

Online exhibition



R&D studio Spatial Strategies for the Global Metropolis (AR2U086 & AR2U088), part of MSc Urbanism, Delft University of Technology

This exhibition presents results of the Research & Design studio *Spatial Strategies for the Global Metropolis*, part of the MSc Architecture, Urbanism and Building Sciences/Track Urbanism programme at Delft University of Technology.

The region under investigation at the 2021-2022 round of the studio was the South Holland maritime region, part of the Rhine, Meuse and Schelde delta. The region of about 3.7 million inhabitants is constituted by a complex landscape of spatial environments, in one of the densest, most urbanised and infrastructure-richest regions of the world. At students' core attention was the port of Rotterdam, whose territory of approximately 100 km² stretches from the city of Rotterdam to the North Sea. Students were asked to explore two interrelated thematic topics within this spatial setting, notably (1) a transition towards a circular port economy, and (2) a social transition which is expected to happen in tandem with the port's enhanced circularity. The spatial visions and development strategies that students designed recognise the mutual dependencies between these transitions, and give these a spatial form.

The responsible chair of *Spatial Strategies for the Global Metropolis* is Spatial Planning & Strategy. The 2021-2022 edition of the studio was prepared in collaboration with Province of South Holland (Provincie Zuid-Holland), and the Port of Rotterdam. It built up upon expertise acquired during the research project Resource Management in Peri-urban Areas: Going Beyond Urban Metabolism (REPAIR), funded by the European Union under the Horizon 2020 framework, and by PortCityFutures, an initiative of the Leiden-Delft-Erasmus (LDE) collaboration.

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Introduction



Urbanism is concerned with understanding the spatial organisation and dynamics of the built environment and with inventing new ways to maintain spatial quality and equality. The MSc Urbanism education at the TU Delft develops core knowledge and skills as a basis for innovative practical and theoretical applications. It provides students with typological knowledge and insights into urbanism tools and techniques. MSc Urbanism is a scientific design education, characterized by interaction between thinking (analysis and reflection) and doing (the speculative/intuitive imagination of spatial interventions).

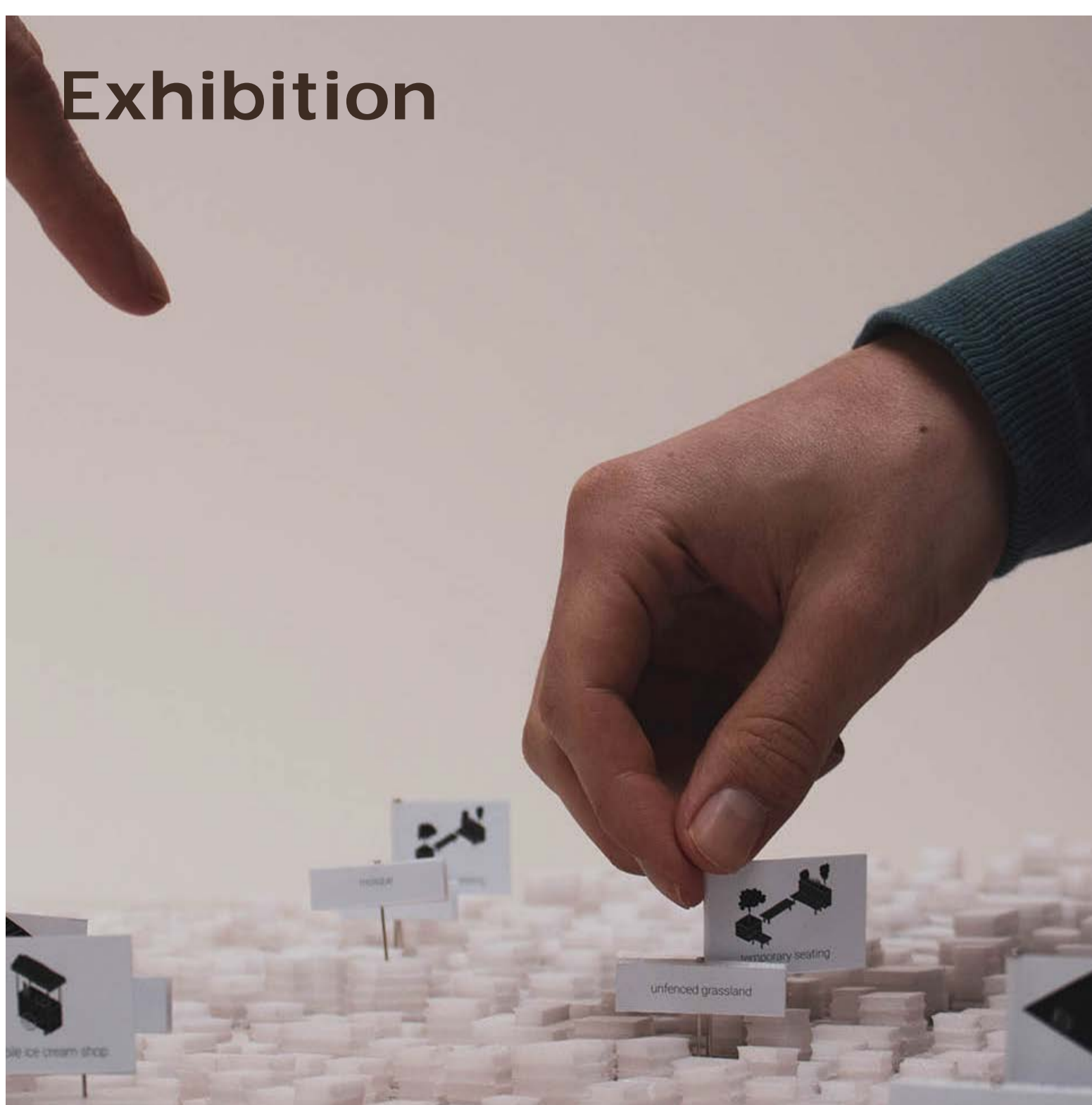
Regional design is the core theme of the *Spatial Strategies for the Global Metropolis* studio that occurs during the third quarter of the MSc Urbanism curriculum. The way global economic powers and planetary natural change influence spatial development is best sensible at the regional level. The practice of regional design explores prevailing spatial conditions, political agendas, and planning regimes, by means of analysis and imagination. It promotes and debates solutions to improve good democratic decision-making, and to inform long-term strategic planning approaches to desirable spatial change.

A circular port economy - One thematic focus of the 2021-2022 round of the studio was the concept 'circular economy'. A circular economy enables resources to flow through human-made and natural systems in ways that create or retain monetary, social, ecological, and economic value through closed or narrowed loops, rather than destructing value and creating waste. A series of material flows gained particular attention. These included: flows of fossil raw materials; plastics and rubbers; minerals and metals; and biomass and organic materials. The Port of Rotterdam authority associates the port's position at a crossroad of these raw material and residual flows with a future internationally outstanding position as a 'waste-to-value port'. Students of the studio critically investigated this proposition by anticipating on its spatial implications.

Social transition of a maritime region - The Port of Rotterdam authority recognizes that sustainability transitions thrive on the involvement of people. Against this background, it calls for better matches between job and labour markets, the (re-)skilling and (re-)training of people, the attraction of talent, enhanced labour mobility, and a greater diversity and inclusiveness of future labour markets. A second thematic focus of the studio was informed by these calls. Students were asked to explore how a transition towards a circular port economy impacts social systems, and how impact can be enhanced through socio-spatial interventions. At particular attention were: new spatial practices in the context of structurally changing work; the identification of circular economies as social environments; new spatial environments for education; the accessibility of jobs; affordable housing and the transformation of deprived neighbourhoods; and new cultural relations between the port and its surrounding cities.

A vision and strategy - Responding to their assignment, students formulated spatial visions and development strategies that support a socially cohesive transition towards circularity in the South Holland maritime region. Their designs - presented in this exhibition - imagine the redesign of material flows that currently produce grave negative environmental and social externalities in the region and that have therefore been identified to be in particular need of reform. Building upon knowledge gained during the supportive course Research & Design Methodology for Urbanism students also paid particular attention to ethical issues involved in the activity of planning and designing, in particular socio-spatial justice.

Exhibition



Students' regional designs - This exhibition presents the projects that the 20 student groups of the 2021-2022 Research & Design studio *Spatial Strategies for the Global Metropolis* have designed over the course of 10 weeks. Each project is represented by an executive summary, which gives key information on the project, and the title page of the group's project report. Visitors who want to gain a deeper insight into projects can access the actual project report in the TU Delft education repository via links collected in this exhibition.

How to take a tour - Projects are grouped by their main thematic concern about: (1) the material dimension of the energy transition; (2) the transition towards circular (maritime) manufacturing, and (3) the transition towards a bio-based economy. By clicking on the below tiles, visitors are led to a theme page that gives more information on the respective material flow in the South Holland maritime regions, and that lists projects that investigated this flow. More information on a listed projects can be accessed through clicking on the title of the project. All routes are indicated by links that have a blue font.

