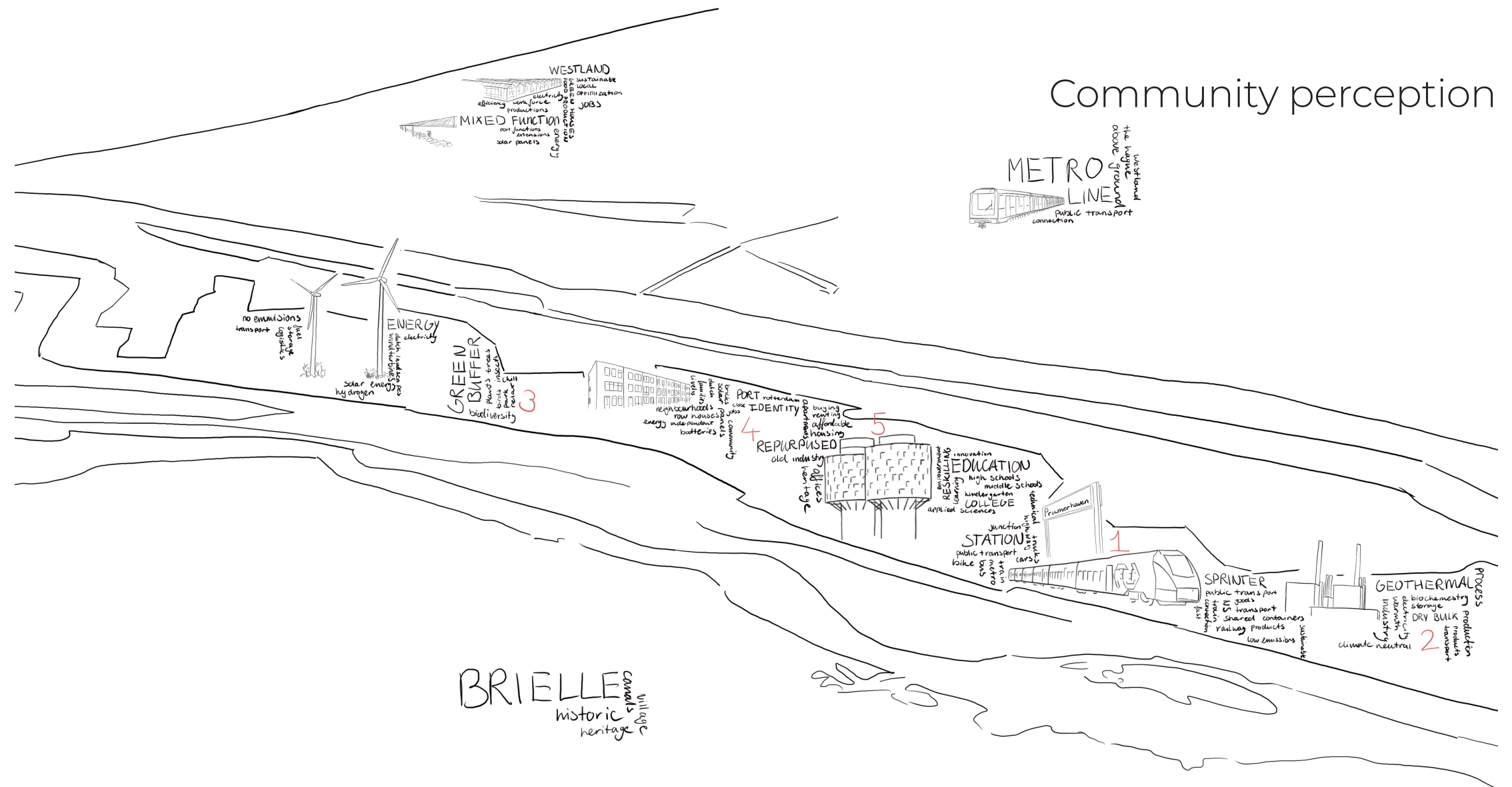


Figure 93: Rotterdam, Europoort, Hartelkanaal, het Calandkanaal en de Nieuwe Water (Aerophoto-Schiphol, 2020)



Figure 95: Europoort C

Current state of surface



Community perception

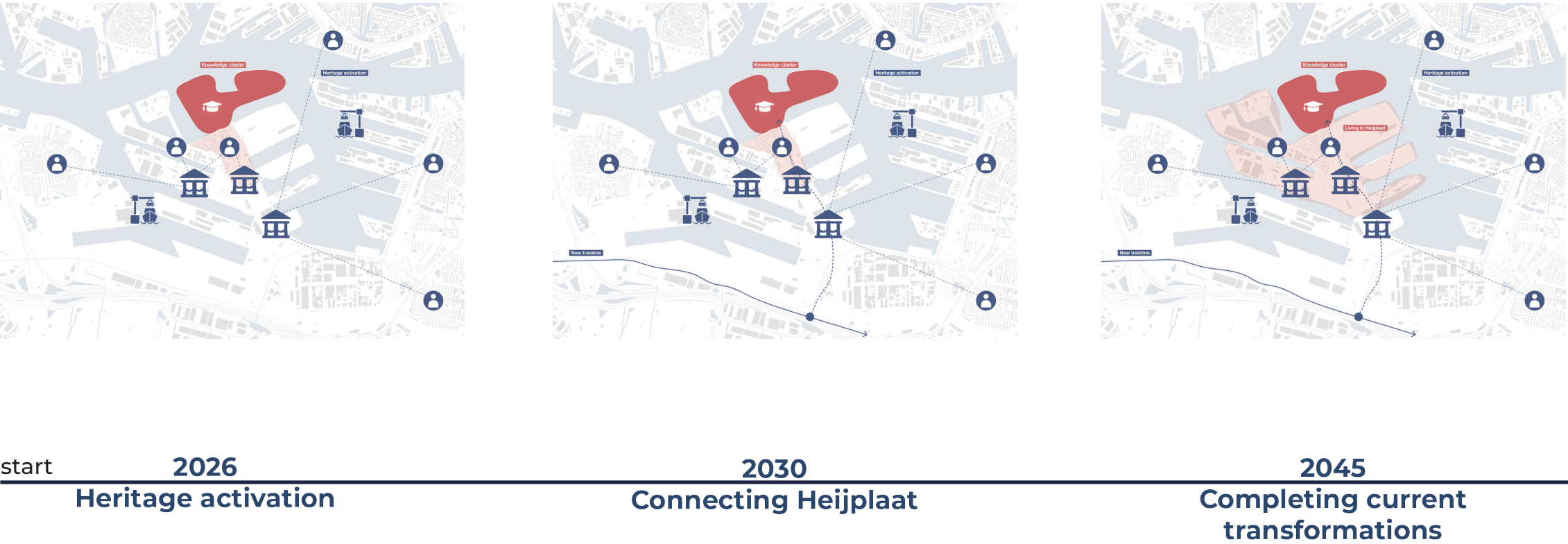


Figure 96: Heijplaat phasin

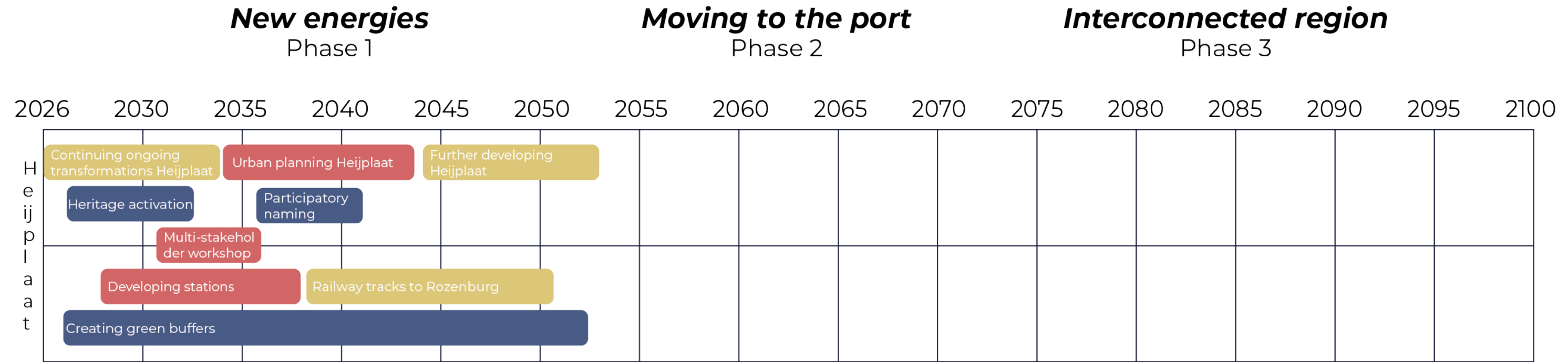
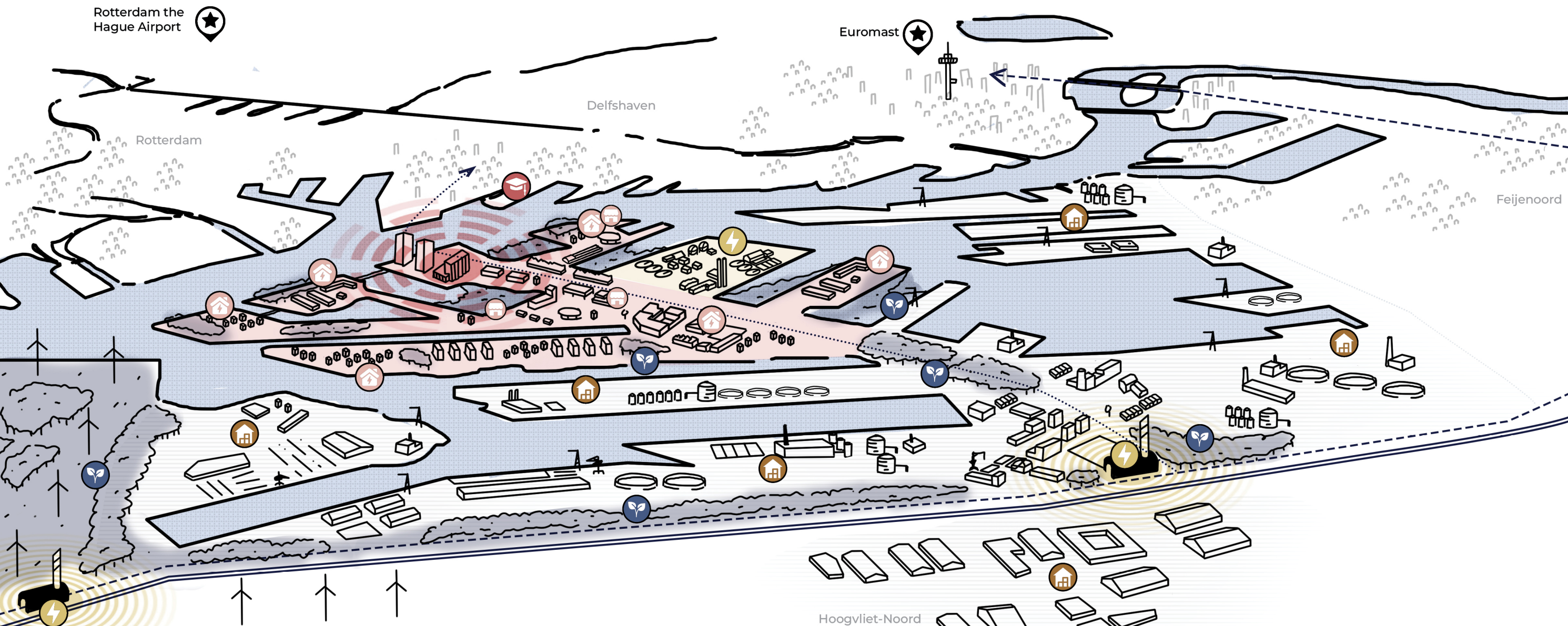


Figure 97: Heijplaat phasing timeline



Heijplaat in Perspective

- Legend**
- Zoning**
- Living, commercial and working area
 - Logistic area
 - Repurpose area for Renewable energy area
 - Buffer area
 - Initial rail way
 - High way
 - Education central area
 - Transit point
- Function**
- Education area
 - Residential
 - Logistic Industry
 - Energy hub - transit
 - New energy innovative area hub
 - Buffer
 - Landmark

Community perception



Figure 98 : Heijplaat A



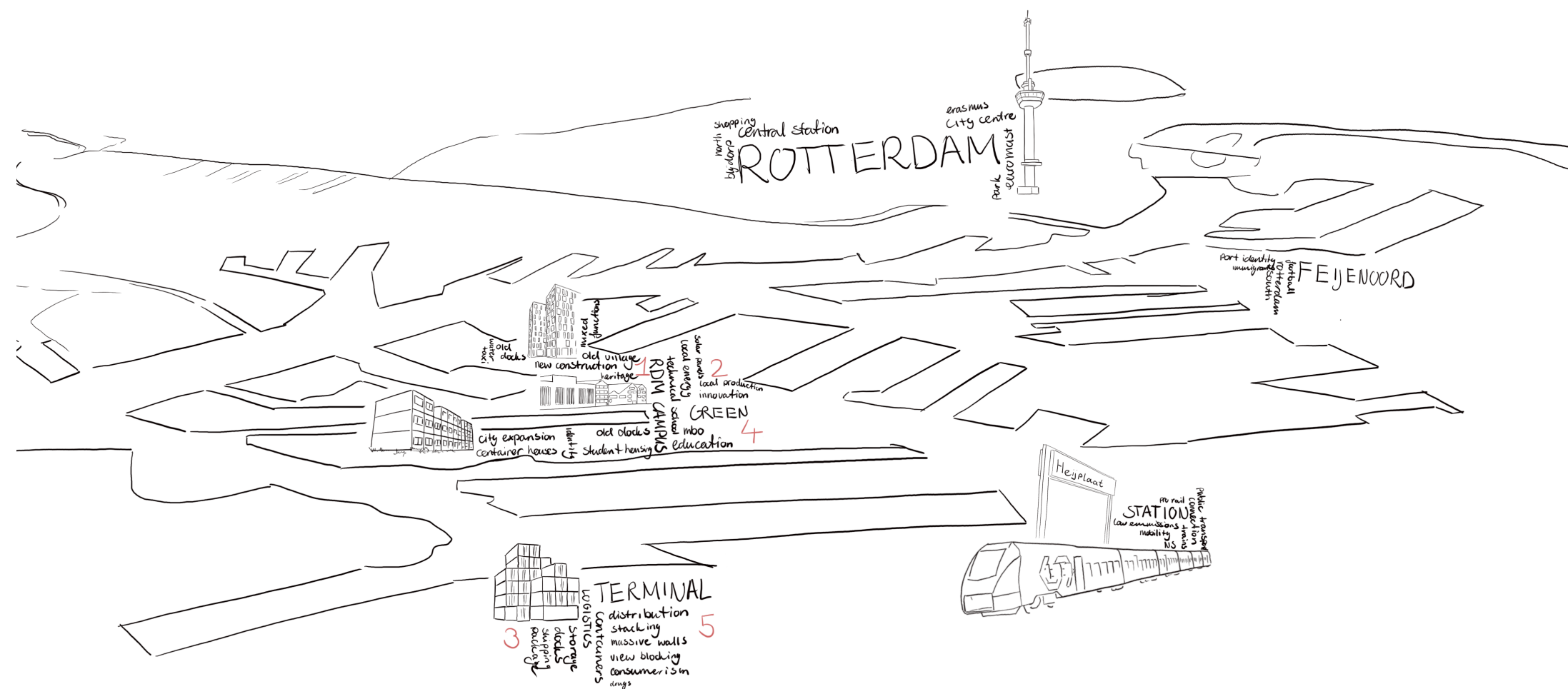
Figure 100: Heijplaat B



Figure 99 : Heijplaat C



Figure 101: Heijplaat C



Current state of surface



Social stratgies from practice
Spain's Just Transition Institute and Tripartite Coal Accords (2018>)

Governance innovation

- Just Transition Agreements (JTAs) were adopted by Spain's Climate Change and Energy Transition Law (2021) as enforceable co-governance tools. They ensured operators, governments, and unions made shared transition commitments, monitored by commissions every six months.
- Resulted in 15 signed JTAs, impacting 197 municipalities and eight Autonomous Communities. The dedicated independent body implements and monitors the agreements, called the Instituto para la Transición Justa (ITJ).
- Similar to the proposed Rotterdam governance model: market access depends on labour commitments. The tripartite structure makes unions co-governing actors with equal agenda setting rights.