Image: Anne Marije Bodde

**THE MATERIAL
DIMENSION OF
THE ENERGY
TRANSITION**

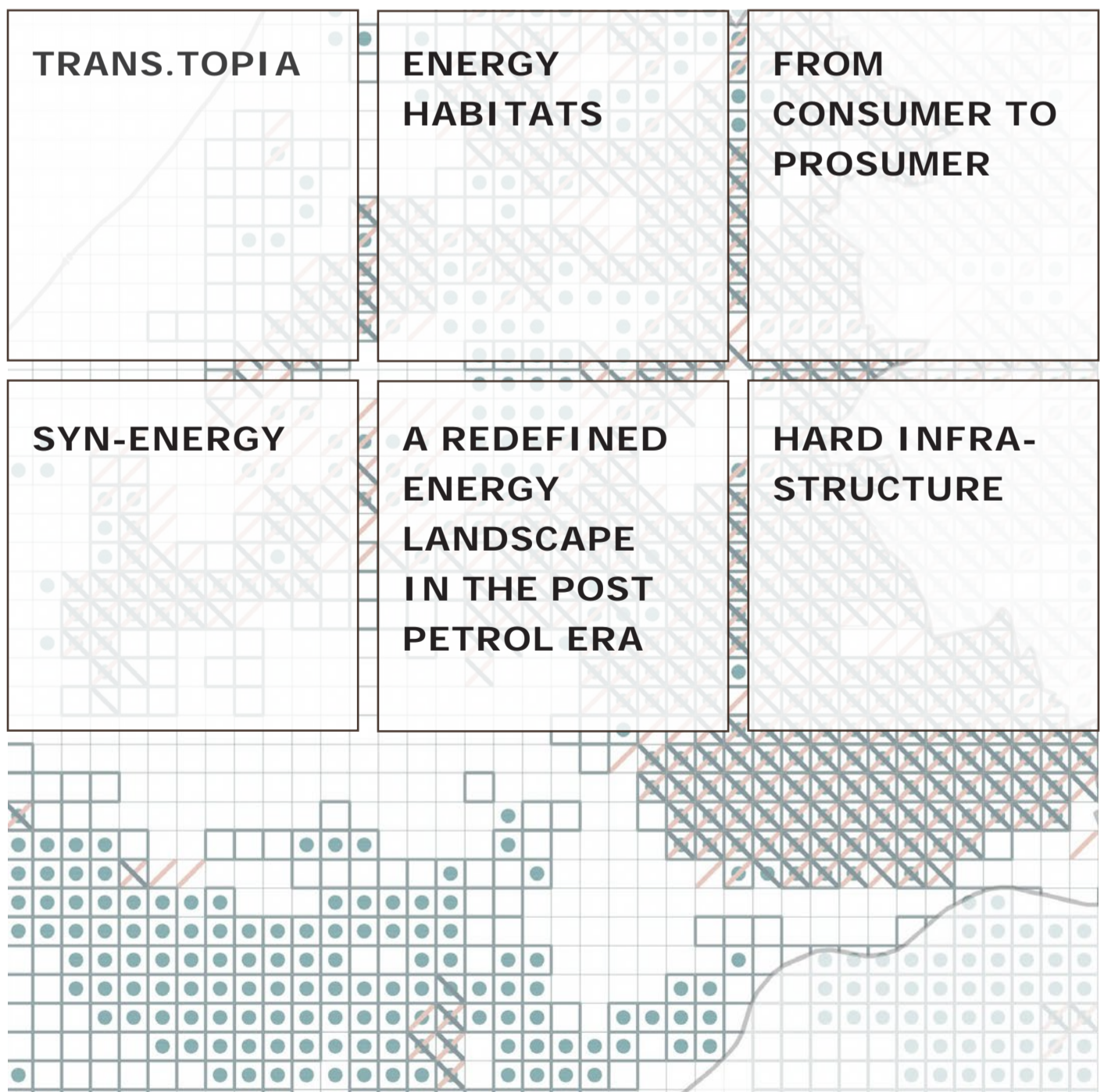
**TOWARDS
CIRCULAR
(MARITIME)
MANU-
FACTURING**

**TOWARDS A
BIO-BASED
ECONOMY**

The material dimension of the energy transition

As evidenced by national and international agreements concerning the mitigation of climate change effects (United Nations, 2016, European Commission, 2019, Ministerie van EZK, 2019), a pressing need for sustainability transitions has become obvious over recent years. The Port of Rotterdam authority has developed a series of strategic approaches towards a carbon-neutral port consequently. Opportunities for change are seen to emerge from in particular synergetic effects between the simultaneously ongoing transitions in the realms of energy and circular economy (Port of Rotterdam et al., 2019). The intended integration of the two transitions has a variety of aspects. The building of a renewable energy infrastructure, including elements such as solar fields and wind farms, is expected to produce massive material return flows in the future. The endeavour thus relies on a needed reform of the construction and demolition sector that foresees a wider, diversified and more value-sustaining re-use of construction waste, and a circular design of the entire construction chain. The port authority envisions a staged approach towards a renewable energy system, drawing on hydrogen, and biomass sources, amongst others. The sustainability and efficiency of this system needs to be symbiotically enhanced by a circular use of these materials. Last but not least will both transitions lead to enormous shifts of land use within and outside the port territory. An intense and circular use and re-use of land is therefore a prerequisite of combined transitions.

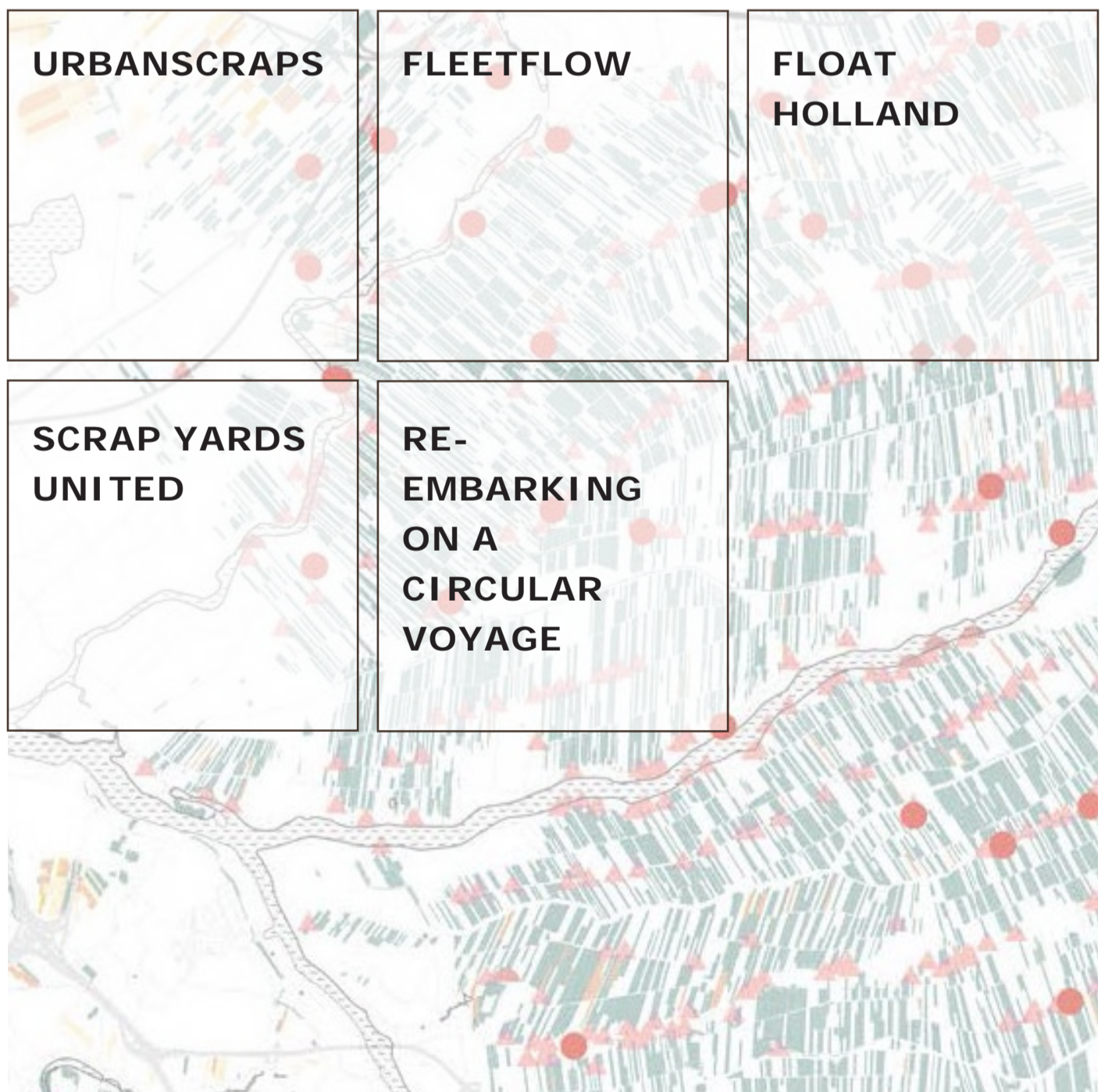
MINISTERIE VAN EZK 2019. Klimaatakkoord [Climate Agreement]. The Hague: Ministerie van Economische Zaken en Klimaat (EZK).
PORT OF ROTTERDAM, RIJKSOVERHEID, PROVINCIE ZUID-HOLLAND, GEMEENTE ROTTERDAM & DELTALINGS 2019. Havenvisie Rotterdam [Port Vision Rotterdam]. Rotterdam: Port of Rotterdam.
UNITED NATIONS 2016. Paris Agreement. Paris: United Nations.
Map: Ana Paula Amieva Gomez, Ann Eapen, Claudia Engel, Isa Van der Bijl, and Tara Kanj



Towards circular (maritime) manufacturing

Among the internationally re-known top economic sectors that operate within the port of Rotterdam's industrial complex is the Water & Delta technology sector whose productivity is becoming increasingly dependent on a circular use of in particular metals. Manufacturing, however, is not only conducted by globally operating sectors. National, regional, and local governments, including the Province of South Holland, recognise the importance of a wider and more multi-layered understanding of a future circular manufacturing sector. Building upon observations of how activities in niche markets trigger transitions, they seek to support in particular small and medium-sized businesses (SMEs) that profit from linking and managing material flows in innovative and smart ways (Provincie Zuid-Holland, 2019a, Provincie Zuid-Holland, 2020b). These so-called 'makers industries' are productive in terms of material output while carefully considering emerging scarcities of material resources. They often rely on and are thus located within port industrial complex. Depending on various criteria – such as the proximity to consumers, material flows, infrastructures, and social activity – they also settle in dense urban areas, under-used peri-urban city fringes, or rural environments though (for an analysis of businesses in South Holland, see Hausleitner, 2021). Their common denominator is in their contribution to environmental, economic, and social sustainability during transitions, and in their production of synergies between transitions in different realms.

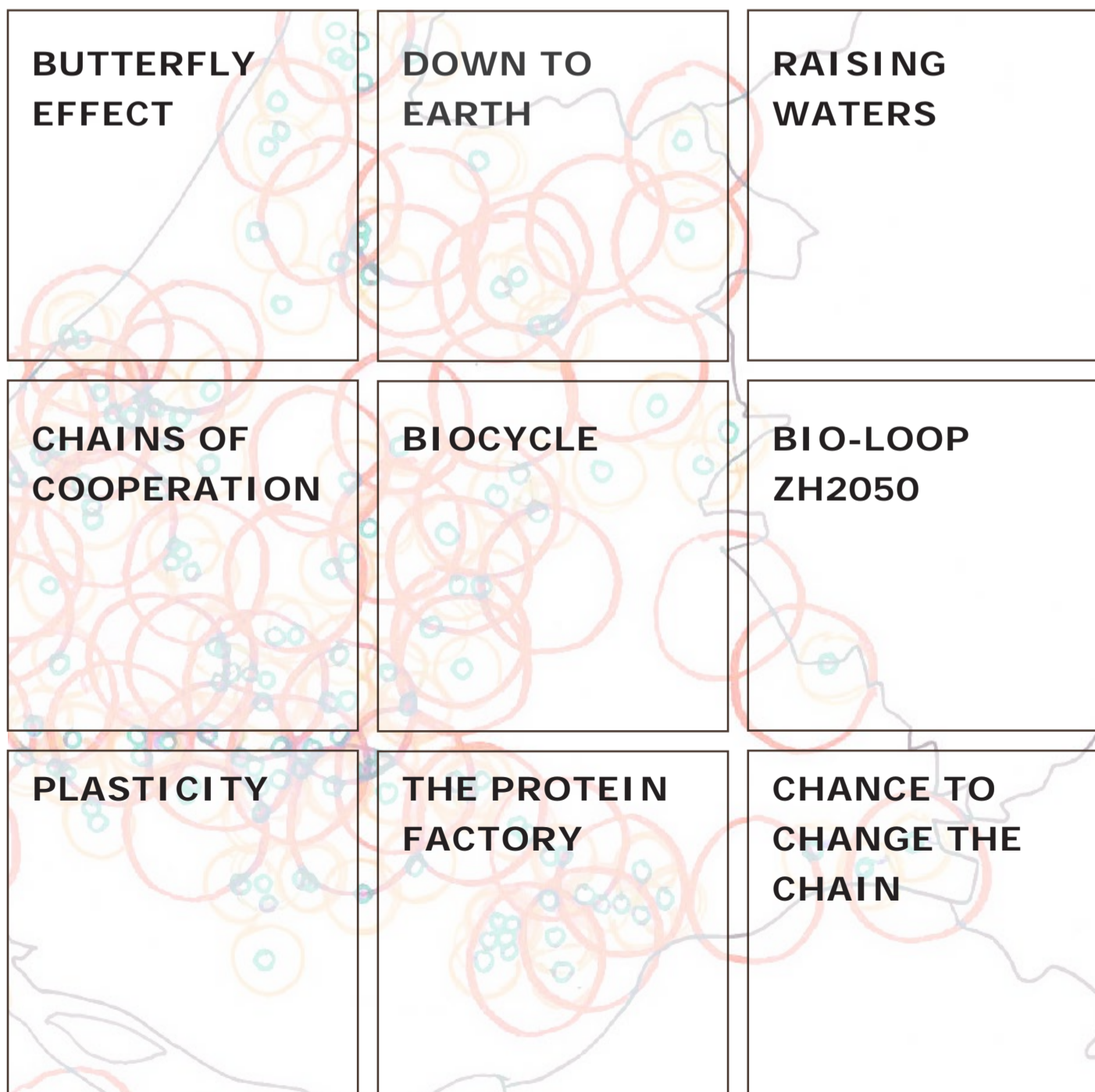
HAUSLEITNER, B. (ed.) 2021. Emerging Urban Spaces for Manufacturing. Case Metropolitan Region Rotterdam – The Hague.
PROVINCIE ZUID-HOLLAND 2020a. Contouren Verstedelijkingsstrategie Zuid-Holland. Conceptversie 0.6 – 12 november 2020. The Hague: Provincie Zuid-Holland.
PROVINCIE ZUID-HOLLAND 2020b. Groelagenda - Samen investeren in duurzaam verdienvermogen en werkgelegenheid. The Hague: Provincie Zuid-Holland.
Map: Alessandra Balletta, Femke Snel, Jülia Daher, and Wieke van Ulsen



Towards a bio-based economy

The port of Rotterdam economy is currently dominated by the use of fossil raw materials. The port's petrochemical cluster as well as numerous businesses in the production of rubber and plastics depend on these materials. Biomass and organic materials play an increasingly important role in many emerging production and consumption circles simultaneously (Port of Rotterdam et al., 2019). The use of these bio-based materials – including food waste, and paper, pulp and wood wastes – opens new avenues for bio-energy, and biochemistry. Because biomass knows many applications its use implies great potential for a more integrated circular economy. An increased reliance on biomass also requires scrutiny though. The South Holland agri-food sector covers half of the province's surface, produces six million tons of products with a value of € 5.5 billion annually, and entailed around 16,500 businesses and 103,000 jobs in 2016 (Drift and Metabolic, 2018). The sector is an important driver of prosperity and innovation in the region. In the context of a future more bio-based economy questions about the contribution of the sector to this economy arise. Simultaneous use of bio-based materials for e.g. construction, energy production, and packaging may for instance threaten food security and lead to the depletion of natural habitats. Any strategy for a circular bio-based economy therefore needs to incorporate principles that organise the multiple claims on the materials efficiently and fairly.

DRIFT & METABOLIC 2018. Zuid-Holland Circulair: Verkenning van Grondstofstromen en Handelingsopties voor de Provincie [Circular South Holland: Analysis of Resource Flows and Optional Action for the Province]. The Hague: Provincie Zuid-Holland.
PORT OF ROTTERDAM, RIJKSOVERHEID, PROVINCIE ZUID-HOLLAND, GEMEENTE ROTTERDAM & DELTALINGS 2019. Havenvisie Rotterdam [Port Vision Rotterdam]. Rotterdam: Port of Rotterdam.
Map: Alessandra Balletta, Femke Snel, Jülia Daher, and Wieke van Ulsen



TRANS.TOPIA

activating the energy transition through a synergy of landscapes



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Key words: energy transition, South Holland, renewable energy, port of Rotterdam, resilience

The Port of Rotterdam has always been a pivotal player in the energy sector. Predominantly, in the oil-based generation of energy and the consequent export of raw material. However, there is a need for a systemic shift in the energy sector as the Netherlands embarks toward its goal to become 100% carbon neutral by 2050.

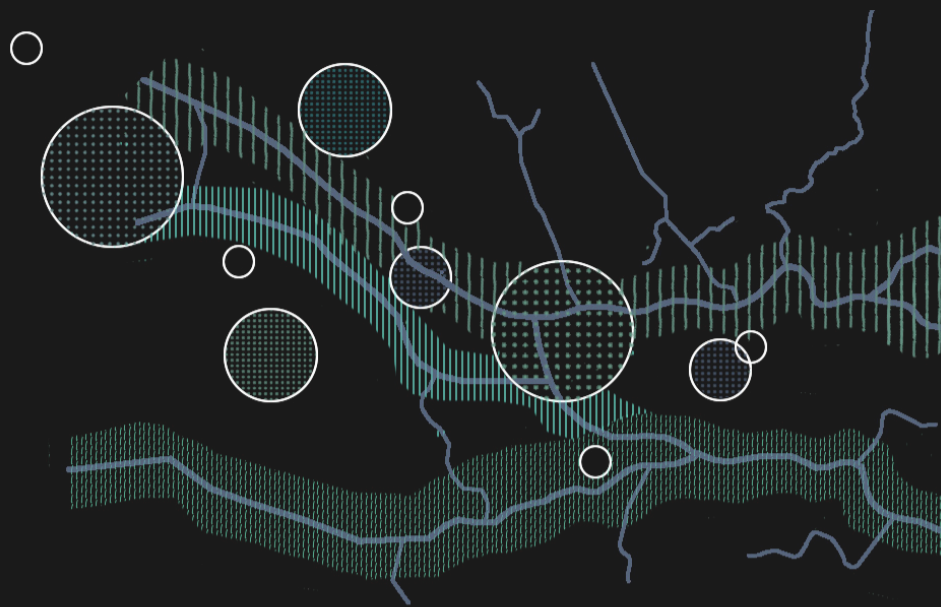
An analysis of the prevalent scenario revealed that the fossil-based energy production systems are not only embedded in the physical infrastructure of the South Holland region but also in its social, economic and geopolitical networks. This means that as we phase out fossil fuels, its implications will be witnessed on both the local as well as global scales. Keeping this in mind, "Transtopia" aims to accelerate the transition towards renewable energy (production - consumption) by proposing synergies between the port of Rotterdam and the rest of the South Holland region.

Primarily, by decentralizing, diversifying renewable energy production, and activating the potentialities of its regional landscapes to harness energy. It proposes endogenous methods of co-creating energy landscapes aimed to establish a resilient and adaptable energy system. One where all sectors of society (civil, public and private) can contribute and play an active role in facilitating this transition. Consequently, the spatial relations between areas of energy consumption and production can be seen as activators of urban development in South Holland. Not only by strengthening the economic resilience of the region in face of the energy transition, but also ensuring social integration in this change by co-creating new infrastructure initiated by a collaboration of active sectors.

Additionally, Transtopia focuses on the transformation of the port into a renewable energy hub. Since selected renewable energy such as solar, wind and biomass will be produced locally, the port becomes a backbone for the production and distribution of hydrogen in the Netherlands and around the globe. As an energy hub, the port will also facilitate research and innovation for renewable energy, establishing collaborations with universities and institutions to constantly improve the functionality of the newly integrated renewable energy systems.

Transtopia aims to accelerate energy transition, focusing on engaging multiple stakeholders by creating policies. Thereby ensuring different levels of systems and synergies, which will eventually transform the urban environment into a symbiotic landscape, with a resilient and inclusive energy system that creates opportunities for economic growth.

[Complete report](#)



ENERGY HABITATS

transforming the port's material landscapes through
a green-blue spine

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Key words: energy habitat, energy transition, fossil fuel drosscape, material landscapes, spatial justice

The first decades of the 21st century are defined by an expected shortage of fossil resources and an emerging climate crisis which make the transition towards renewable energy resources not only inevitable but also urgent. In the process of this transition, the port of Rotterdam, associated with the biggest fossil fuel industry landscape in Europe, is confronted with the danger of becoming a drosscape. As the Province of South Holland attempts to deal with this challenge under the umbrella of circularity, new issues regarding environmental and social justice in the whole area arise and call for a coordinated planning effort towards a just transition. This effort begins by answering how can the province use the obsolete fossil fuel infrastructure to transform the port's material landscapes fostering spatial justice and balancing the problematic relationship between natural and man-made systems.