Lessons for Rotterdam

- The monitoring commission forms the example of what the Accord's compliance governance architecture needs, forming an institutionalised deliberative forum.
- Transition timeline and sequencing are negotiated objects, not managerial prerogatives.

Critical failure mode: things to be cautious about

- Transition timelines are mostly set without labourer influence. JTAs are temporal governance tools that subtly shape outcomes rather than providing actual agency. The agenda is mostly set by the government-industry dialogue, before the tripartite forum begins.
- This reflects directly to Rotterdam: delegating compliance to the Port Authority's Concession Compliance Unit reproduces the asymmetry

Spain failed to fix. An autonomous tri-partite compliance body is the bare minimum, validated empirically, not merely theoretically.

Spatial lesson

- There persists a spatial disconnection between retraining centres and new employment locations, with workers being retrained in Asturias and Teruel, after which they relocate to Barcelona or Madrid. The Accord should thus retrain in the port or in its port communities, since the Spanish example makes binding spatial targeting a governance necessity instead of a design preference.

Port of La Rochelle: "Collective" and "Accompanying" Governance

Governance innovation

- Carter (2024) demonstrates three port governance modalities: regulatory (top-down), accompanying (state-facilitated voluntary transition - current Rotterdam governance), and collective (negotiated co-produced transition strategies). La Rochelle already functions collectively, because the port authority built a shared institutional identity among involved stakeholders. Here the circular economy strategy is designed as a governance act that creates confidence, exchange, and federative practices among stakeholders.
- This relates to Port of Energy and HCCE in Rotterdam's current governance: soft power building relational preconditions for binding

compacts.

Lessons for Rotterdam

- Deliberative governance platforms must be constituted before binding compacts are formulated. Shared identity and relational capital are prerequisites for productive conflict, not alternatives to it.
- "territorial interdependency" forms the analytical foundation for the Port-City-Hinterland Governance structure (Carter & Drouaud, 2022): Westland greenhouse transformation and The Hague-Westland transit corridor are territories through which the transition is actually made.

Critical failure mode: things to be cautious about

- The collective actor in La Rochelle depoliticises the conflict needed to be held: if a port community identity is formed, agreement on narrative becomes fundamental to participation. By contesting transition framing as an union, this actor is framed as a disruptive outsider rather than an actual co-governing actor.
- Productive conflict must thus be institutionalised by the Rotterdam Compact, retaining the ability to shape timelines, compensations, and disruptive capacity without losing its governance seat. The independent compliance body enforces this, decoupling enforcement from consensus building in the deliberative forum.

Spatial lesson

- Port ecological transitions go beyond port boundaries along the sea, into the hinterland energy corridors (Carter & Drouaud, 2022). This necessitates cross-jurisdictionary governing spaces. The mutli-municipal governance approach that Rotterdam 2100 proposes forms the appropriate approach, validated in French territorial governance.

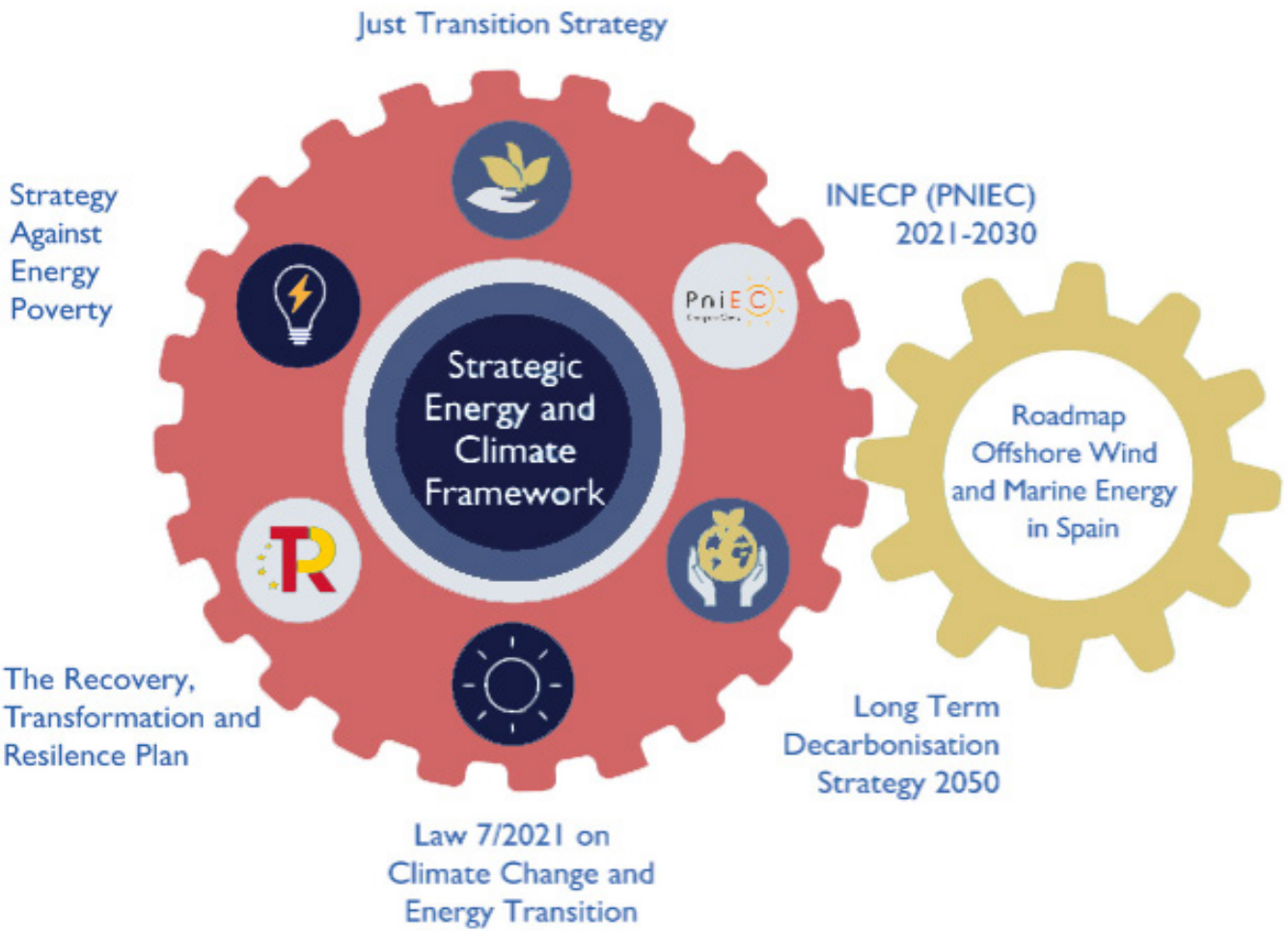


Figure 102: Roadmap Offshore wind and marine energy in Spain. (Ministry for Ecological Transition and the Demographic Challenge, 2022).

Hamburg Sustainable Energy Hub (2023>) - community driven?

Governance innovation

- Launched in 2023, Hamburg Port Authority appointed several sustainable energy priority zones, with SEH functioning as a cluster coordination platform for shared infrastructure, projects, and grids.
- Moorburg forms Hamburg's Green Hydrogen Hub, similar to Rotterdam's E-Fuel Repurposing Programme: energy assets converted through public-private investments over market substitution.
- However, HafenCity is a community-integrated governance model, governed through a phased masterplan, dedicated public development company, and embedded public consultation and community association mechanisms.

Lessons for Rotterdam

- The SEH's cluster coordination logic should be adopted for co-designing shared infrastructure, coupling transition activities spatially, and coordinating joint feasibility work between firms.
- HafenCity's corrective governance architecture further contributes through review points, public consultations, community integration, and phased masterplanning. Due to their embeddedness from the start, they're incorporated into industrial commitments rather than included afterwards.

Critical failure mode: things to be cautious about

- The SEH has no time-bound delivery commitments, community governance architecture, or formal role for trade unions. Community involvement is more focused on improving communication than improving co-governance.
- Rotterdam poses a greater challenge,

because Botlek-Europoort form great industrial clusters with communities bearing transitional burdens, making community-integrated co-governance even more necessary.

Spatial lesson

- The phased governance of HafenCity created a time-bound accountability structure across a 25-year horizon. But the SEH does not have similar architecture rooted in community outcomes.
- The Port-City-Hinterland paradigm must thus be embedded in time-bounded milestones, part of the Compact's concession design. It reflects durable governance accountability in the industrial transition.

Physical strategy

Nordhavn - Copenhagen (Cobe, n.d.; LAP, n.d.)

Spatial strategy - 6 principles:

- Islets as neighbourhoods
- Harbour and cultural heritage
- City on the water
- Green loop - 5 minute city
- Urban green
- Intelligent grid

Strategy for development:

- Inner islet is the first to be developed
- One islet designed and developed at a time to leave space for insecurities and challenges of the future
- Using existing structures as starting point for the new development

Strategy in phases :

- Attracting people:
 - Iconic public attractor like a museum or clubs
 - Mixed program of housing, shopping and working
 - Introducing Green quay's
 - Natural rainwater basins

- Luxury boat industry
- Introducing public transport - Water taxi
- Sustainable critical mass
 - Nordhavn park, sports fields and ecological water edges
 - Dense urban program
 - Sustainable energy sources
 - Program of mixed use
 - Offices and Living
- Independent sustainable district
 - Transport mainly by metro, combined with mobility hubs
 - Central parking, mobility hub at metrostop
 - Low rise buildings and small public spaces
 - Nordhavn park, squares and wide views
 - Harbour heritage used for cultural programs
- Pedestrian district
 - Mix of large green structures on and around buildings
 - Introducing the luxury houses and smaller units
 - Sculptural architecture
 - Densification creates more services
 - Ferrydock with old harbour heritage
- The future
 - Copenhagen sustainable skyline towers
 - Free zone for artists and marine life
 - Solar energy installation on the water
 - Ecology barrier
 - Energy winning city

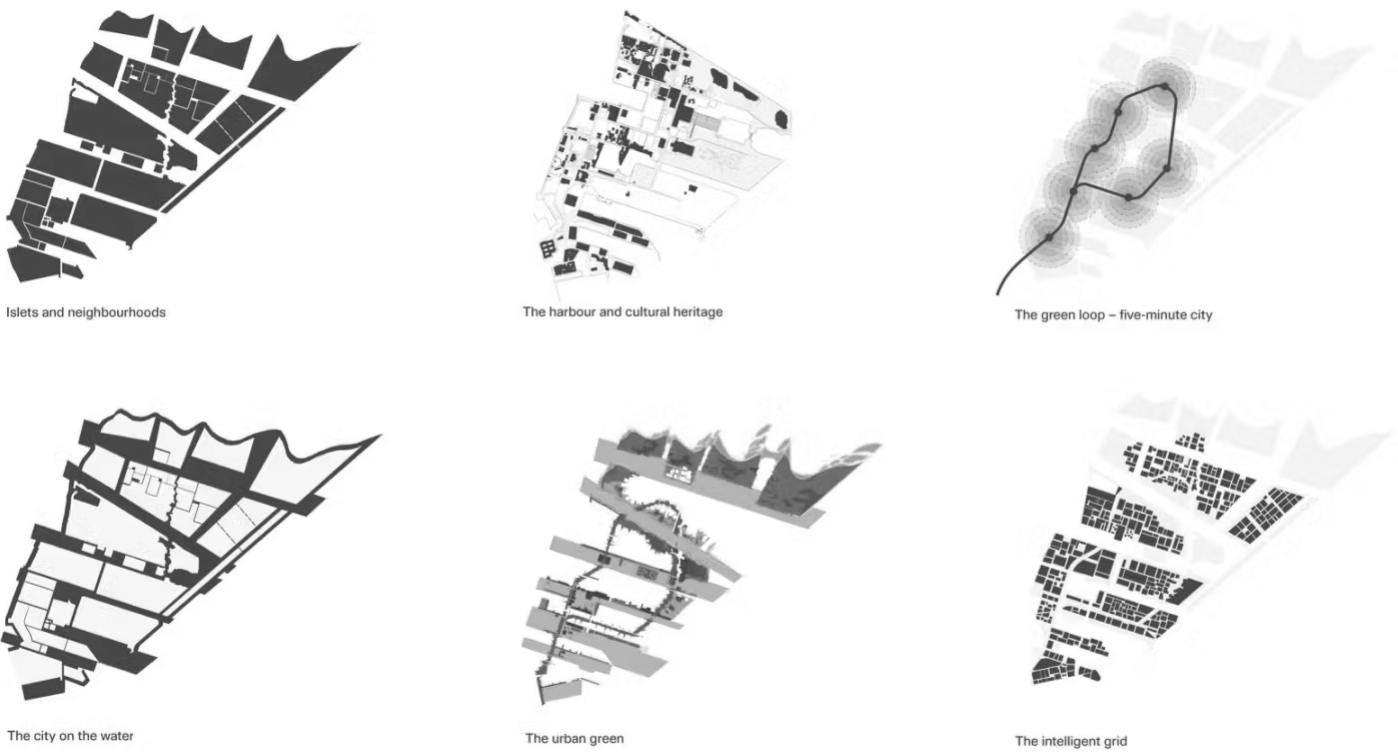


Figure 103: Nordhavn – Cobe (Cobe n.d.)

Hafencity - Hamburg
(KCAP, n.d.; The City at Eye Level, 2018)

Strategy:

- Flood prevention - elevated infrastructure and buildings, promenades at water level
- 8 sub-districts implemented in phases
- Land-purchasing and -developing strategy
- Each plot has a specific set of criteria for the site - low prices to attract new use and experimentation
- Ground floor concept - activity at ground level
- Founded set of associations made up of community
- Residents and commercial uses
- Flexible system
- Fine-grained mix of functions for diversity and openness
- Preserve old harbour structures and identity

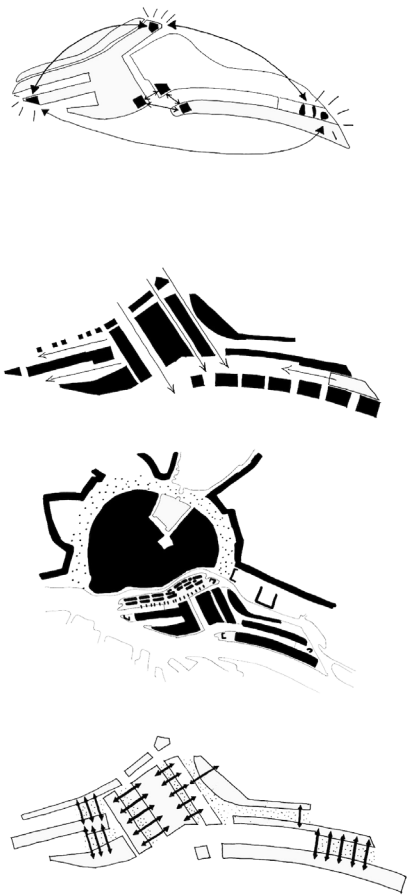


Figure 104: Hafencity
(Hamburg KCAP, n.d.).

Mental strategy

Biennale:

Recurring cultural events like Manifesta (European Nomadic Biennale) demonstrate how art biennials can catalyse urban transformation beyond temporary spectacle. By embedding artistic programmes within post-industrial sites and involving local communities in the curatorial process, biennials generate lasting spatial and social legacies. For Rotterdam's port, a biennial format centred on energy transition could position Maasvlakte as an internationally recognised site of innovation, while anchoring the event in the everyday lives of port workers rather than external audiences (Biennale, n.d.; Comune di Livorno & Visit Livorno, 2025; Mediterranei Invisibili, n.d.).

Narratives:

Industrial communities have long used storytelling to make sense of structural change. From IBA Emscher Park's cultural rebranding of the Ruhr to Nantes Patrimonia's collaborative heritage platform and the American Factory documentary's worker-centred perspective, effective narrative strategies foreground lived experience over institutional messaging. For the port of Rotterdam, building narratives from within, through oral histories, participatory archives, and worker-led documentation, produces more legitimate and durable identity shifts than top-down communication campaigns. (Dinarama, 2022; IBA, 2019; Le Voyage à Nantes, 2025; Nantes Patrimonia, n.d.; Prima Events & HYPEUP, 2026)

Perceptions:

Changing how a place is perceived requires physical encounter before symbolic reframing. Projects like the High Line, ZUS's Luchtsingel, and Milan's Piazze Aperte show that spatial interventions, even temporary ones, alter how people relate to places they previously ignored or feared. For Maasvlakte and Heijplaat, the sequence matters: access precedes experience, experience precedes meaning. Tactical interventions that invite the body into the space are the prerequisite for any deeper perceptual shift (DS+R, n.d.; Prati, 2023; Saner, 2025; ZUS, n.d.).

Communication:

Participatory communication strategies, such as Wyoming Voices' digital storytelling with coal communities or SHAPE Energy's multi-stakeholder workshops, demonstrate that the most effective transition narratives are co-produced, not broadcast. When workers themselves articulate what is changing and what is at stake, the message carries legitimacy that institutional campaigns cannot replicate. For Rotterdam's port workers, communication tools should function as instruments of agency, not channels of persuasion (Centre for the New Energy Economy, 2025; Energy Cities, 2023; Wyoming Semiquincentennial Planning Task Force, 2026).

Critique:

The risk of mental strategies is well documented in critical placemaking literature. Fincher (2016) concept of place-masking warns that cultural interventions can obscure power conflicts behind consensual narratives. Moran and Berbary's (2021) notion of

placemaking as unmaking reminds us that every new identity suppresses an existing one. Pritchard's (2017) place-guarding reframes the goal entirely: rather than building new meaning, the priority may be protecting what communities already value. These critiques are conditions for using mental strategies responsibly, they are not absolute negations of their effectiveness (Alexander & Berbary, 2021; Fincher et al., 2026; Keidar et al., 2023; Pritchard, 2020; Shaw, 2002).



Figure 105: Piazze Aperte: How Milan Gave its Piazze Back to the People - Global Designing Cities Initiative (Prati, 2023).



Figure 106: La biennale dello stretto II (ennale Invisibili Mediterranei Invisibili, n.d.).

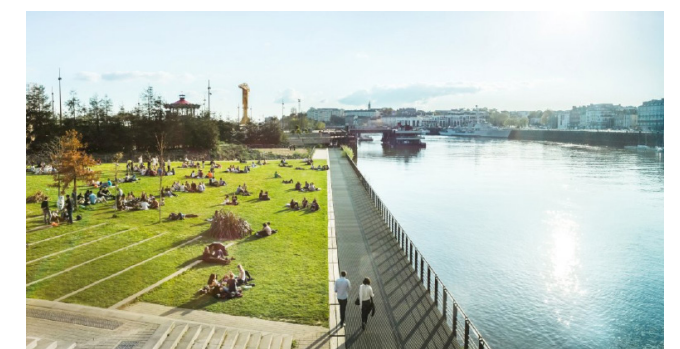


Figure 107: Visit Nantes: Ile de Nantes district (Le Voyage à Nantes, 2025).

Education Hub

The educational hub will act as a major catalyst for increased vibrancy and activity in the area. These education hubs in each area are connected with the new railway in the Port area. Through these connections, it generates higher economic growth and organically triggers development in surrounding sectors.

The presence of the educational institute, with its student and staff population, creates immediate demand for commercial services (shops, cafes, restaurants) and housing (student accommodation and residential units). This demand fuels the creation of new work opportunities in the retail, hospitality, services, and construction sectors.

Furthermore, the institute's focus on new energy transitions and its connection to the energy innovation area will attract research and development firms, start-ups, and related businesses, leading to a mix of academic, commercial, and professional activity. This concentration of people, businesses, and knowledge will strengthen the area's identity and value, making it a lively, attractive destination.

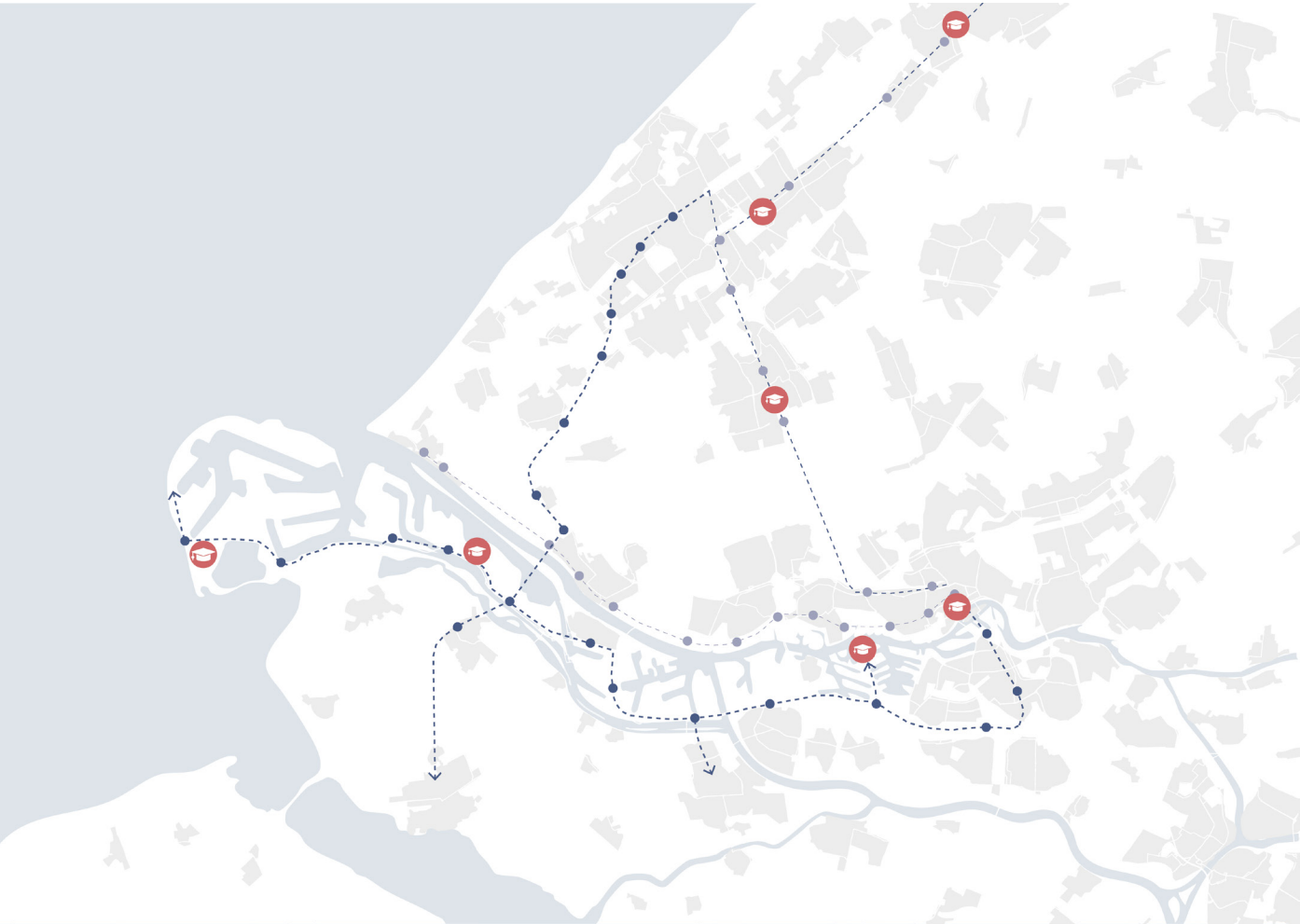
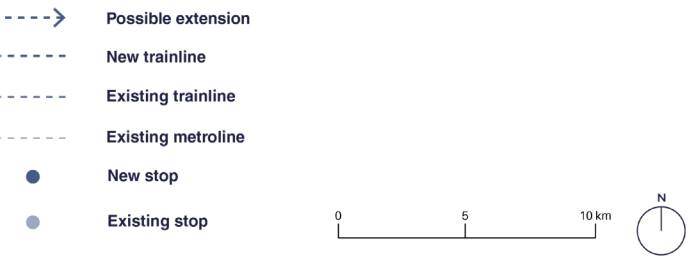


Figure 108: Education hub

Work In Progress



Figure 109: Education hub collage

Work In Progress

Energy Innovation Area

This area is a central element of the implemented plan, visually showcasing the transition from fossil fuels to a clean, renewable energy system. It involves repurposing existing infrastructure for the production and storage of clean energy, such as hydrogen, wind, and solar. This area is directly connected to the windmills in the North Sea and later integrated with the wider North Sea energy network. This integration solidifies its role as a key hub for the energy transition.

The area functions as a “living lab,” connecting an educational hub with a real-world research environment to foster innovation in the new energy sector. Furthermore, the plan

includes connections with nearby neighbourhoods to promote a more decentralised energy network, bringing the benefits of clean energy directly to the community.

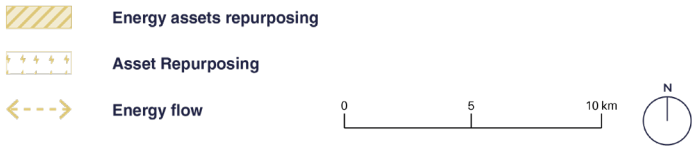


Figure 110: Energy innovation areas

Work In Progress



Figure 111: Energy innovation area collage

Work In Progress

Energy Community Hub
The station will function as an energy hub, where residents produce their own energy using solar panels while remaining integrated with nearby stations. The introduction of a new rail connection will link the neighbourhood, encouraging more people to use public transport to access other areas of the port, thereby leading to less emissions. This new rail infrastructure will also help residents living near the port feel more connected rather than isolated.



Figure 112: Energy community hubs



Figure 113: Energy community hub collage

Housing

The Port is designed as a sustainable, mixed-use, energy-autonomous community that cultivates a strong, innovative identity by centring on enhanced livability and resident integration with local energy systems. It achieves energy independence through solar power and a central hub, fostering engagement across a diverse, multi-generational neighbourhood that includes floating and mid-rise housing units. This integrated living concept minimises commutes and strengthens the neighbourhood by co-locating residences, educational facilities, and energy infrastructure. Furthermore, new rail infrastructure connects the historically isolated port to surrounding areas. A commitment

to adaptive reuse sustainably transforms former factories and fossil fuel infrastructure into new housing and offices, linking the site's industrial past with its self-sufficient, green future.

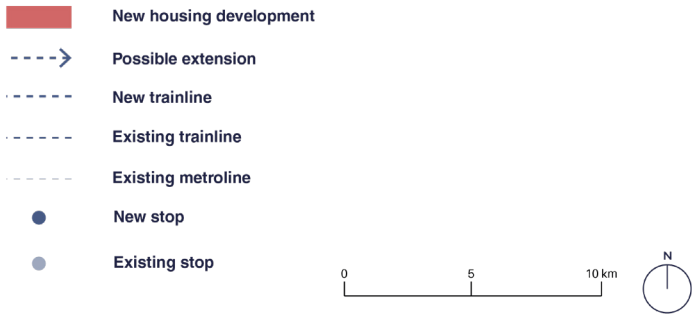


Figure 114: Housing

Work In Progress



Figure 115: Housing collage

Work In Progress

Logistic Hub

These areas will maintain their logistical function, but with increased integration into the new energy system. The primary logistics hubs are located in Maasstrand and Heijplaat, strategically located near the city boundary at the end of the logistics zone. These hubs are efficiently connected to the new railway system, which extends into the surrounding neighbourhoods, facilitating the distribution of goods to much further and rural areas. This area is integrated with a new energy grid, creating more efficient and lower emissions in the port of Rotterdam.

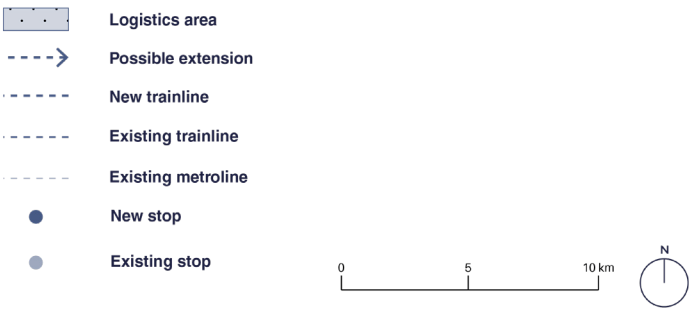


Figure 116: Logistic hubs
Work In Progress



Figure 117: Logistic hub collage
Work In Progress

Green Buffer Zone

The buffer serves a dual purpose: it acts as a transition zone, allowing people to live closer to the industrial area and connecting with existing green spaces. These spaces enhance the neighbourhood's quality of life, safety, and health, while also boosting biodiversity within the port. The buffer helps mitigate the visual and noise pollution from the port, softening the hard edges of the industrial zone.