Consequently, the project decodes the layers of the material, social and environmental dimensions investigating the critical issues that associate with the port's distinctive territories. In parallel, it defines the main concepts that can instruct this just transition arising from the fenced urban and port districts towards the whole province and combining top-down with bottom-up planning processes. As the project evolves in time, starting at the most critical territories as nodal points and involving all the different actors, it takes the form of a central green-blue spine that meets South Holland's energy demands while embodying a redefined symbiosis between nature and human. The result defines a new paradigm for the energy transition and the remediation of fossil fuel drosscapes that incorporates material circularity, environmental and social justice under the concept of "Energy Habitat".

[Complete report](#)

FROM CONSUMER TO PROSUMER

Towards an inclusive socio-spatial energy transition for South Holland: the case of the Rotterdam region.

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Key words: prosumers, energy transition, local frame, mainframe, vulnerable neighbourhoods

The transition to renewable energy is necessary and urgent. Fossil fuels are depleting, leading to geopolitical instability and are driving climate change. The climate crisis and growing inequalities are among the greatest problems of the 21st century. Temperatures, sea levels and gas prices are rising. This transition poses spatial and economic challenges for the maritime region of South Holland, as the port is a large hub for fossil energy and contributes greatly to the national economy. The social challenge posed, is to create a fair transition. Some groups are more vulnerable to the transition than others, as they are more prone to be subjected to energy poverty and to potentially lose their (fossil related) jobs. Therefore, we conducted a research on how to create socio-economic and spatial justice for the Rotterdam maritime region through a fair distribution of burdens and benefits in the energy transition. This research resulted in a vision for South-Holland in 2050, "from consumer to prosumer", proposing a mainframe and a local frame. The mainframe proposal concerns a large renewable energy landscape in South Holland with a central circular hub in the port. The local frame proposal is the main focus of this report and concerns the vulnerable neighbourhoods that become prosumers instead of consumers. This means that they will not only consume energy, but renewable energy systems will be installed to also produce energy, while at the same time improving the quality of living.

New job opportunities will be created in the circular construction and demolition sector in the neighbourhoods as well as in the port. The Rotterdam region will fully transition to renewable energy, while also decreasing inequality, unemployment and poverty.

[Complete report](#)



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Kuan-Ting Liu
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Mariana Bobadilla García

Tutors: Alexander Wandl, Caroline Newton

Key words: energy transition, renewable energy, circular material and energy flow, energy poverty, synergising

Our society is dealing with multiple wicked problems: the Climate Crisis, poverty, inequality and our need for a sustainable and healthy environment to live in. The Climate Crisis increases the urge to reduce the dependency on fossil fuels and requires a structural transformation to our management and distribution of space, economy and community. More than 8% of the Dutch population faces energy poverty, and this percentage will increase with the rising energy prices and unstructured national framework. The Province of South Holland, in the Netherlands, is a region thriving from an economy based not only in the biggest port in Europe, the port of Rotterdam, but also thriving design, technologies and innovations in the cultural centres of cities like Delft, Leiden, Rotterdam and The Hague. This region has a great potential to strategically change the energy generation towards alternative, renewable sources, as well as the energy consumption of the region to tackle social inequalities such as energy poverty.

This report will elaborate on the question of how a just energy transition towards 100% renewable energy of the Province of South Holland can be created through synergising and adjusting the spatial distribution. Through research by design, approached by students of the Department of Urbanism at the TU Delft, the scope and application of regional planning for energy development will be illustrated to facilitate an adaptive, inclusive and collaborative energy transition in the Province of South Holland.

A systemic change is needed, which will create the opportunity for the port of Rotterdam to evolve from the current petrol scape to a renewable energy scape and to become a leading role model in the energy transi-

tion towards regional renewable energy generation and distribution, and a global hydrogen hub. A fair system without energy poverty, accessible, affordable and efficient energy and mobility, a re-purposed energy space for diverse renewable energy systems and a recycling system, and a local energy production will enable a just transition towards a fossil fuel free future for the Province of South Holland.

[Complete report](#)

A redefined Energy Landscape in the Post-Petrol Era

Phases of transition towards a circular sustainable future for the port of Rotterdam region



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Maria Lakoumenta
Ludo van Muilekom

Tutors: Birgit Hausleitner, Marcin Dabrowski

Key words: circular economy, spatial justice, energy transition, decentralized energy network, post-petrol era

The importance of the energy transition is an emergent issue on a global scale. The United Nations, the European Union, the Dutch National government and the Province of South-Holland all have set clear and urgent goals. But still, it seems very hard to find the right strategy to tackle this challenge, together with a desired circular economy and without letting people behind. The Province of South Holland envisions sustaining the region with the port of Rotterdam as an important energy node for Europe and the region itself. Now, the port still relies heavily on petrol, which will become obsolete in this transition. Therefore, the petrol dependency endangers a sustainable and secure future for the port of Rotterdam region. The energy transition will be achieved through three phases from 2020, to 2030 and 2050 in an aim to gradually phase-out fossil fuels and phase-in renewable alternatives, together with increasing levels of circularity and social inclusion. Hence, this process revolves around the integration and intertwining of three main pillars that shape the framework of this project: Energy transition, Spatial justice, Circular economy.

In the post-petrol era of 2050, the region of South Holland will embody a dynamic and adaptive energy landscape. This new energy landscape will become more resilient and autonomous. The landscape will consist of an interdependent and just network of actors and relies entirely on renewable energy sources.

In the future, the port of Rotterdam will be an important node on the global and regional scale. The future port will be the core of the decentralized energy network in the region, consisting of several energy nodes that connect autonomous and self-sufficient energy regions. Besides, these nodes are serving as hubs for energy storage, rais-

ing awareness, education and other social activities. The port and the energy network will be opened up to the public to establish a new cultural relation between use and production of energy. Pernis-Botlek will be the strategic location where this comes together. The development strategy will reveal how individuals from all origins and walks of life will be included and can adapt to this change. Since, not only public actors have high interest to make this transition happen, private actors and citizens that have to change their business models and daily activities have to be considered. Therefore, the strategy also reveals how different stakeholders can work collaboratively and what actions are needed to combat the energy transition together. This will be shown with case studies in Brielle, Delft and Westland. To maintain the economic importance in the energy sector of the port on a global scale, an invert of energy flow will be purposed, from the import of Petrol to the export of hydrogen.

[Complete report](#)

A HARD TRANSFORMATION

Transforming Hard Infrastructure to create a sustainable future through the use of green, connected and smart solutions.



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Ke Zhou
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Tutors: Alexander Wandl, Caroline Newton

Key words: infrastructure, sustainability, green, connected, smart

Humans are consuming resources at a rate that the natural world can not sustain. Nations around the world are grappling with large amounts of possible interventions that can stop or at least delay the battle against environmental degradation. While we may not notice it, hard infrastructure (energy, transportation, water management and communications), have a out-sized effect on the negative impact that humans have on the natural environment. It is a representation of the backbone of modern society that can both enable, and disable, our ability to transition to a more sustainable future. Directly linked to this our loss of connection with nature. Infrastructure is a critical piece of the puzzle that is the creating of a sustainable future. That's why this project will focus on using hard infrastructure to enable us to live within the planetary boundaries in the context of South Holland in the Netherlands. An inventory of the existing infrastructure network is completed to understand the scope of the problem. Subsequently, a literature review, analysis of similar case studies and industry research was completed to understand potential solutions. Then, using the existing natural structure as a backbone, a series of green, connected and smart interventions are proposed. These interventions occur on provincial, municipal and local scales and work together to enable the human sphere and the ecosphere to exist in symbiosis.

This project is a proposal for how to achieve a sustainable, innovative, just, accessible and resilient South Holland by the year 2060 through a re-imagining of the hard infrastructure system.

[Complete report](#)



UrbanScraps

A local steel cycle for maritime manufacturing in South-Holland by 2050



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Tutors: Diego Andres Sepulveda Carmona, Robbert Jan van der Veen, Karel van den Berghe

Key words: circular economy, maritime manufacturing, R-ladder, steel flow, urban manufacturing, participation

Mankind is exhausting natural resources. Therefore, the need to transform the linear material flows towards circular chains is increasing. Steel is a material that is produced and used globally and has high potentials for recycling. However, in the maritime sector, steel is currently barely recycled, let alone reused in a more direct way. Maritime manufacturing is a vital industry in the province of South-Holland, strengthened by a strong knowledge network. The aim of this project is to localise and extend the steel life cycle, to create an environmentally and socially sustainable province in which maritime manufacturing can grow in a responsible way. In order to close the loops, the R-ladder is used as a framework for circular material flows in the manufacturing industry and in the participation of the citizens. A local steel life cycle for maritime manufacturing will be achieved through the connection of the steel using maritime companies in Rotterdam and the Drecht Cities with the steel production company of TATA Steel in IJmuiden. Missing links in the cycle, a secondary steel processing company and ship disassembly companies, will be brought to the province, providing a new purpose to the port of Rotterdam when

fossil fuels phase out. The transition to material circularity will be made possible through innovations in modular shipbuilding and renewable fuels. Innovation centres in the maker's industry will bridge between knowledge and practice. The consumers will be involved in the material transition through community re-hubs in their cities, where they can share, reuse and recycle products. In this strategy, the extensive water network will function as a backbone along which spatial developments will take place. The water backbone will be a connector for both public transport and industrial transport. This strategy for a transition towards circular steel flows in maritime manufacturing, can be an incentive and inspiration for other manufacturing sectors to close their material cycles.

[Complete report](#)

FleetFlow

Circularity into every stage of the ship's lifecycle



Kim van Balken - Jinlai Song - Timo van Oorschot - Ziqi Xu

Kim van Balken
Jinlai Song
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Tutors: Birgit Hausleitner, Marcin Dabrowski

Key words: ship manufacturing, circular economy, recycling industry, South Holland, material flow

With the growing world population and concerns about resource scarcity, environmental pressures, and social challenges more and more industries have a growing interest in transitioning towards a circular economy.

In South Holland, specifically in the port of Rotterdam, the ship manufacturing sector requires fundamental change. Circularity is currently hardly integrated into the ship manufacturing sector, as the life cycle of most ships follows a linear path. The cycle starts with raw metals being extracted from the earth, ending with scrap steel being poorly recycled for other sectors in Asia. Because of the lack of a global regulatory framework, and the growing capacity and capability pressures on the ship recycling business in Europe, the business will not be able to process the increasing number of ships to be recycled in the future.

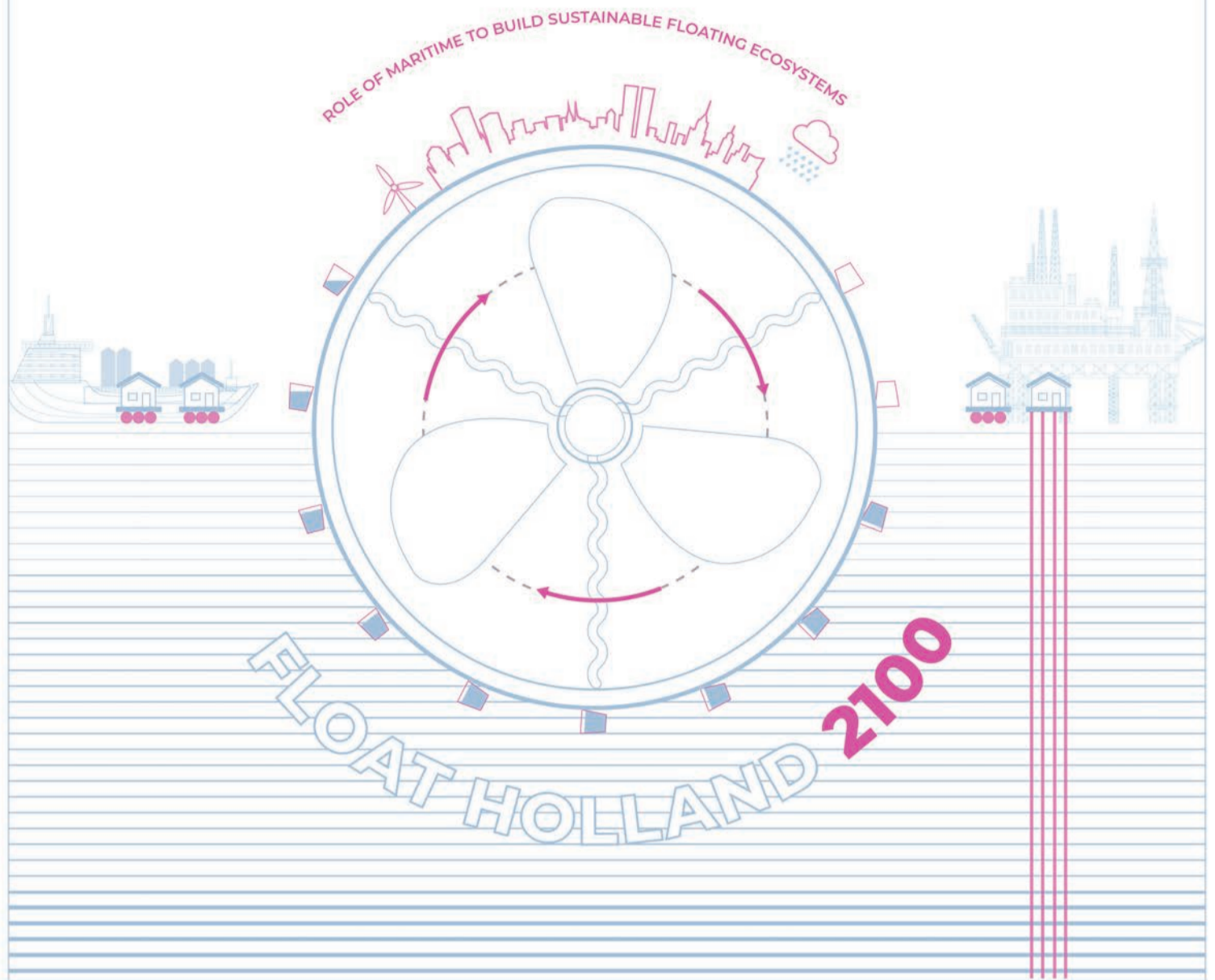
To generate a spatial vision and strategy to solve these issues, which helps transition to a more circular ship manufacturing sector, this research uses evidence-based design. Several methods are used including literature research, data analysis, site analysis, and research by design.

This is done to work towards the final goal: integrating spatial, technological, and regulatory solutions into the ship manufacturing business of South Holland, to build circularity into every stage of the ship's life cycle. Essential in reaching this goal, is safeguarding the ship manufacturing sector, which is in a vulnerable position, in symbiosis with resilience, innovation, collaboration, and transparency.

In the end, the province of South Holland will be a world-leading example demonstrating more circular ship manufacturing in the port of Rotterdam. Spatially, this will result in a better port-city relationship, where ship manufacturing is embedded and mixed with other activities where possible, creating a synergy between different stakeholders. In addition, flows are connected by sustainable water transport.

By transitioning to a more circular ship manufacturing sector, the port of Rotterdam can contribute to the mitigation of the negative effects of climate change and resource scarcity. Additionally, the port of Rotterdam and its shipbuilding sector is of great international importance, which means the implementation of circularity can stimulate change and benefit people from the local to the global scale.

[Complete report](#)



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Tutors: Alexander Wandl, Caroline Newton

Key words: maritime manufacturing, adaptivity, water networks, flood-risk, transitioning landscape

The Netherlands is inextricably linked to a network of water, polders, and dykes. Recent climatic and anthropogenic transitions pose several threats to destabilize this balance including the rise in sea level, extreme weather, and floods which could drastically change the landscape of South Holland as we know it by 2100. With this potentially unstable future in context, the demand for space and houses in the Netherlands rises consistently.

However, the combination of these issues presents an opportunity to restore the balance and linkages of Dutch ways with water. The future of the Maritime manufacturing industry can act as an adhesive to sustain these links by drawing on transitions around water at a global as well as local scale. Hence, the project intends to investigate the changes in the role of water systems in 2100 and how the Maritime manufacturing sector can steer it to address future spatial and climatic adversities.

In 2100, we envision the Maritime Manufacturing industry to expand its role to facilitate the adaptivity of the natural, social and technological landscape of South Holland, using water as the primary medium. We intend to introduce a radical transition by planning for diversified spaces on and for water, serving both an economic prospect as well as increasing consciousness of its role within society.

The vision addresses 3 major transitioning landscapes (wet peat lands, salt marshes, and water bodies) to develop systemic strategies and plan spaces by making optimum use of products by the Maritime industry. The vision opens up several areas of investigation around the 2100 'Portscape' including the scope of circularity in the shipbuilding/ship-recycling industry, rethinking material-

flows, and transitions in socio-economic structure in context to new social environments.

[Complete report](#)

SCRAPYARDS UNITED

nesting local scrap
metal cycles in a
national network
ZH2050

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Key words: metal, scrap yard, R-ladder of circularity, manufacturing, port of Rotterdam

Steel is a widely used and very circular material, it can be recycled endlessly but that consumes a lot of energy, therefore, it is one of the most polluting industries in the world. Only 2% of this pollution is caused by production, the other 98% is caused by transportation during the production and recycling process. Half of the pollution caused by transport is by export and import of scrap metal from and to the port of Rotterdam to Asian and African countries, this also creates geo-dependency on non-EU countries for essential materials. We will use research through design approach, quantitative (LISA data and Open street map data) and qualitative methods such as research on the steel cycle, scrap yard activities, stakeholders, and social and spatial environment. The main objective is to reduce the logistic effort by closing loops more locally by creating a network of bigger and smaller hubs and reinstalling makers- and manufacturing industries around the hubs in a symbiotic relationship. Hereby we aim to move metal recycling higher up in the R-ladder of circularity. Different socio-spatial, techno-economic and governmental strategies should make scrap yards

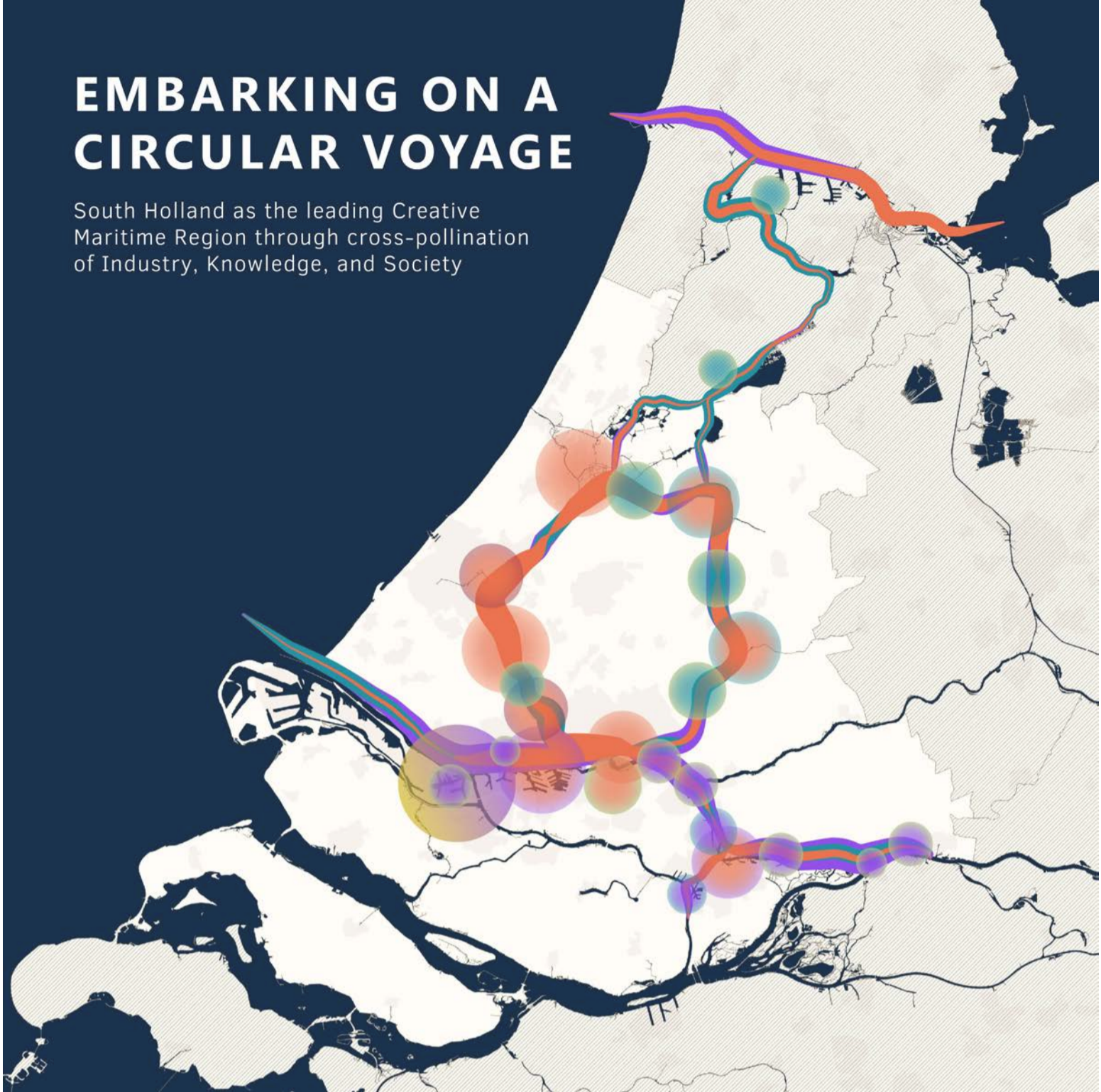
more attractive and interesting locations and intertwine them more into the urban tissue. Hereford, they should attract makers- and manufacturing industries around the scrap yards to form a symbiosis in the use of metal and scrap metal. Simultaneously, this increases dutch manufacturing and increases the local economy and decreases geo-dependency. The end of the report provides a set of strategies that can be applied to scrap yards throughout the country to improve the locations and the network between them. This project can form a precedent, both for other bigger industrial or port cities in Europe, as well as for different material flows.