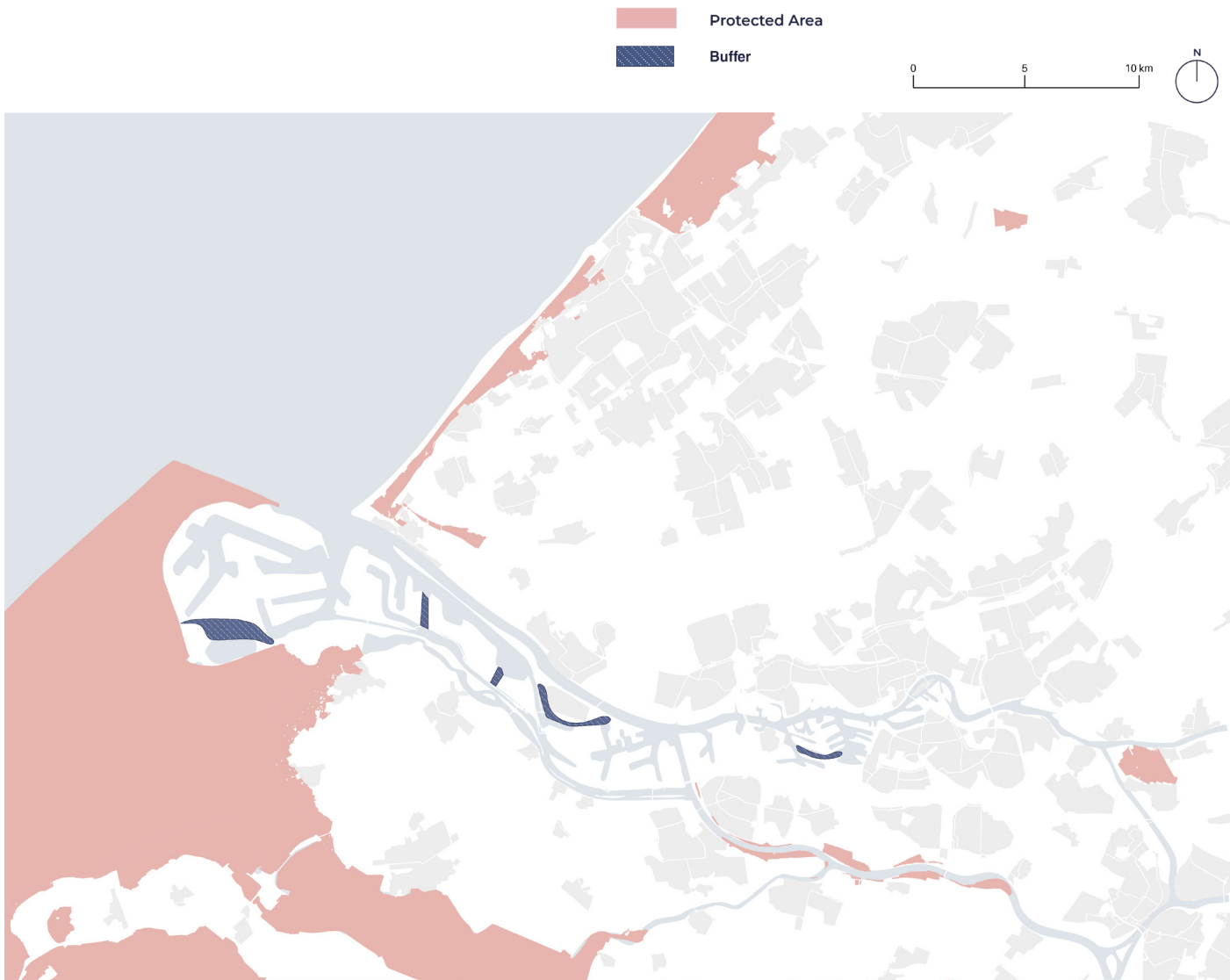
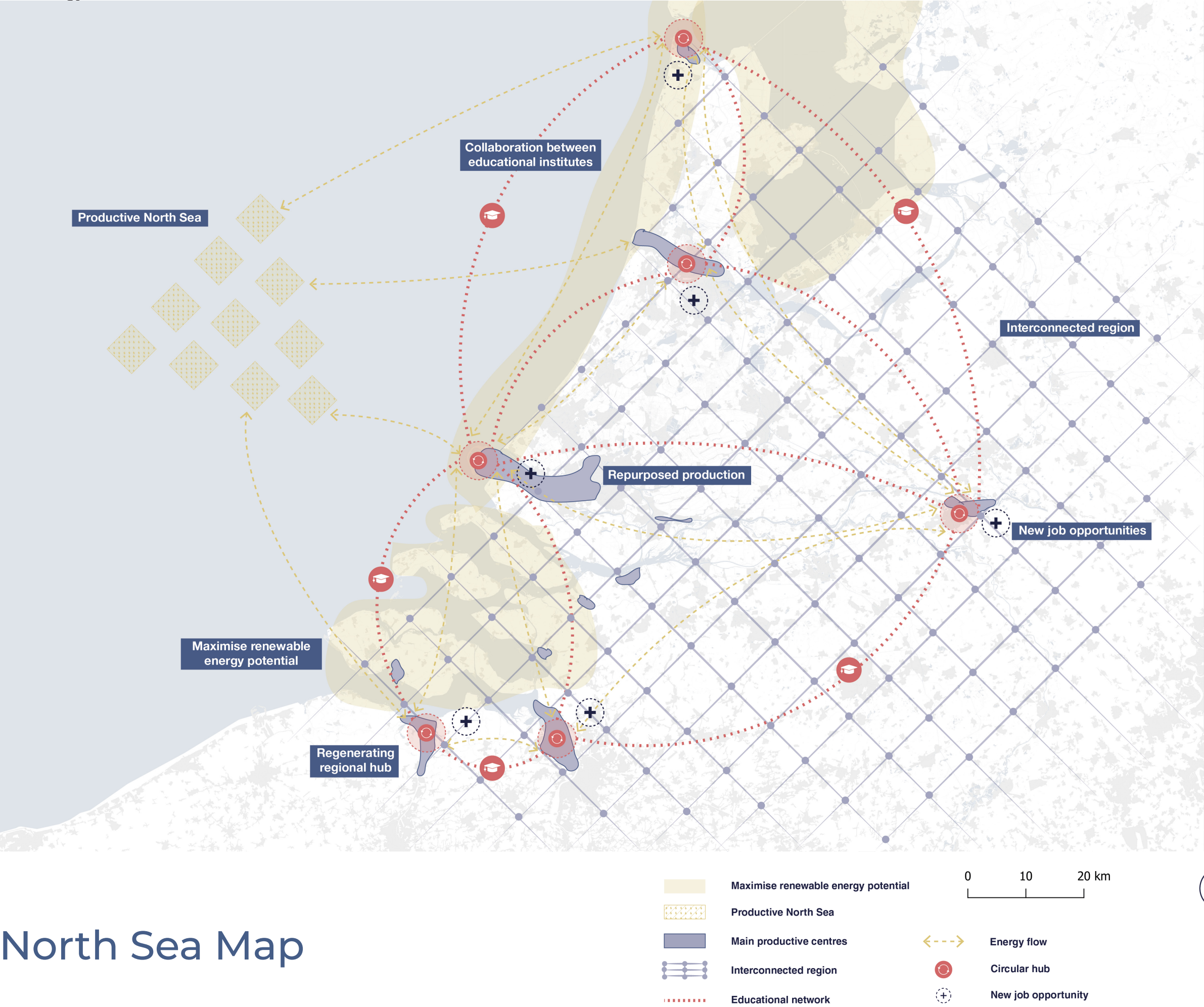


Figure 118: Green buffer
Work In Progress



Figure 119: Green buffer collage
Work In Progress



North Sea Map

North Sea Map
The large-scale application of the proposed strategy positions the Port of Rotterdam as the core engine of the North Sea Energy Hub. Beyond local interventions, the strategy integrates a regional energy grid, connecting offshore wind landing zones and hydrogen pipelines to the European hinterland. This ensures the port remains a global metabolic powerhouse while fostering industrial symbiosis across the entire region. The whole region strengthens its connectivity through a large-scale infrastructural project, creating new connections across the Netherlands and neighbouring countries. Socially, the strategy establishes a regional knowledge network, linking educational hubs to new green-tech clusters to facilitate a just workforce transition. By synchronizing large-scale physical infrastructure with social equity, the strategy secures the port's economic future while upholding intergenerational justice across the North Sea basin. This holistic approach transforms the port from an isolated industrial zone into a connected, regenerative regional anchor.

Figure 120: North Sea Conclusion Map

07 Conclusion

Conclusion

An urgent challenge persists for the Netherlands to transition to energy-neutral systems by 2050 to mitigate its climate impact. The Port of Rotterdam forms a fundamental territory in this shift, processing nearly 12% of Europe's energy demand. This makes it the country's largest petrochemical hub, but especially the biggest decarbonisation opportunity. However, existing governance mechanisms predominantly focus on the infrastructural and technical challenges associated with the transition, leaving the 192,000 workers directly dependent on the port to bear the transition costs without co-governing rights. This especially affects young and early-career workers, entering a labour market too late for stable fossil-based employment opportunities, yet too early for reliable careers in the e-fuel economy. This is researched through the following central question:

"How can the Port of Rotterdam shift from an oil-based refinery toward renewable-based energy systems in a way that secures inclusive, intergenerational employment justice, and strengthens its role as a North Sea energy hub?"

The answer to this question is not solely rooted in spatial redesign or technology substitution, but requires simultaneously restructuring space, governance, and employment opportunities. This is done through the Port Energy Transition Compact, which binds the e-fuel industrial transformation with land repurposing and youth labour opportunities into one framework. Here, the E-Fuel Repurposing Programme sequences the transformation of industrial assets and fossil-based infrastructures through setting concession conditions. Similarly, the Port Skills and Labour Accord also sets concession conditions, but specifically focused on binding retraining commitments, portable credentials, and youth hiring quotas in favour of the community needs. This is operationalised through the mixed-use transformations of the three areas, Heijplaat, Prumerhaven, and Maasstrand. These areas close the geographic gap between communities facing displacement costs in Rotterdam South and the emerging e-fuel employment cluster in and near the Maasvlakte via improved public transit corridors and educational facilities. Residents furthermore participate in the energy transition through energy-producing communities dispersed throughout the region. Applied in this port region, this forms a scalable pilot across similar fossil-dependent industrial territories in the Netherlands, extending national frameworks such as the Programme Energiehoofdstructuur and MIEK.

“Which parts of the Port of Rotterdam’s current industries are most feasible to repurpose, and why?”

The Port of Rotterdam is home to various pipeline and utility corridors, terminal interfaces, heat, and power infrastructures. Through concession design, infrastructure provisioning, and land leases, the Port Authority directly controls these assets. Specifically in Heijplaat and Maasstrand, relatively short leases allow for fastened, yet phased transformations. In Prumerhave, multi-decade leases make transformations more difficult to achieve. However, even here, a phased strategy, transforming the region from its core onwards, extending it when leases run out, will make the transformation possible over time. This makes repurposing feasibility predominantly a governance question instead of a technical one.

“How will current and future employees be impacted by the energy transition, and how can this be bridged to ensure employment security?”

Demand for transition functions such as system operators, electrolysis technicians, digital control, cybersecurity, and safety compliance roles will rise. Simultaneously, existing operational jobs in terminal handling and refining will slowly diminish. However, because these workers are mostly practically trained, vacancies will emerge due to the growing qualification mismatch. This mismatch is mitigated through the Port Skills and Labour Accord via credential portability and retraining rights. To meet employer demands, the curriculum of the educational corridor is institutionally aligned. These educational institutes are made accessible by placing them within a 30-minute public transit ride from Rotterdam South.

“How can the port of Rotterdam strengthen its local, national, and international position through the energy transition?”

The mixed-use redevelopments create a connected port territory which is accessible and economically diverse, retaining the port labour communities locally rather than displacing them. Nationally, the vision for Rotterdam anchors it as the essential land interface for North Sea offshore energy flows, ensuring alignment with energy security and

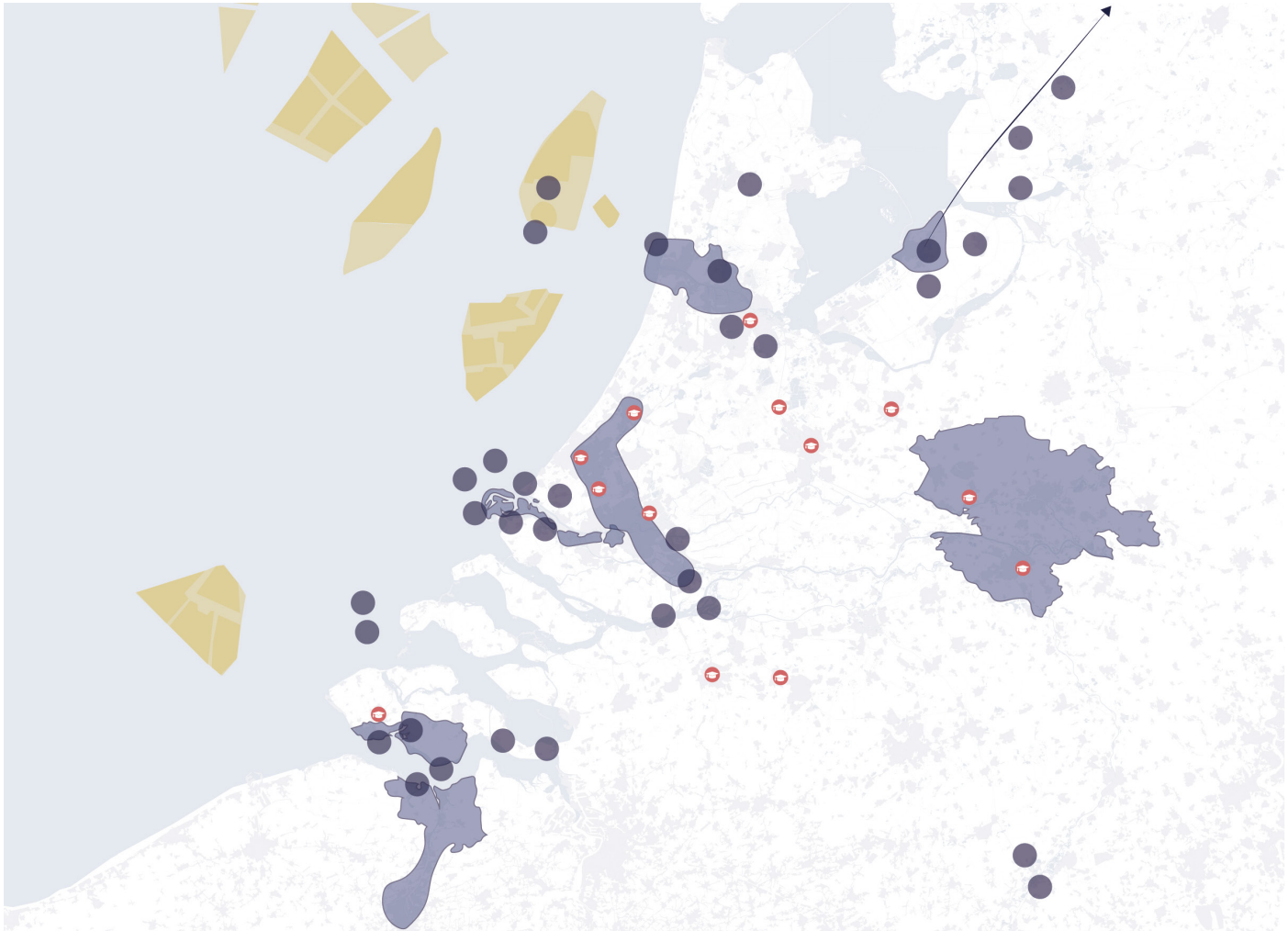


Figure 121: Relation to National plans

Relation to National Plans

industrial decarbonisation policies proposed in the MIEK. This extensive network of hydrogen, e-SAF, and CCS infrastructure in connection to the North Sea makes Rotterdam the gateway to European hydrogen distribution and e-fuel imports, establishing itself as a global hub for the energy transition, anchored in REPowerEU.