We propose a strategy in which metal scrap is kept more local, and is R3 - Reused or R4 - Remanufactured locally, and only moving to the R5 - Recycling facility when R3 and R4 are not possible. Additionally, we propose an R5 - recycling facility in the port of Rotterdam, where steel can be recycled locally and in a green sustainable manner. Next to the R-ladder strategies, we propose a fourth R-strategy, namely Reconnect. To be able to create this R3, R4, and R5 strategy we need to create a connection between the scrap yards in the Netherlands and define their function within the system. Additionally, to be able to Reuse and Remanufacture more locally, we need involved stakeholders, consisting of governments, the steel industry and also society as a whole to participate. Therefore, we propose to transform scrap yards into more attractive places, not only for collection and sorting but also to introduce other activities.

[Complete report](#)

EMBARKING ON A CIRCULAR VOYAGE

South Holland as the leading Creative Maritime Region through cross-pollination of Industry, Knowledge, and Society



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Key words: circular economy, shipbuilding, maritime manufacturing, steel recycling, makers industry

The Netherlands has set the ambitious goal to have a fully circular economy by 2050. The Port of Rotterdam (PoR), the largest and busiest port in Europe, has strong potential to become a future circular hub. The PoR has been a major player in the seaport industry for centuries with, among others, a strong logistics sector and a robust shipbuilding industry. However, the Netherlands does not have a solid shipbreaking sector. During 2016 - 2020, an astounding 86% of the vessels that were serving Dutch beneficiaries were scrapped in the Global South. To achieve a circular maritime manufacturing sector in just under 30 years, collaboration between stakeholders is needed to realize innovative solutions. The research question is therefore how can cross-pollination between the shipbuilding industry, knowledge sector, and local makers lead to a circular ship manufacturing sector? A combination of literature review and research by design was applied to gain insight into the required changes in the material and waste flows, and the possible role of the Makers industry in realizing a Dutch circular maritime manufacturing sector. It is expected that the educational needs and skills required of the labour force will have to evolve to fit the circular economy, therefore, the requirements to ensure a just social transition were investigated. The results are a spatial vision for a circular maritime manufacturing sector anchored to the existing waterway networks of South Holland, and a road map to implement this vision. By 2050, South Holland is the leading creative maritime region, where stakeholders in the Randstad collaborate on innovative solutions based on a shared maritime identity, respect for nature, and accessible physical learning and working environments. With the projected sea level rise, achieving a circular ship manufacturing sector is poised to play a crucial role in realizing a resilient water-based future.

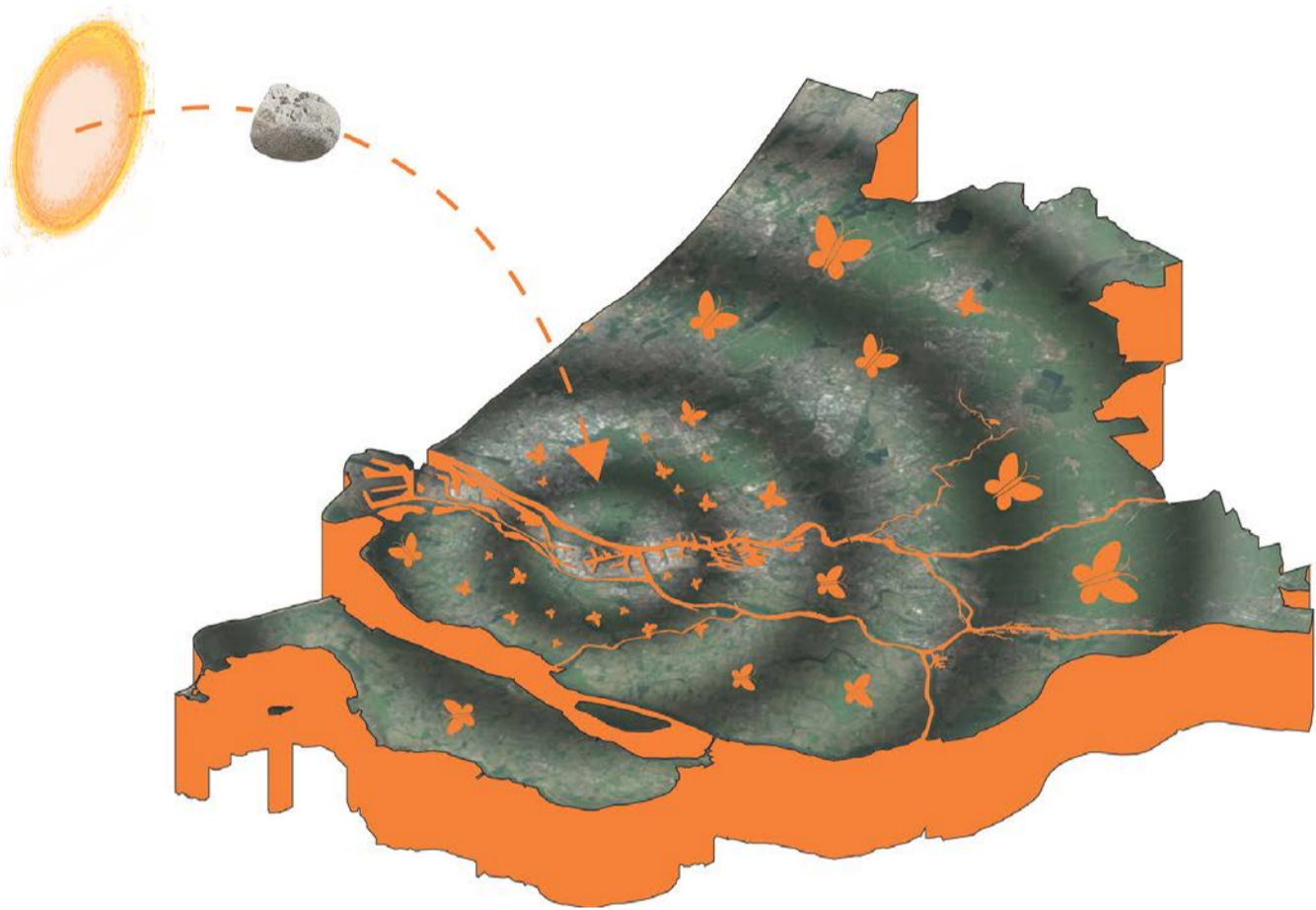
Recommendations:

- Ensure full governmental support through zoning policies for dedicated Makers Areas and industrial sites for the new shipbreaking sector along the navigable waterways of the province of South Holland.
- Realize physical learning environments in the form of 'mini ports' along the main western waterways using existing docking locations for real-life multidisciplinary education simulations.
- Construct new affordable water-based/floating residential areas on the peat lands in the eastern part of South Holland.
- Introduce new open management programs for the opportunities to an integral sharing of data, goods, products, waste, and energy.

[Complete report](#)

Butterfly Effect

Affordable circular bio-based building for South Holland



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Key words: bio-based building materials, organic agriculture, waste valorisation, Province of South Holland, port of Rotterdam

The Province of South Holland, not unlike the other provinces in the Netherlands, has a big housing demand. To meet it more building materials are needed in a short time frame. The current building sector is not environmentally friendly. Hence, a transition to a more sustainable building sector is necessary. Bio-based building materials are the possible solution for this. By transitioning to the bio-based building industry not only the construction sector would be affected, but the agricultural and waste industries would also undergo a positive transition.

With this information the following research question is formulated "How can the Province of South Holland synergize the circular bio-based industry and organic agriculture in order to improve the quality of life in a just way?".

To answer this question an analysis was done of the current building sector, the bio-based building industry, the urbanisation strategies, and the land use in the Province of South Holland. Out of the analysis, the potentials were concluded and a vision for 2050 was created.

We believe that in 2050 affordable bio-based building materials will be grown and manufactured locally in the Province of South Holland. This will allow for multiple transitions. A strong and continuous biodiversity network will be formed. Circularity will be ensured by the waste valorisation network of bio-refineries. Agriculture will be transformed to a diverse, organic, and sustainable landscape both visually and in practice. This will all be interconnected with new and existing housing areas, forming a unique mix of working and living. These four transitions will lead to new and diverse job opportunities, provide

better access to local organic food, and natural areas. Butterfly Effect will create a better and healthier living environment for everyone.

The implementation of the vision was elaborated by four different strategies and their illustrative locations. Each of them focuses on the implementation of one specific layer of the vision. Namely these are creating biodiversity network, creating waste valorisation network and transforming polluting industry to circular bio-based industry, shifting agriculture from deteriorating to re-mediating, and creating new living and working environments.

In short, by transitioning to the bio-based building material industry, Butterfly Effect will be created.