08 Reflection

Group Reflection

To understand if the vision and strategy actually contribute to the fair representation of our chosen community and society at large, we must reflect on their implications on these facets. This reflection will function as an extension to the conclusion, going more in-depth into the success factors of the proposed plan. On the other hand, this joint reflection also forms the basis of the later personal reflections. The joint reflection, namely, identifies the lessons learnt in formulating and finalising our project, allowing us to more personally relate these lessons to how we interpreted the course. Together, this allows us to conclude this course, bringing its experiences along for the following projects to come.

Community

What is the added value for the community, and what public goods are created?

The proposed strategy adds the opportunity for communities to anchor themselves in a new place, which can increase social cohesion. These places are strengthened with more jobs in different sectors and more public spaces. The public goods, like the beach at Maasstrand, are made more accessible and in every village, new parks and green spaces are introduced. Not only the addition of more plants, but also the removal of fossil industries, contributes to cleaning the air and a healthier environment.

Does the vision translate the community's wishes into reality through the proposed strategy?

Although it was very difficult to find the specific wishes of the community of young port workers, we eventually translated their wishes through research conducted on their generation. So the wishes are not specified to port workers; they most likely do share the same ideas and wishes as their peers. They are well represented in the strategy, with only some slight modifications from the stakeholder analyses compared to the community's vision.

How well is the community engaged, and how beneficial is the strategy for them?

Throughout the phasing of the strategy, we tried to engage the community in different layers, which was an important part of our framework, as the mental dimension. They are an active part of the process, mapping heritage, naming structures and being part of the planning through participation.

The strategy not only makes room to realise the plan, but it specifically contributes to the community's well-being by formulating goals such as more housing options, greater job opportunities, more public spaces, community engagement, and better transportation.

How are barriers to participation (e.g., language, literacy, time, digital access) being mitigated?

We must acknowledge that we did not have enough time to discuss the topic of participation to this level of detail. Nevertheless, we imagine the participation to entail multiple sessions with different people from the community representing different personas, invited to discuss certain topics, throughout the process. Additionally, informative evenings discussing the proposed plans with the community will also further facilitate equitable participation. In doing so, we mitigate the persistent barriers. Otherwise, a combination with an online survey could also add to the participation. In either case, all stakeholders will come together and discuss.

Is there space for disagreement, negotiation, and mutual learning?

For the most important stakeholders, there is space to share, discuss and learn from each other's vision. This will help to form an understanding of each other's needs, resulting in a mutually agreed strategy. However, we did not specifically discuss when these meetings would take place and how often. If more time were available, this would have been elaborated on more, creating a greater chance of successfully reaching an agreement among the stakeholders working together on a sustainable future.

Ethics

What kind of people and society does this strategy help us become?

Our aim is for this strategy to move into a future where those who are greatly affected, but have less power, will be included during the process of developing the strategy. In this way, designing the vision and strategy will be done through a societal perspective, combining community concerns with sustainability. This moves spatial planning towards a more bottom-up approach, whilst still including the other stakeholders affected by the proposal as well.

Does our strategy produce the greatest good for the greatest number of stakeholders?

We have designed our strategy with the idea in mind that it is beneficial for our community in the long-term, but others outside the community could also benefit from it. For example, the terminal operators losing power will be incorporated in investment opportunities in the redevelopment of the port, mitigating negative financial externalities. Although we always design trying not to exclude anyone, from the design table to realised projects, uncertainties always persist.

Pluriverse

How does the strategy acknowledge relationships rather than just actors or sectors?

We tried to acknowledge that on a complex site such as Rotterdam, multiple actors are at work. The workers keep the place going, the education institutes deliver the knowledge and come up with new concepts, the companies drive the economy, and the government bodies decide what can and cannot happen. By recognising this through the analysis of the existing governance structuring, and restructuring this governance paradigm into a future-oriented structure, we sought to understand the exact relationship between the actors and how to shape them in ways to realise the proposed strategy and vision.

Are we enabling the coexistence of multiple possible futures and experimenting with alternative ways of organising space, power, and life?

Embedded flexibility in the governance of the project enables multiple futures, instead of prescribing one transition path. The realised implementation is influenced by local conditions and negotiated through layered instruments, such as the PTJTP, Accord, and Automation Protocol. By linking industrial transformation to communities, socially grounded and adaptive port-futures are enabled. By experimenting with co-governance, new configurations of power shape the future governance of the Port of Rotterdam, and potentially many more ports to come.

Does the strategy allow for more-than-human actors to be seen as stakeholders or agents?

The focus of this project was more to empower the local port worker community, rather than to deliberately

empower the more-than-human actors. Nevertheless, our strategy allows for more direct involvement by ecological actors. In the governance reform, the Water Board gained more influence through its veto right on water safety and management issues. Simultaneously, wildlife gets represented better through the deliberate inclusion of its needs in redevelopment designs, whilst also attaining better representation through consultative rights in port-level decision-making via NGOs.

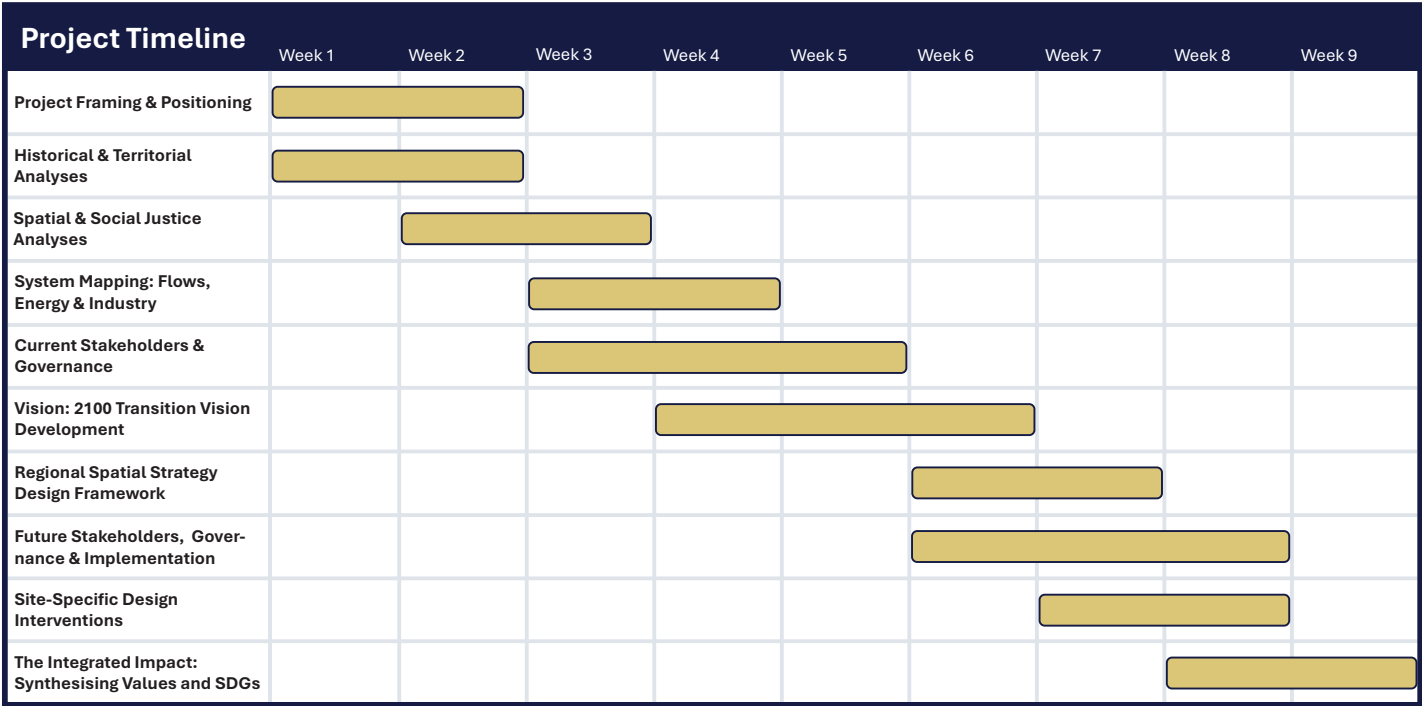
SDG´s

Reflect on the values and SDGs stated at the beginning of the report. What Sustainable Development Goals does our strategy support or enhance?
By combining the energy transition with social inclusion, the strategy aligns with SDGs 7, 8, 9, 10, 11, 13, and 17. It forms a just transition through the reduction of inequalities via inclusive governance, enhancing workforce reskilling in favour of industrial innovation and clean energy systems. This makes the transition socially and environmentally resilient through improved multi-actor partnerships, climate action, and sustainable integration.

Contribution

What does this work add to existing knowledge, debates, or practices? Does it fill a knowledge gap?
This work recombines labour governance, energy transition, and spatial planning into one framework, reframing the port transformation as institutional and socio-spatial. This goes beyond the normative “just transition” discourse by influencing binding instruments like spatial justice mapping, concession conditionality, and automation governance, tackling the literature gap between policy ambition and implementation. This illustrates how social equity should be institutionally embedded to facilitate a just transition of port systems through spatial and economic restructuring.

Timeframe



Limitations

What are the constraints and limitations of the research?
The research is limited due to the forward-looking, speculative nature of it. This makes it rely on projected long-term institutional change and policy adoption without the necessary empirical evidence to back this. Chosen case study examples, namely, offer limited generalisability due to their context-specific nature. By assuming that industry compliance, political will, and union capacity will fall in favour of the strategy implementation, its actual realised implementation might fall short. Concretely, the existing stakeholders could severely affect implementation through a variety of factors, from financial constraints, power asymmetries to resistance.

What are recommendations for future research based on this project's limitations?
The research can be elaborated on by testing the proposed instruments through policy simulations, pilot projects, or comparative case studies throughout different ports. Its feasibility would be determined by the positioning of stakeholders, especially governments, unions, and the largest terminal operators. To extend the new insights, measurable indicators for spatial justice and socio-economic outcomes should be developed, shaping the way governance innovations are effectively evaluated and how transition benefits and costs get redistributed among communities.

Figure 122: Project Quarter Timeframe

Meike Haan

I remember starting this quarter with a focus on both the social aspect of the human and more-than human communities. However, going through the process I understood how difficult and different the views, uncertainties and ideas already are within a community. Especially, since I think we as university students and perhaps also as Urbanists already have a strong opinion of our own when it comes to climate change and the energy transition. I found it really interesting to learn it could be viewed from so many more perspectives without excluding points from different views. A strong example of this was when we as a group chose our own age group as a community. It was first hard to not intertwine our own opinions into the communities, even though we are a part of the generation we are not representatives. It was something we had to learn, but we were able to separate it quite quickly.

I didn't have much experience with this scale before and would expect it to be too large to go in so much detail. It surprised me how much we were able to think things through and work it out in the detail we did, varying in scales. It was really nice that this course was a group project, as it would probably in reality also be, to gain more experience. Although you still have to accept you cannot solve or consider everything, especially in the short duration of the course.

Overall I was really surprised how well the groupwork went, since in the past I experienced trouble before sometimes within groups. I felt like we really worked well together, with an equal share of work and I am happy with the project we produced.

Rachel Hartog

At first, I viewed the topic of the energy transition as highly complex and difficult to approach. As this subject was new to me, the initial phase of the project required lots of reading and orientation to understand its main discussions, systems, and implications, before even determining where in the Netherlands we wanted to position our work. This made the beginning of the studio demanding. My initial interest lay in how the energy transition affects everyday life in neighbourhoods. How spatial design can support participation, trust, and the whole social and governance dimensions of transition processes. This aligned with the interest in the team, and I feel comes forward in our project.

A challenge during the project was determining which community we wanted to address. Once this focus had been established, we encountered a lack of specific information about that community. This made it difficult to ground our work in detailed social data. This showed an important issue, the communities most affected are not always those most clearly represented in available data.

A key part of our project was focusing on short-term feasibility rather than solely on the long-term end goal of a climate-neutral port. I consider this one of the project's strengths. It enabled a more realistic and critical engagement with the transition as an ongoing process. Using present day tensions and implementation challenges rather than on an abstract future condition. My understanding of justice was also broadened. Initially, I associated it mainly with participation and trust. I came to understand it in its total in terms of who benefits

from transition, who bears its costs, and who is represented in decision-making. My view of the port evolved from seeing it as an industrial machine to understanding it as a layered social-spatial system shaped by labour, governance, infrastructure, ecology, and regional relationships. Overall, this project strengthened my ability to work across scales and to engage with complex systemic questions. While I initially felt intimidated by the size and unfamiliarity of the topic, I now feel more confident in approaching large urban challenges.

Phill Rosdorff

Working on this project throughout the last 9 weeks has taught me a tremendous amount of insights into the workings of regional urbanism, but for me specifically, the study of urbanism as a whole. Since I'm currently an architecture major, I have not worked on this scale since my bachelor's in Human Geography and Urban Planning. This course specifically taught me how to recombine and apply design thinking (accrued in architecture) on such a large scale (accrued in geography and planning), skills I never properly combined.

In our project, I was able to perform in-depth analyses on the history of the port, the affected communities, and especially the governance mechanisms behind its operation. This has taught me that urbanism is something far beyond just design. It is the deepened understanding of how areas work and how this affects the communities that depend on it. Through this understanding, urbanism is able to shape the

everyday reality of these communities by shaping spaces in favour of the public good. With these insights, I aim to recombine my knowledge in both fields and to adopt the urbanism lens in my architectural projects. This will allow me to better understand the societal needs behind the buildings I design, as well as understand their context in relation to their surroundings. I'm convinced that this has transformed me into a better future architect.

I want to thank my groupmates for the extremely fun and insightful period. I sincerely enjoyed the collaboration, and I couldn't have wished for a better group. Lastly, I want to thank Marcin and Alex for the guidance. It really has taught me a lot about the urbanist mindset, shaping my perspective for the rest of my career to come.

Ruggero Venturi

During this studio (although it lasted only 9 weeks), I gained valuable knowledge about regional design by combining the energy transition with the idea of fairness between generations. While I was more confident with the regional scale, the energy transition was a topic quite new to me, so at the beginning I had to face some challenges in trying to fill my knowledge gap. The Work in Progress project helped me see the Port of Rotterdam in a way not just as a place for work but as a system where industry and social life need to work together.

I figured out how to work with scales from a large vision for 2100 to smaller areas like Maasstrand. Using different tools, from social analysis to metabolic mapping, was important to turn

industrial flows into useful spatial data. I applied a framework that balanced social aspects and I learned that reducing carbon emissions requires careful planning to make sure people have jobs and good living conditions in the future.

A challenge I found during the studio process was to spatialise different aspects of our group vision and strategy. We came up with different tools in order to achieve the goals of our community, and some of them were related to social and mental aspects, making it difficult to find spatial implications.

Working with a team from different backgrounds helped me bring together technical information and what stakeholders need into clear plans. Now I think the planner's job is to find a balance between what industry needs and what is fair for society, making sure the change to a more ecological system is strong and includes everyone. The urban planner must make sure the energy transition is not a technical change but a change that makes spaces better for people and the environment and that is what this project and the Port of Rotterdam are all about: a territorial design that works for everyone.

Risti Ayu Emilia Zahra

At the start of this quarter, I reflected on my interests in the contrasts between geography, functions, and priorities. I was also drawn to how energy can feel accessible and relevant to everyone, not only governments or powerful stakeholders. I questioned how energy systems could avoid monopolisation and instead involve wider communities, from individual habits to national policies. At the beginning, this scale felt unfamiliar.

My background is in small public space projects, and energy transition seemed both niche and difficult. I was unsure of my interest. However, I was curious about working at a larger territorial scale and in a new context. Throughout the quarter, I learned to represent communities that were very different from my own. This pushed me to understand their perspectives more carefully. I also explored new tools to gather public perceptions through articles and data, which made analysis more efficient and insightful. I began to see that energy transition is not a distant issue. It requires collective responsibility and negotiation between stakeholders. This process revealed the complexity of power, compromise, and decision-making. I realised that as an urbanist, I must position myself critically and fairly. I aim to represent community needs while balancing other interests. Moving forward, I want to deepen my understanding of participatory processes, ensuring that communities can genuinely influence decisions.



Figure 123: Project Authors Group Photo



09

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- Gallery of Länsisalmi Power Station / Olla Architecture - 14 https://www.archdaily.com/891535/lansisalmi-power-station-parviainen-architects/5abb9d6cf197cc66400001cd-lansisalmi-power-station-parviainen-architects-photo?utm_source=Pinterest&utm_medium=organic
- Cambrio's SigmaNEST 2022 software advances CAD/CAM for metal fabricating <https://static.thefabricator.com/a/cambrios-sigmanest-2022-software-advances-cadcam-for-metal-fabricating-1643837416.jpg?size=1000x1000>
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- Krøyers Plads - Arquitecturas Cerámicas https://www.ceramicarchitectures.com/wp-content/uploads/2018/04/0_COBE-2016-Kr%C3%B8yers-Plads_F03_Rasmus-Hjortsh%C3%B8j-COAST.jpg
- windmill <https://id.pinterest.com/pin/695102523781340027/>
- Euromax Container Terminal, Port of Rotterdam https://www.ect.nl/nl/terminals/hutchison-ports-ect-euromax?utm_source=Pinterest&utm_medium=organic
- master plan for Potrero Power Station in San Francisco, Perkins and Will https://www.instagram.com/p/B_
- <https://www.mfr-architectes.com/projets/>
- GFC Architecture · Nuovo Science Centre di Città della Scienza https://divisare.com/projects/324257-gfc-architecture-nuovo-science-centre-di-citta-della-scienza?utm_source=Pinterest&utm_medium=organic
- Borgloon Fruit Station: Revitalizing Belgium's Historic Railway into a Cultural Gateway by Burolandschap | uni.xyz <https://uni.xyz/journals/borgloon-fruit-station-revitalizing-belg>
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- Solar panels at Tengeh Reservoir in Tuas in a photo taken on Oct 21, 2016. https://www.straitstimes.com/singapore/tengeh-reservoir-to-house-one-of-worlds-largest-floati ng-solar-panel-systems?utm_source=Pinterest&utm_medium=organic
- Euromax Container Terminal, Port of Rotterdam <https://id.pinterest.com/pin/695102523780996879/>
- <https://id.pinterest.com/pin/695102523780995423/>
- <https://id.pinterest.com/pin/8373949302473444/>



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Appendix

Literature supporting the strategy timeline

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Social Media Analysis

Instagram

Haven Rotterdam Instagram
<https://www.instagram.com/haven-rotterdam/>

Post on Leuvehaven
https://www.instagram.com/p/DU-VrNglibOG/?img_index=1
The post on the transformation of Leuvehaven shows several comments from people feeling nostalgic about the former harbour function of the area. They state that they value the nostalgic references of the area and would prefer no complete transformation of former port functions.
Soort gelijk: https://www.instagram.com/p/DQY5b0QjcQX/?img_index=1

Post on day in the life of a harbour content creator
https://www.instagram.com/p/DS_4XRMjMn5/
Only positive reactions

Post interviewing Hogeschool Rotterdam students about portwise (their knowledge about the port)
<https://www.instagram.com/p/DS2XU0xDOiS/>
Only positive reactions

Video about young people working in the port of Rotterdam
<https://www.instagram.com/p/DSX-me3KiH6E/>
only positive reactions

Portwise street interviews: only positive reactions
<https://www.instagram.com/p/DR-2Ctp9DPxn/>

Wereld Havendagen Rotterdam instagram

<https://www.instagram.com/wereldhavendagenrotterdam/>
Alleen maar positieve reacties

Jong Haven Vereniging Rotterdam instagram
<https://www.instagram.com/jonghavenverenigingrotterdam/>
Barely any reactions, but positive

Youngship Rotterdam instagram
https://www.instagram.com/youngship_rotterdam/
Barely any reactions, but positive

Techniek College Rotterdam
<https://www.instagram.com/techniekcollegerotterdam/>
Barely any reactions, but positive

Maritime offshore nl
<https://www.instagram.com/p/DUGA-8tJDH8L/>
Barely any reactions, but positive

Rotterdam meme page (not per se harbour focused, maybe we find something)
<https://www.instagram.com/rotterdamsememes/>

Reddit

Shrinking Rotterdam Labour Market Forum on reactions about the energy transition of the port, causing a shrinking labour market in the area. People seem to be in favour of energy transition and a shrinking labour market, as long as profits will be fairly distributed.
https://www.reddit.com/r/thenetherlands/comments/limb3k7/rotterdamse_haven_krimpt_gemeente_en_provincie/

Rotterdamse haven krimpt, gemeente

en provincie slaan alarm bij kabinet : r/nederlands

Honderden mensen verliezen baan in de haven, nu twee grote chemiebedrijven hun fabrieken sluiten. : r/Rotterdam

Complaining about how harbour work is not paid enough
Haven Rotterdam verliest miljoenen door personeelskrapte : r/Poldersocialisme

Deadly work accident at a company in the harbour
People seem to side with companies here, surprisingly. They're saying there are a lot of safety protocols, and you can barely do any work without passing lots of safety tests. People also say that it is often the workers who don't take these protocols too seriously, leading to accidents. Others are saying that companies don't spend enough attention on safety, stating: "the company got fined 25.000 euros for lack of safety measures which led to a deadly accident, calling it bullshit and too low. Specifically because it keeps on happening at the same couple of companies, apparently. So it greatly depends on the company how they deal with worker safety.
https://www.reddit.com/r/thenetherlands/comments/1nnlu5d/man_overlijdt_bij_bedrijfsongeval_in_rotterdamse/

Tips to living locations when working in the port (traffic)
any crew here working at port of Rotterdam? : r/Rotterdam

Forum: Interest in working for the harbour
IAmA harbour worker in Rotterdam. :

r/lAmA

Any leads on working in the rotterdam port : r/Rotterdam
Shows how to get jobs at the port, but like always, jokes about getting drug packages from containers.

Deep appreciation of old/former harbour areas (people like old harbour elements, even when areas transform)
I just wanted to appreciate how beautiful Leuvehaven in Rotterdam is : r/thenetherlands

Delfshaven, Rotterdam's Hidden Gem : r/Rotterdam

Delfshaven : r/Rotterdam

Enthusiasm about visiting the port for tourism
Is the port of Rotterdam worth visiting as tourists and if yes: how to best experience it? : r/Rotterdam

Best way to see the Europe's busiest harbor in action : r/Rotterdam

Rotterdam for container ship enthusiasts : r/Rotterdam

What's the best way to visit the Rotterdam Harbour? : r/thenetherlands

Is the port of Rotterdam worth visiting as tourists and if yes: how to best experience it? : r/Rotterdam

Twitter/X

Tweet about the sustainability policies of Rotterdam
The chemical factory making PET bottles is dismantled and rebuilt in Oman. A lot of negative comments are tweeted on X, saying: We're just

exporting unsustainable practices, which we still have to import, making it even more unsustainable.
(20) Alice van Drie on X: "Omdat we geregeerd worden door domme deugers Een forse chemische fabriek bij Rotterdam die recyclebare PET-flessen en verpakkingen maakte, is gesloten en wordt ontmanteld. De installaties worden 11.000 kilometer verderop ingevaren in de haven Sohar van Oman en worden daar https://t.co/cWuG08EHio" / X



Alice van Drie

@AlicevanDrie

Follow

...

Show translation

Omdat we geregeerd worden door domme deugers 🤔

Een forse chemische fabriek bij Rotterdam die recyclebare PET-flessen en verpakkingen maakte, is gesloten en wordt ontmanteld. De installaties worden 11.000 kilometer verderop ingevaren in de haven Sohar van Oman en worden daar weer opgebouwd. Om vervolgens ook naar Europa te exporteren. Een hoge ambtenaar is er „best ziek van.” „Beschamend”, aldus de ambtenaar op basis van anonimiteit. „Europa en Nederland willen autonoom zijn tegenover China, Rusland en de VS, en zonder chemie heb je geen industrie. En dan vertrekt zo'n bedrijf.”

Lees via @telegraaf



A lot of reposts of an article about the fear of Chinese influence in the Rotterdam Harbour
(20) Barendrechts Dagblad on X: "AngstvoorgripChinaopRotterdamse haven https://t.co/ynysB98s3g" / X



Barendrechts Dagblad

@barendrechtsdb

Follow

...

Angst voor grip China op Rotterdamse haven



From barendrechtsdagblad.nl

9:26 AM · Feb 24, 2026 · 37 Views

Especially right-wing (also some extremist right wing) politicians / supporters oppose the energy transition, since it drives economic activity away from the port (abroad)



Stolk79

@stolk79 · Feb 22

Best raar want ze hebben aan alle linkse hobby's meegewerkt. Voornamelijk de idiote energietransitie en stikstofreductie in de haven van Rotterdam waardoor alles onbetaalbaar dreigt te worden en de bedrijven vertrekken en de hele fabriek elders plaatsen.



Peiling De Hond: Leefbaar grootste kanshebber in spannende Rotterdamse dri...

From ad.nl

1 52



JOVD Rijnmond

@JOVDRijnmond · Feb 20

Het Rotterdamse #vestigingsklimaat zakt tot een nieuw dieptepunt. Opnieuw ziet een bedrijf af van een fabriek in #Rotterdam, want "Honderd nemen in de Rotterdamse haven is niet meer rendabel." Genoeg werk te doen voor kabinet #Jetten. #JOVD #JOVDRijnmond



Japanse chemiegigant ziet af van fabriek in Botlek: 'Onvoldoende rendement'

From ad.nl

67

Harbour as tourism: Chinese tourists attracted to Rotterdam, from the markethall, to increasingly the Port as well.



Hans van Putten

@Hansvanputten01 · Feb 21

Aziatische toeristen terug in Rotterdam: jongeren willen naar de Markthal, maar ook naar de haven. Het Fotomuseum is een nieuwe trekpleister erbij. Onze spectaculaire architectuur en de nieuwe prachtige musea doen het goed bij toeristen.



Aziatische toeristen terug in Rotterdam: jongeren willen naar de Markthal, maa...

From ad.nl

2 111

Work In Progress

4 years in a row, there has been less and less cocaine imported into the harbour, but 5x the amount of cannabis



SBO Veiligheid

@SBOVeiligheid · Feb 16

Voor het vierde jaar op rij is er minder cocaïne aangetroffen in de Rotterdamse haven door het Hit and Run Cargo-team (HARC); een samenwerking van de Douane, de FIOD, de Zeehavenpolitie en het Openbaar Ministerie: [blog.sbo.nl/veiligheid/202...](#) #ondermijning



23



Johan Peters

@Rotterdamagain · Feb 13

Antwerpen is de cocaïnehaven van Europa. Is Rotterdam dan de cannabishaven? Minder cocaïne aangetroffen in Rotterdamse haven, wel vijf keer zoveel cannabis [nu.nl/binnenland/638...](#) via @NUnl



Minder cocaïne aangetroffen in Rotterdamse haven, wel vijf keer zoveel canna...

From nu.nl

18

Several reports and tweets on oil fraud in the port, involving tens of millions of euros, with criminal networks



Crimesite

@Crimesite · Feb 7

'Miljoenenfraude met olie in haven Rotterdam'



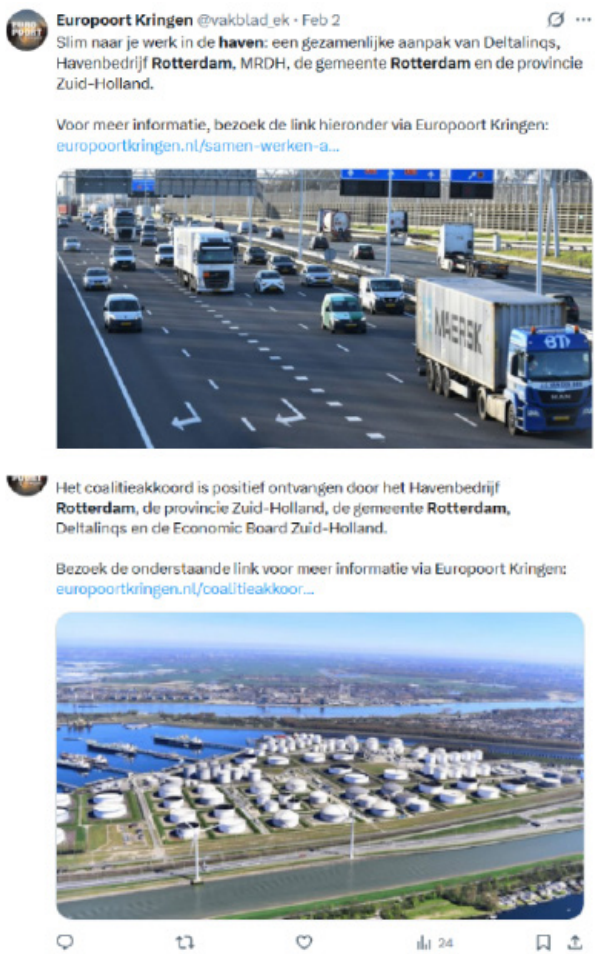
'Miljoenenfraude met olie in haven Rotterdam'

From crimesite.nl

2 1 1.3K

New coalition agreement between harbour and several governmental bodies

201



Immigrant worker conditions in the port (according to a X user)



The Twitter page of the Port Authority doesn't get any comments
(20) Havenbedrijf R'dam (@HavenRotterdam) / X

Fanpage with industry and harbour photography. Now a lot of comments tho
(20) Richard Telder (@portries) / X

Futureland Rotterdam
(20) FutureLand | Rotterdam (@FutureLandRdam) / X

Deltalinqs
(20) Deltalinqs (@deltalinqs) / X

Haven magazine Onze Haven (no comments)
(20) Onze Haven (@OnzeHaven) / X

Havenmeester Rotterdam (no comments)
(20) Havenmeester R'dam (@De_Havenmeester) / X

Jong Havenvereniging (no comments)
(20) Jong Havenvereniging (@JongHaVe) / X

ATLAS TI
Based on the sentiment

Positive

- "The problems in the labor market will worsen further while the higher professional education sector continues to shrink because universities of applied sciences are losing out to universities." Don't be under the illusion that you can run it from that one office. It's a complex organization, and you need those 4,000 people to solve all the issues. So you have to give those 4,000 rooms to maneuver.