[Complete report](#)



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Key words: soil city, soil remediation, bio-based economy, nature-based solutions, Province of South Holland

'Down to Earth' proposes regenerative soil as the foundation of an innovative bio-based region in South Holland, that connects society and economy on all scales while restoring ecological systems. Agricultural Practices that have heavily relied on tilling and the heavy use of chemical fertilizers has reduced the quality of the topsoil compromising both food security and the carbon sequestration capacity of the soil. Additionally, Industries along the port of Rotterdam that is heavily dependent on fossil fuel have polluted the land it is based on and emitted large amounts of carbon. The most powerful technology we have at hand to draw down this carbon load is healthy soil that can support plant life and micro-organisms naturally.

The strategy proposed in this report focuses on retaining the economic prosperity of South Holland while re-mediating the soil that supports it. Based on an understanding of the current land uses in South Holland and the level of disruption it causes to the natural systems within the soil, the region has been abstracted into pixels. Each spatial type would have a specific intervention that focuses on keeping the soil in it open and alive.

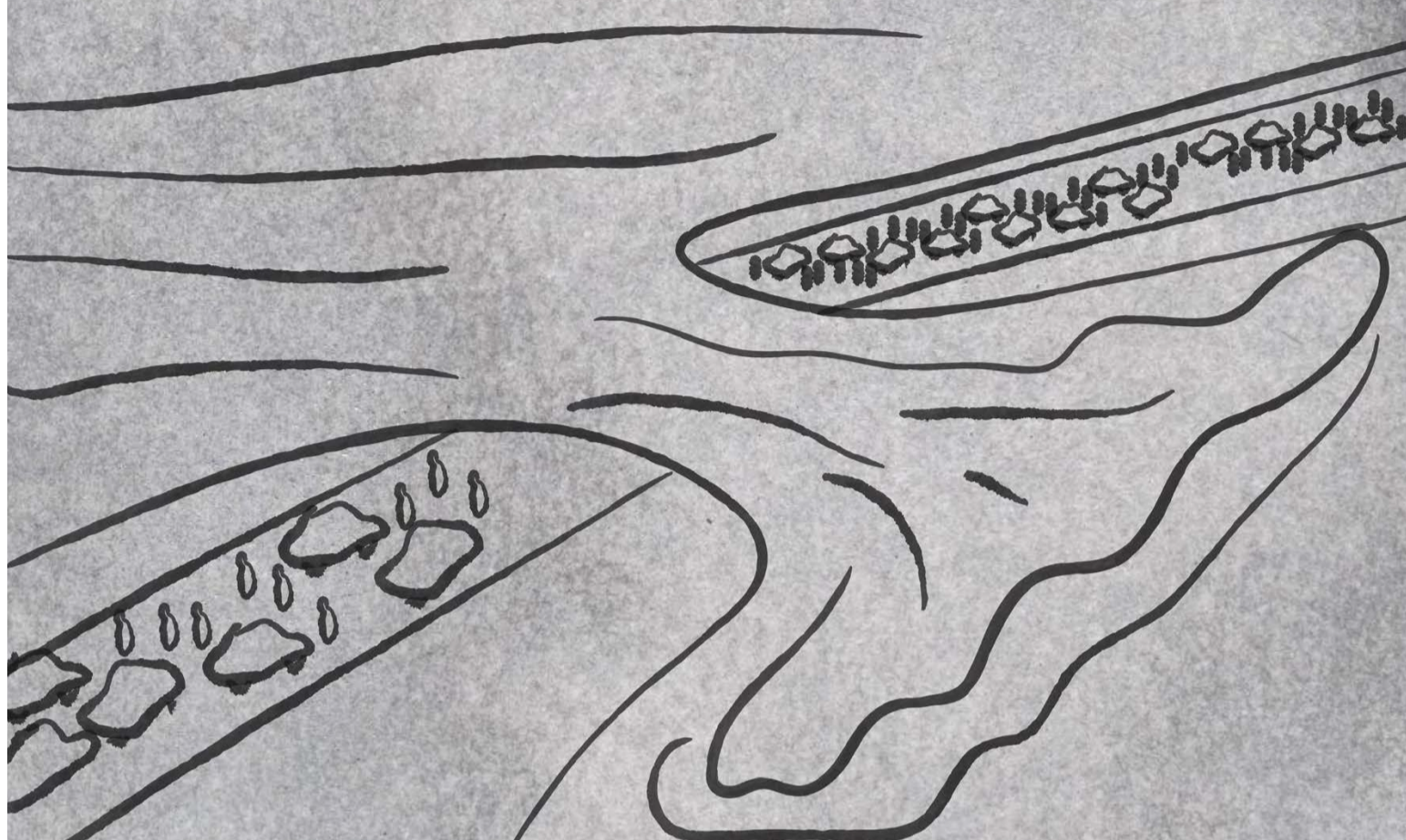
These interventions are further strengthened by creating links that support the exchange of biodegradable material and clean energy between stakeholders. This would serve as an additional economic incentive to support the pressing need to mitigate environmental damage. The guiding principles that make this transition possible include renewable energy generation, eco-sensitive development, nature-based solutions, valorization of biodegradable waste, and using policies to change consumer patterns and reformulate development trends. The pro-

posal, along with the layers of soil data that support it is a case of why soil remediation through bio-based economic activity is vital to sustainable growth and a vision of what development within planetary boundaries would include.

[Complete report](#)

raising waters

a circular water-based vision for an adaptive future of South-Holland



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Key words: delta landscapes, sea-level rise, adaptive water management, South-Holland

The Netherlands, and in particular South Holland, is to a large extent below sea level, making the region vulnerable to environmental challenges linked to sea-level rise. According to IPCC, a sea-level rise of two to five metres is not excluded, while the Delta committee advised the government recently to not invest in new infrastructure in the west of the Netherlands, because of the high risk of flooding.

This project aims to propose a vision for the cultural and economic adaptation of the province of South Holland in a scenario of a three-metre sea-level rise in 2100. Exploring the historical Dutch approach to water management, the project believes that adaptability can be achieved through a cultural shift in that approach. A shift is realised using education and stakeholder strategies from fighting the water to opening the dikes and adapting to it. Through research by design and vice versa, a new delta landscape was shaped, strengthening the existing potential of the area. The potential lay in environmental, economic, and cultural areas of society. The future environment is not only adaptive but also a desirable living environment for humans and non-humans.

The result of this project is a better understanding of how a more circular economy approach can be an adaptation tool to the irremediable consequences of sea-level rise in delta landscapes, using the South Holland region as a case study. Exploring the consequences and further adaptation to this new scenario spatially, this study is an example and a trigger for other delta landscapes to explore the different challenges that the area will face, presenting a possible and desirable future.

[Complete report](#)



CHAINS OF COOPERATION

a tool for change

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Key words: bio-based, waste-to-value, circular economy, cooperation, waste chains, CO2 trades

The province of South Holland is a region in the Netherlands that can be characterized by its flourishing economy. The place where the vein of the river Maas stretches out over land and the port of Rotterdam has settled in as a strategic trade-point. Moreover, the abundant agricultural sector in Westland holds accountable for not only multiple glasshouses, but also many livestock farms in the province. When it comes to social inclusion in this big trade-port frame, the disconnection between the workers of the port to the chain of trade they are involved in is clearly noticeable though. At the same time, farmers have no relation to the port industries and chains of distribution and cooperation.

This said, the vision strives to transform the linear, incoherent and patchy economy into a bio-based economy, truly rooted on circular and cooperative hallmarks. Enclosed within is a strategy that embeds entirely the waste-chains that can be found in both the Port and the agricultural sector and have currently been under-used. The idea of generating bio-energy from processed waste flows from glasshouses and farmers ensures that the production runs on bio-based means. To completely close the cycle, the vision enhances the port provision of CO2 through pipelines underground to the glasshouses in the Westland, as it further supports cultivation of crops and helps to reduce unsustainable energy consumption. New cycles based on waste, unveil new landscape demands in the Province of South Holland, in which waste streams can be treated, traded and re-used for new purposes. These are zones with high potential to become spots for the exchange of knowledge from both parties (Port and agricultural sector) on how to strive and cooperate in the transition towards a circular and cooperative economy, in the near future.

[Complete report >](#)

BIOCYCLE

Promoting the Biobased Economy
in the Province of South Holland



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Fábio Alzate Martinez
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Margot Schouls

Tutors: Diego Andres Sepulveda Carmona, Robbert Jan Van der Veen, Karel Van den Berghe

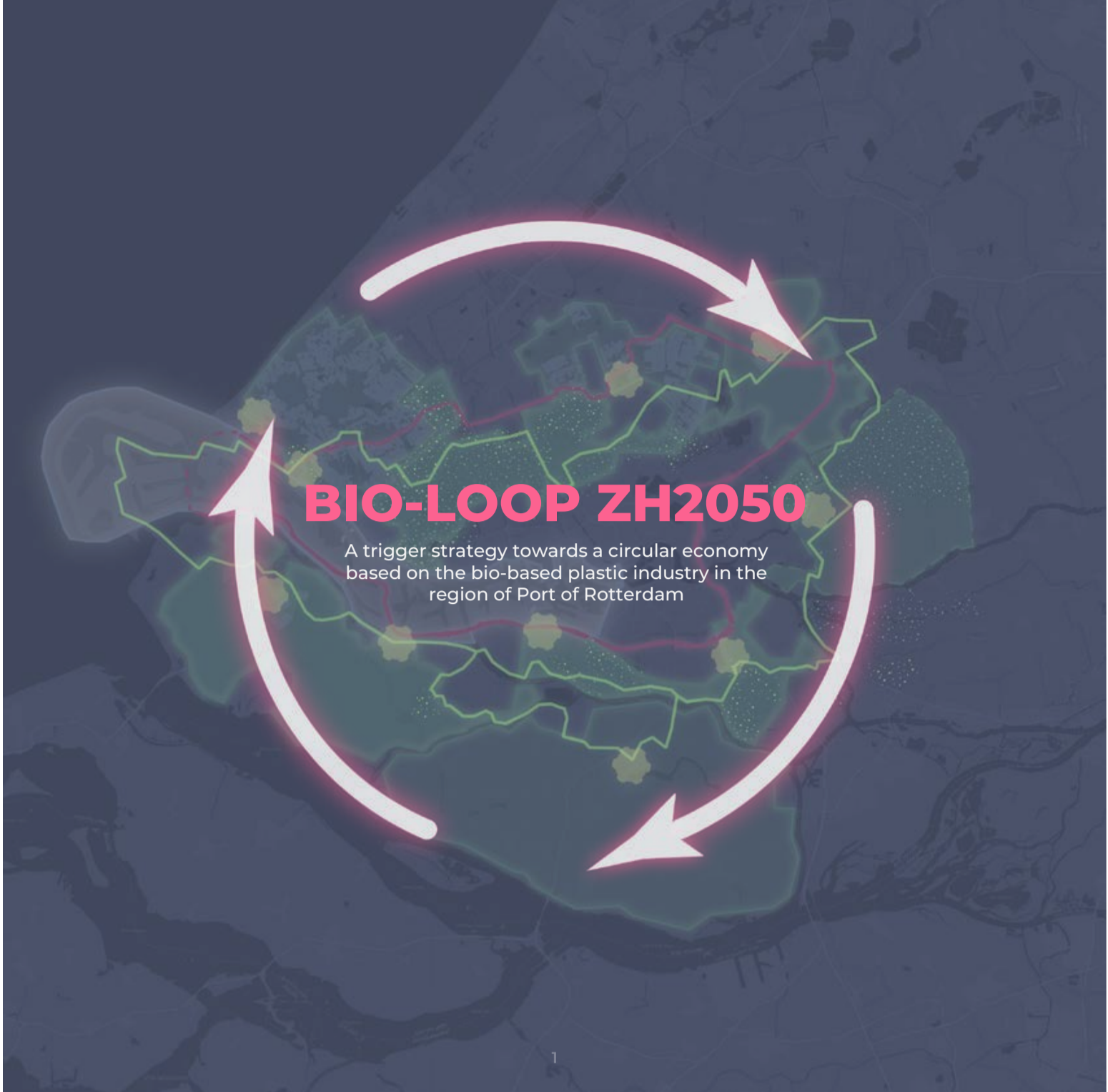
Key words: : biobased economy, port of Rotterdam, conflict of space, knowledge hubs, bio-energy