Neutral

- No meat tax or car sharing In addition, the report examined readiness for "social transition" and "wellbeing transition": respectively, the shift towards greater social cohesion and a greater emphasis on a pleasant life and health rather than just economic growth and money.
- Machine Translated by Google
- "Right now, because of this energy transition, we need technical people. Healthcare is already faltering, and the teacher shortage is becoming even greater. Reversing this trend now is absolutely essential, because retraining a scientist to work on water pipes later is much more difficult.
- Retraining at a technical college. I was about ten years old then. I didn't understand exactly what was going on, but I did understand that it was a big deal because my parents were whispering to each other. It was about colleagues who had become stressed out, for example.
- "What I'm doing now in Rotterdam

is the highlight of my career. I feel at home. I have a somewhat explicit way of taking a stand, but I've never thought here, 'Is what I'm saying now even possible?' Here, I can be the leader and the person I am. It didn't work in Amsterdam; it turned out I was breaking all sorts of hidden codes, but I don't want to make it an Amsterdam-Rotterdam thing . It could also be because I was more than twenty years younger and had much less experience.

Negative

- While respondents generally indicate they consider the transitions quite important and are willing to support them, only a small group actually changes their behavior completely. For both the energy transition and resource use, a majority indicate they will only change their behavior when the less environmentally damaging option becomes the cheapest, or if they are forced to, or if there is no other option. Price incentives thus again prove to be an important way to encourage change.
- Gap Some results are shocking: with the exception of Brielle, no municipality has formulated a concrete target for the current coalition term. Five municipalities don't even know how much energy they use themselves, and four don't know how many of their civil servants are involved in the energy transition.
- Saturday Edition
- The Netherlands has been converted. With the most solar panels per capita in the world, the green energy transition is in full swing in our small country. However, people on the other side

- of the world are paying a high—sometimes fatal—price for this green lifestyle.

“I’m very happy that we’re going to have this conversation. We need to talk about the origins and the human cost of our raw materials.” Dutch Daily Newspaper Page 1 of 5 How do we achieve a green future that is also fair?

Minnesma sees green hydrogen as a “more sustainable solution.” “Coal pollution is not only harmful to the climate, but also to the people living around the steel mill.” However, research by Kwizera, among others, shows that green hydrogen production is also harmful to people, but in the global south.

Interview transcript

March 10, 2026, 1:06 PM

Sander de Bruine 2:50 Well, very broadly speaking, it could be a bid.

Phill Rosdorff 2:55 The energy transition was also touched upon here. The one the port will have to go through — or even just in civil engineering, the energy transition — that’s something that came up a lot.

Sander de Bruine 3:09 It seems like that didn’t really come up.

Phill Rosdorff 3:14 OK. So, right now you’re doing an internship at Dura Vermeer. What exactly are you doing for your graduation research?

Sander de Bruine 3:27 Yes, here at the existing terminal of APN terminals. They stack containers on asphalt there. But that can cause damage.

Phill Rosdorff 3:44 Yes.

Sander de Bruine 3:45 At the corner points of the containers. And it sinks. At the crane tracks. Because those crane tracks get loaded so frequently that they sink a lot more than the container pavement. So yes, that’s my problem statement, and then I’m going to conduct a design variant study on it, to see which design variant fits better.

Phill Rosdorff 4:12 Yes. Great. And you’re specifically at the Maasvlakte. That’s quite far from Rotterdam, or from most places where people live. How do you get there — by car, I assume — and how did you experience it when the recruiter first approached you?

Sander de Bruine 4:26 Yes, indeed. Yes, that’s right.

Phill Rosdorff 4:39 What did you think at the time? Like, how am I going to get there? Did you already have a car available?

Sander de Bruine 4:44 I sometimes look for internships like that. I was still living in Bruinisse — and from Bruinisse, those projects are really completely impossible to commute to.

Phill Rosdorff 4:50 Right.

Sander de Bruine 4:56 So I started looking into whether there were companies that could possibly provide a car. And then I heard that if you did an internship at Dura Vermeer, you’d get one. And Lieshout is also included, so that’s why I chose to do my internship there.

Phill Rosdorff 5:12 Yes, and I assume that basically all your colleagues also have to go there by car?

Sander de Bruine 5:20 Yes, if you work at least 32 hours for Dura Vermeer, then yes, you really can’t do without it.

Phill Rosdorff 5:26 Yes. OK. And are you also specifically focused on this topic for your thesis? What are the general activities of Dura Vermeer, specifically their ports and industries division? What do they specifically focus on in the port sector?

Sander de Bruine 5:54 Yes, a lot of commissions from private clients, rather than the government. And now the next trainer terminal. But also a lot of foundations for chemical

factories.

Phill Rosdorff 6:12 OK.

Sander de Bruine 6:12 And the infrastructure for those. And occasionally, yes, also more architectural work, like a warehouse. We also had a really large one.

Phill Rosdorff 6:21 Yes.

Sander de Bruine 6:24 A warehouse built. Where that company — with those monopiles — yes, but...

Phill Rosdorff 6:32 Yes.

Sander de Bruine 6:33 For wind turbines.

Phill Rosdorff 6:37 OK, and do you ever work on projects where the energy transition is clearly visible? Or is that not yet really common?

Sander de Bruine 6:38 That kind of thing. Yes, we have a project in Borssele. They’re building land stations there, I believe. Those stations are meant for offshore wind farms, to bring the energy onshore.

Phill Rosdorff 7:05 Yes. Yes. But that’s not...

Sander de Bruine 7:10 So that’s going well.

Phill Rosdorff 7:11 But isn’t it really a major part of your business case? The commissions you’re after?

Sander de Bruine 7:18 No, not the biggest I think. No.

Phill Rosdorff 7:21 OK. And now for a more personal question — you work

in the port and will likely continue to do so — how do you see the future of the Port of Rotterdam? In terms of the influence that digitalization and the energy transition will have on the work you do now?

Sander de Bruine 7:55 Yes. I think there are enough opportunities for that — for land stations and other infrastructure. Because someone has to build them, and that fits well with the port and industry division of Dura Vermeer.

Phill Rosdorff 8:13 Right.

Sander de Bruine 8:15 But it also has some negative effects, of course. Like large oil companies just pulling the plug — because the government simply no longer supports it — Shell, for example.

Phill Rosdorff 8:31 Yes.

Sander de Bruine 8:31 They had a truly massive project we had already started on. And then it was just cancelled.

Phill Rosdorff 8:37 OK.

Sander de Bruine 8:38 And there are a few more examples like that.

Phill Rosdorff 8:41 Does that have an immediate economic impact on your company?

Sander de Bruine 8:47 Yes, because commissions fall away and that means less work.

Phill Rosdorff 8:52 Yes. And the additional commissions that digitalization and the energy transition could potentially bring —

those aren't compensating for that yet?

Sander de Bruine 9:09 No, I don't get that impression. No.

Phill Rosdorff 9:13 Do you happen to know of any parties that you think are already doing more in that area, working more intensively on it?

Sander de Bruine 9:27 Do you mean clients?

Phill Rosdorff 9:30 Yes, or also your competitors perhaps. I'm not sure, it's also fine to get a general sense of the atmosphere.

Sander de Bruine 9:39 What do you mean?

Phill Rosdorff 9:40 Yes, are clients for example already more engaged with that?

Sander de Bruine 9:48 No, not really. The private clients aren't really focused on it either, because all the sustainability ambitions come from the government — from Rijkswaterstaat projects.

Phill Rosdorff 9:54 Yes. Yes. So it's not really being requested from the private market. OK. You say these transitions are currently driven mainly from the government side — are you personally in favour of that? How do you look at it?

Sander de Bruine 10:27 Yes, that's hard to say. They want to build as CO₂-neutral as possible now. But should you place that responsibility on the contractor? There are actually some nice examples of projects where a good initiative is shown by the client,

and the client also meets you halfway with sustainable techniques.

Phill Rosdorff 10:59 Yes.

Sander de Bruine 11:00 And also co-finances it, so to speak. Then a project can turn out successfully.

Phill Rosdorff 11:04 Oh yes. Yes.

Sander de Bruine 11:09 But if that doesn't happen, it can just cost unnecessary money.

Phill Rosdorff 11:14 Yes.

Sander de Bruine 11:16 And you sometimes see somewhat absurd things — like a construction site that has to be CO₂-neutral, and then they just place a generator outside the building. If that's what it comes down to, it makes no sense.

Phill Rosdorff 11:33 Right, so it's finding a loophole in the rules to still make it happen.

Sander de Bruine 11:42 Yes.

Phill Rosdorff 11:45 Are there things you personally think could be improved to actually promote the energy transition in the sector — or maybe in your company?

Sander de Bruine 12:09 Well, I actually think finances are really the only factor.

Phill Rosdorff 12:18 Yes.

Sander de Bruine 12:20 And yes, that growth in collaboration with the client.

Phill Rosdorff 12:27 Yes. And the

changes that will take place in the port over the coming decades — how do you think this will translate spatially? More space will probably have to be freed up for more sustainable forms of energy production and infrastructure, but at the same time other things may have to give way. How do you think that will be distributed?

Sander de Bruine 13:13 I think more and more space will gradually become available for sustainable initiatives. Technology just keeps moving forward. And yes, sustainable energy is the future, I think.

Phill Rosdorff 13:31 Yes.

Sander de Bruine 13:32 I think the port in general will also become more sustainable. The Port of Rotterdam company is also working hard on it. Phill Rosdorff 13:39 Yes, certainly.

Sander de Bruine 13:40 Yes, and ultimately you still need government support. But I think that's going reasonably well with Rob Jetten right now. Although when you have a right-wing cabinet, then yes, it seems harder for the Port of Rotterdam which does want to become more sustainable.

Phill Rosdorff 14:01 Yes, so national policy direction is also needed for that.

Sander de Bruine 14:08 Yes, it seems that way to me.

Phill Rosdorff 14:17 And when this sustainability shift starts taking place in the port, I assume that certain chemical and highly polluting parts of the port will gradually be phased out. Do you see it as possible that

parts of the port area could shift in function — like you see now with Heijplaat or other areas where the port is being transformed into more of an urban space? Could that become increasingly possible, or will it remain too industrial an area for people to really be there?

Sander de Bruine 15:17 If all the polluting companies gradually move out, I think it would become increasingly liveable, yes. And I also think that the port will keep expanding further out to sea, and that the beginning of the port will become more and more habitable.

Phill Rosdorff 15:42 Yes. OK, and can you imagine yourself ever living in such an area, or would that be too much “port” for you?
Sander de Bruine 15:58 I don’t see myself living there. It doesn’t appeal to me.

Phill Rosdorff 16:01 No, I understand — we thought the same when we saw the Rozenburg area as students.

Sander de Bruine 16:12 Rozenburg isn’t the nicest place, I’d say. No.

Phill Rosdorff 16:16 So how is it to be there every day for work?

Sander de Bruine 16:26 During work, I have a spot in the office with a view of the Maas. That is actually a beautiful location to work.

Phill Rosdorff 16:34 Oh yes. Certainly.

Sander de Bruine 16:39 And driving out to the Maasvlakte — to one of the largest container terminals in Europe — that’s already something beautiful to see every time you go there for

work.

Phill Rosdorff 16:52 Yes.

Sander de Bruine 16:52 For work.

Phill Rosdorff 16:54 Yes, I understand.

Sander de Bruine 16:54 But living there is a completely different thing, of course.

Phill Rosdorff 16:57 Yes. And you seem quite enthusiastic — do you also see yourself continuing to work there after graduation, or staying in the port sector in general?

Sander de Bruine 17:13 Yes, I can see myself working here, but it also depends on what the port and industry division can offer in terms of growth. Because the project I’m on now is — together with more nationwide projects — part of a much larger company with its own design department.

Phill Rosdorff 17:36 Yes.

Sander de Bruine 17:40 And the port industry design unit is still very small. And yes, I’m a bit afraid that I won’t really be able to develop further there.

Phill Rosdorff 17:55 Yes.

Sander de Bruine 17:55 There are just not many — yes, not many senior designers working there.

Phill Rosdorff 18:01 So the growth potential there wouldn’t really be possible.

Sander de Bruine 18:08 No, indeed.

Phill Rosdorff 18:10 And are many

of your fellow students also going to work in the port or doing their graduation internship there?

Sander de Bruine 18:19 Yes, in the last few years there’s been an increase. The port and industry division has been growing enormously.

Phill Rosdorff 18:32 Yes.

Sander de Bruine 18:32 It was founded around 2018 with about 10 people, and now there are 140.

Phill Rosdorff 18:40 Yes. Wow.

Sander de Bruine 18:44 And other companies like Ballast Nedam Industry and Industrial Construction are also just growing.

Phill Rosdorff 18:52 Yes.

Sander de Bruine 18:53 But I actually don’t know where that growth is coming from exactly. I think it’s simply because more and more is being built in the port.

Phill Rosdorff 19:00 Yes, especially on the Maasvlakte now.

Sander de Bruine 19:03 Yes.

Phill Rosdorff 19:04 Which is very, very busy, yes.

Sander de Bruine 19:06 It was all sand before, and now it’s being completely built up. That probably has something to do with it. Yes.

Phill Rosdorff 19:10 Yes exactly. And do you also see that more effort is being made to attract more students to the port area broadly?

Sander de Bruine 19:25 Yes. I notice there is a huge demand for that. And I’m also approached very often by recruiters on LinkedIn who can offer positions in the port area.

Phill Rosdorff 19:42 OK. Yes, that makes it attractive.

Sander de Bruine 19:49 Yes.

Phill Rosdorff 19:50 You have a much better negotiating position. OK. Then — a sort of concluding question — how do you see working in the port in the future, with the changes that are going to take place? Can we ensure it remains economically valuable for Rotterdam? Because we saw in the statistics that there are fewer and fewer jobs overall in the Port of Rotterdam, and more and more jobs that require higher education.

Sander de Bruine 20:45 OK.

Phill Rosdorff 20:46 How do you think that can best be addressed — perhaps by the Port of Rotterdam Authority?

Sander de Bruine 20:57 Yes, I think innovation is one big factor. And simply automation — you need fewer personnel for that, of course. Like the APN terminal we’re working on now, which is about 80–85% automated, I believe. All those cranes are automatically controlled. It’s a great system.

Phill Rosdorff 21:27 Yes. Exactly.

Sander de Bruine 21:32 And beyond that...

Phill Rosdorff 21:32 How do you think more people could be attracted to...

Sander de Bruine 21:34 Yes.

Phill Rosdorff 21:40 ...go and work there, like you did, after their studies?
Sander de Bruine 21:49 Yes, good question. Employment conditions, I think — those are often important. Accessibility—whether it's reasonably commutable for people. But yes, if the port area becomes increasingly liveable with new residential areas, then that problem gets solved. And I think more people would then also work there if they can live there too. Especially labour migrants, because they generally have lower housing standards.

Phill Rosdorff 22:31 Yes. Yes. OK. Let me check — Rachel, do you have anything to add? OK then. That's what we needed in any case. Do you have anything else to add?

Sander de Bruine 22:54 Let me think. I had written a few things down. I think we've covered most of it, at least from what I know.

Phill Rosdorff 23:30 OK. Great. Super. Well, thank you very much for your help in any case.

Sander de Bruine 23:42 No problem.

Phill Rosdorff 23:42 Super, it was great to speak with you. I think we've been able to clarify a lot for ourselves from this.

Sander de Bruine 23:52 That's great.

Phill Rosdorff 23:53 So yes, I wish you lots of success with your internship and with graduating.

Rachel Hartog 23:59 Yes, thank you very much.

Sander de Bruine 24:01 Thank you. Good luck to you too with your assignment.

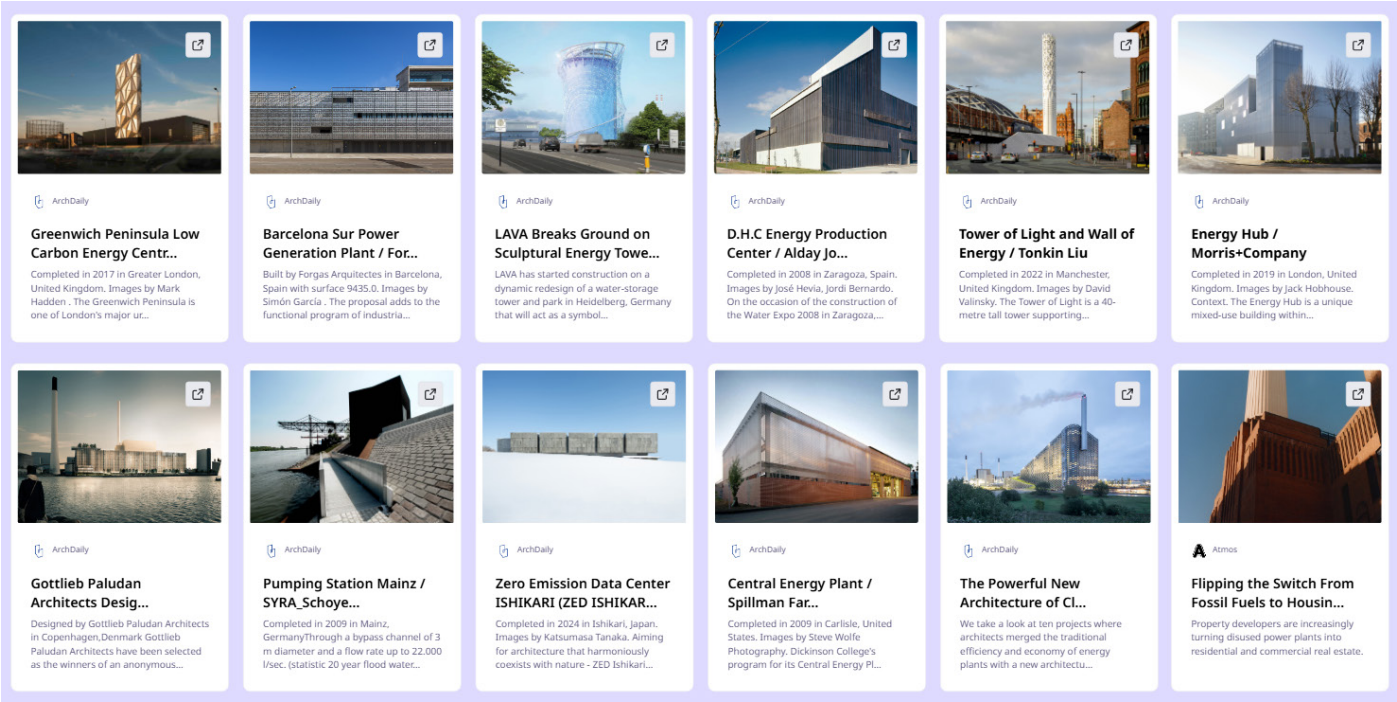
Phill Rosdorff 24:05 Thank you. Yes, thanks a lot.

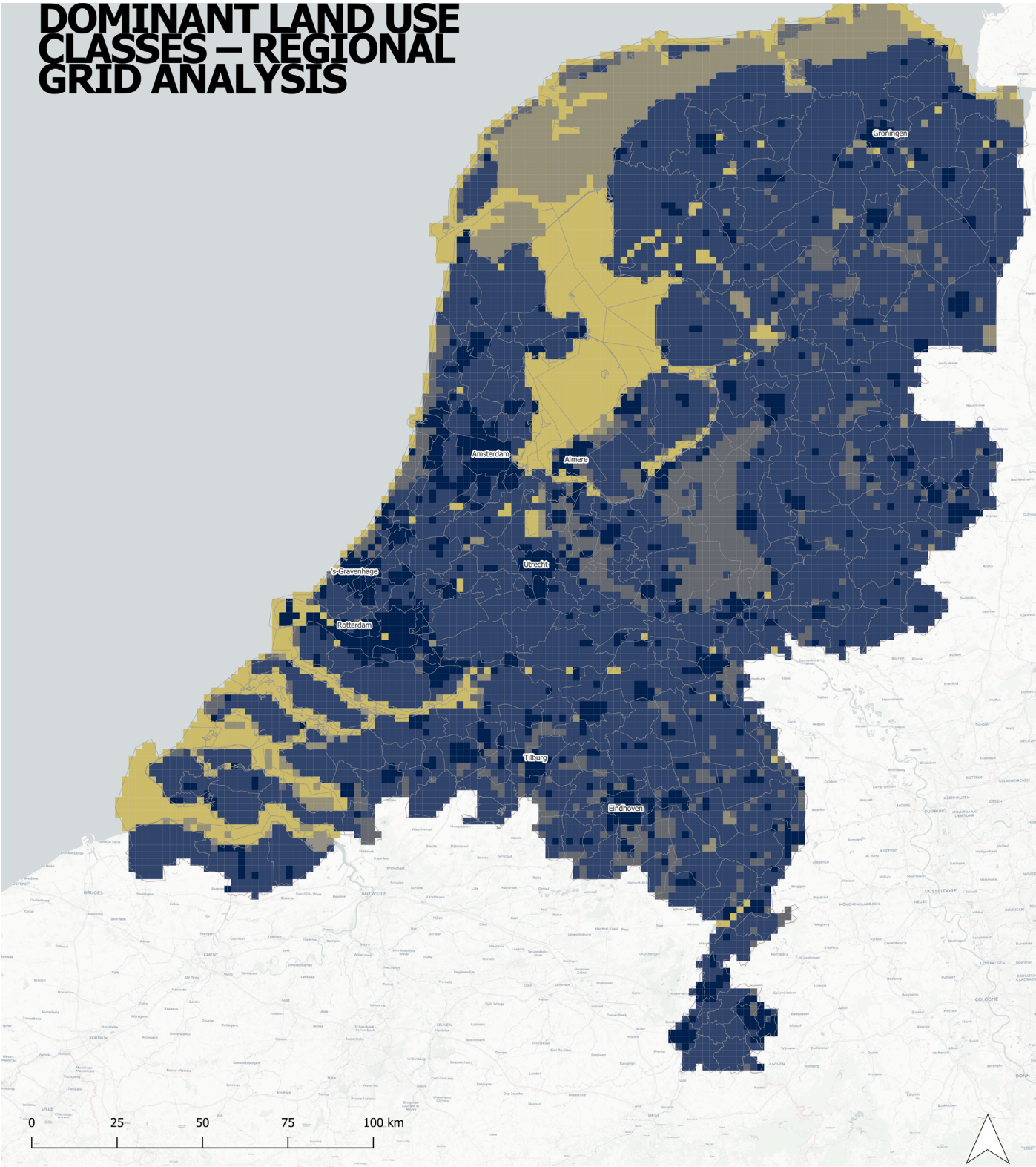
Sander de Bruine 24:09 OK.

Phill Rosdorff 24:10 OK then.

Sander de Bruine 24:11 Bye bye.

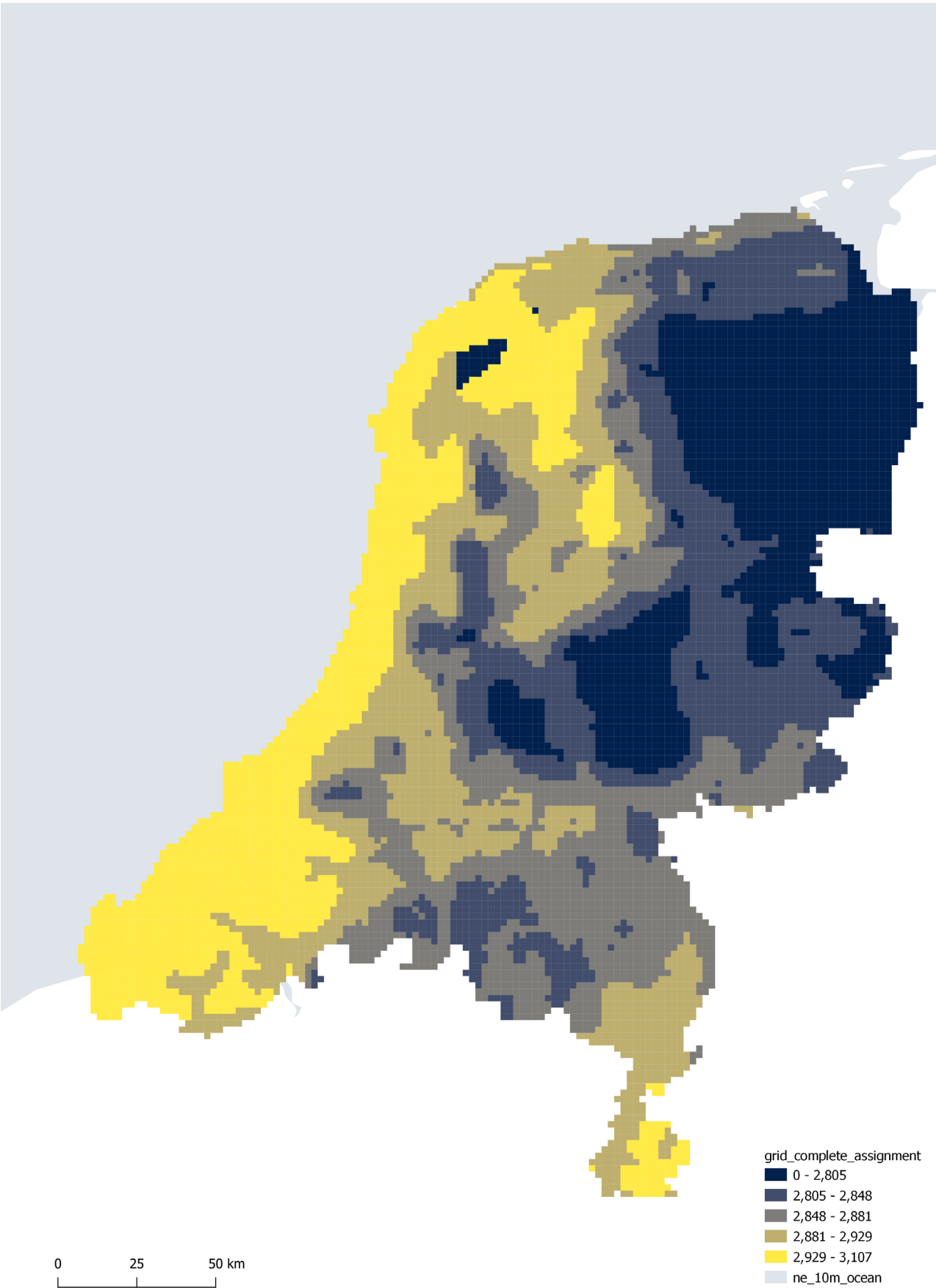
Project references



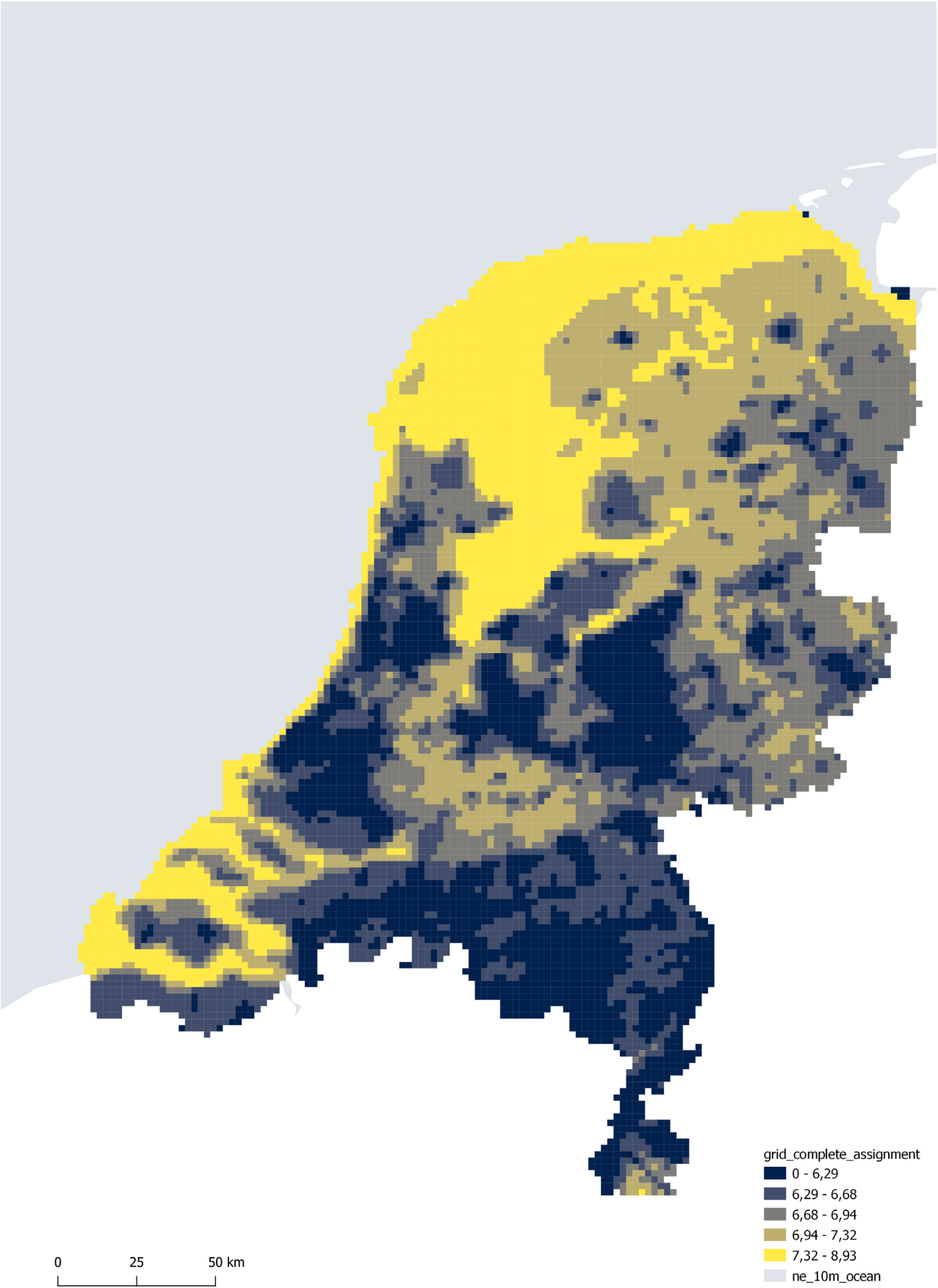


- Land use classes**
- Artificial surfaces
 - Agricultural
 - Forest
 - Wetlands
 - Water

Data sources:
Copernicus CLC2018:
<https://land.copernicus.eu/en/products/corine-land-cover>
CLC User Manual:
<https://land.copernicus.eu/en/technical-library/clc-product>



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