There is an urgent ongoing transition towards sustainability in built environments. In accordance with the European Green Deal and the Sustainable Development Goals it is important to; reduce greenhouse effect emissions; increase biodiversity; promote clean energy; and mitigate climate change effects. This transition will significantly impact South Holland, which has almost half of its surface dedicated to the agricultural sector. Also, it will impact the Port of Rotterdam, the area's most important economic asset, which heavily relies on the petrochemical sector. Furthermore, the land-use of these industries creates a conflict of space between urban areas, agriculture, and nature - whereas lack of ecology is leading to a dangerously low biodiversity.

In this sense, this report proposes to relieve the environmental pressure of the agricultural and petrochemical industries, whilst ensuring the continuity of its economical relevance and job offering to the province of South Holland. To tackle this, this research aims for a biobased transition that also creates a more balanced land-use and reduces emissions of the current petrochemical industries. With this the spatial implications were explored by researching on how to ignite the biobased transition in South Holland by linking its agro-urban structure with new potential bio-industries, promoting optimized cascade flows, and sustainable land use.

After an iterative process of designing and research, the BIOCYCLE strategy comprises all the key aspects to achieve social, industrial, environmental, and agricultural sustainability by integrating the spatial structures of South Holland with its main actors. Therefore, allowing a responsible transition towards the bio-economy model that reinforces the current economic competitiveness of the region by incorporating the full potential of the agro sector as an economic generator by empowering local actors.

[Complete report](#)



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Key words: bio-based plastic, circular economy, biomass, green belt, port industry

Nowadays, circular economy is of growing importance in the social, economic, and environmental fields. The realisation happens on different scales. First steps towards a circular economy have already been taken, but it will take time before a circular world is reached. Also, under the Sustainable Development Goals (SDG), the bio-based concept raises more awareness.

This strengthens the aim to create a circular economy. The industry in the port of Rotterdam is mainly based on fossil-based industries that follow the linear system. Therefore, high emissions and waste are caused. This contradicts the aims of the SDG and the idea of a circular system. Consequently, the port area should be transformed into a flexible system that can adapt to changing future situations. This will be realized by a circular system that contributes to the development of the bio-based industry.

This transition is triggered by the current oil- and plastic industries taking place within the Port. By treating the bio-plastic industry as a trigger industry, a strategy for the transition towards a bio-based system is created. This leads to a circular economy that depends on bio-based materials. Since the bio-based system might face future challenges, it is important to guarantee further adaptation and self-improvement over time. The final goal is to create a closed-loop within the Port region to reduce emissions and waste products using these bio-based materials.

To close this loop, the Bio-Loop ZH2050 is integrated into the Port area. A Green Belt strategy promotes the circular economy within the province of South Holland, and by implementing the Living Labs, knowledge and tech-

nologies are improved over time. The Bio-Loop ZH2050 influences the aim of the province to become 100% circular by 2050 and several SDG topics. Environmentally, this project supports the transition towards a circular bio-based system and to reduce the impact of pollution and climate change. Socially, the Bio-Loop ZH2050 creates the possibility to get society involved in the bio-based circularity. And finally, economically, the port of Rotterdam will become the port of Europe based on the bio-based economy, which is the entrance connecting the global market and EU market.

[Complete report](#)



PLASTICITY

Shaping the transitions to a resilient and circular plastic manufacturing system



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Key words: plastics manufacturing, circularity strategy, transition management, port of Rotterdam

Different government bodies, from the European Union down to the Port of Rotterdam authority have implemented the policy goal to become circular by 2050 to minimize demand and dependence on finite resources. However, a circular economy - an economic model in which materials circulate in closed loops and waste is viewed as a resource - is vastly different from the current linear system of extraction, consumption and waste. The plastics industry that is currently present in the port of Rotterdam is one such industry where large amounts of raw material is being used and large amounts of waste generated. It is still far from circular. Thus, transitions in the industry itself and in our interaction with products are necessary. The question that arises is: how can the transition to circular plastic manufacturing in the Rotterdam maritime region contribute to a more sustainable, resilient and just economy?

Theory on transition management and socio-technical systems, analyses of spatial use and networks of the plastics industry in South Holland, and research on the developments in plastic manufacturing, has led to the understanding of the current networks and flows in the plastics industry. A subsequent analysis of stakeholders, policies and design options has led to a vision and strategy for the South Holland region, on how to shape a new circular plastics economy.

In the proposed strategy of Plasticity, (1) the strength of a strategic location in the port of Rotterdam is used to expand the renewable cycle of the bio-plastics industry, and (2) by actively engaging citizens in reusing and recycling plastic products on a local level in the whole region, a technical circular cycle is enhanced in the whole prov-

ince. Plastic is used as an example to demonstrate the contemporary issues around dependency on fossil material in the South Holland context, but similar principles regarding integrating the biological and technical cycle, facilitating space for innovation and growth of circular models, and engaging the whole socio-technical system in the transition process can be applied to other sectors and places. This expands the applicability of this vision and strategy beyond plastic.

[Complete report](#)



THE PROTEIN FACTORY

An inclusive spatial strategy for
the transition towards a sustain-
able system of protein-based food
within the province of South
Holland.

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Key words: port of Rotterdam, protein alternatives, agriculture, animal husbandry

The Netherlands has a crucial role in the global animal-based food supply chain by the virtue of the port of Rotterdam. However, the current production process of meat and dairy products is not sustainable in the long term as it is dependent on global supply and also responsible for a vast amount of emissions and waste. Moreover, the whole system lacks resilience to global challenges such as pandemics, wars, animal diseases, and other unpredictable events. What is more, in the Netherlands, the meat consumption trend is decreasing due to raising environmental awareness and ethical problems.

We tackled the problems firstly by analysing the current situation: conducting the site visit, mapping, analysing GIS data, and listing stakeholders. Furthermore, the research was conducted taking into consideration related literature and relevant documents. Research by design was used to experiment with strategic proposals. The project was carried away by carefully analysing and making proposals on various scales and taking into consideration environmental, economic, and social aspects. Overall, both qualitative and quantitative research approaches were used when applicable.

This was used to make an inclusive, knowledge-based, and well-developed vision and strategy for the province of South Holland. The main goal of the project is to achieve a sustainable protein-based food supply chain that would be resilient to societal changes, adaptable to environmental challenges and would offer more locally produced protein alternatives. With this vision and strategy, local production and plant-based protein cultivation would be encouraged. As a result, a reduced livestock footprint could be achieved. Moreover, innovative methods of energy production and waste management would

be implemented. This transition also aims to improve job accessibility, stimulate innovation and shift consumer behaviour towards more responsible consumption. Gradually, it should be implemented in other Dutch provinces to achieve a full transition toward a sustainable protein-based future in the Netherlands.

[Complete report](#)



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Key words: circular food supply chain, inclusive food supply chain, organic fertilizer production, community exchange, land use interfaces

Food. It is grown, processed, distributed, sold, eaten and then oftentimes carelessly discarded. In the European Union, 88 million tonnes of food waste is produced each year, while the Netherlands stands out as the EU's largest producer. Food waste causes soil degradation, emits significant amounts of greenhouse gasses and can contribute to poorer respiratory health. Moreover, food waste is also representative of our growing disconnect with natural systems and subsequent unsustainable lifestyles. Yet, annually, more natural habitats are destroyed to make way for agriculture and livestock, often in response to providing for a growing population. However, there can be a re-imagination of a more circular bio-based economy and food supply chain that lessens the pressure on the earth. The existing infrastructure of the port of Rotterdam and its surrounding areas provide a fertile landscape in which this can take place. Additionally, while reducing food waste, intensifying social segregation and inequality concerning ethnicity, income and urban/non-urban divides in South Holland can be addressed to ensure environmental, economical and social robustness and longevity.

Solutions for problems relating to food waste, and social segregation and inequality, have then been translated into a spatial vision and strategy to realize a more circular and inclusive food supply chain in South Holland by 2050. The vision and strategy are based on holistic analyses of the spatial distribution and character of the current linear food supply chain and demographic studies of the inhabitants of South Holland. This is then supported by policies and strategic projects that aim to use and build onto existing frameworks and spatial conditions to achieve the overarching aims. Key drivers of

the vision and strategy include a transition of the port's current fossil fuel economy to a regional hub for organic fertilizer production to be exported domestically as well as internationally. Additionally, a network of community exchange centres and a matrix of interfaces together aim to change the spatial and societal fabric of South Holland. To do this, they provide space for members of the same and different communities to share knowledge, experiences and tools, as well as re-establish connections with the natural world.

[Complete report](#)