



Just Zeeland?

A place based and community
driven alternative to centralised
energy production

Authors

Elerina Karolou | 6295843

Kiki van der Veen | 6343651

Mila Veenboer | 6376274

Stepan Prikazchikov | 5253314

Supervisors

Alex Wandl & Marcin Dabrowski

Colophon

Project

Just Zeeland?

Q3 courses

AR2U086 | R and D Studio: Spatial Strategies for the Global Metropolis

AR2U088 |Research and Design Methodology for Urbanism

Programme

MSc Urbanism, TU Delft

Faculty of Architecture and the Built Environment

Author

Elerina Karolou | 6295843

Kiki van der Veen | 6343651

Mila Veenboer | 6376274

Stepan Prikazchikov | 5253314

Supervisors R&D studio

Alex Wandl & Marcin Dabrowski

Quarter coordinators

dr. Verena Balz

dr. Nikos Katsikis

Supervisors Methodology course

Roberto Rocco

Juliana Goncalves

Date

08 April 2026

Image and Data Credits

All maps, drawings, and diagrams are produced by the authors unless stated otherwise.

External sources are acknowledged in captions and referenced in the bibliography.

“The content of this publication has not been approved by the United Nations and does not reflect the views of the United Nations or its officials or Member States”.

© **2026.** Elerina Karolou , Kiki van der Veen , Mila Veenboer and Stepan Prikazchikov

This work is licensed under a **Creative Commons Attribution 4.0 International (CC BY 4.0) Licence**. This means that parts of this work may be shared, copied, redistributed, and adapted for any purpose, including commercial use, provided that full and appropriate credit is given to the authors, a link to the licence is provided, and any changes made are clearly indicated.

Disclaimer

This report is an academic exercise. The views expressed are those of the authors and do not necessarily reflect those of TU Delft or associated stakeholders.

Date and Location

Delft, April 2026

Abstract

Just Zeeland is an energy transition project that places spatial justice at its core. Located in the province of Zeeland, the project responds to national ambitions to transform the region into a major energy and industrial hub, including the expansion of nuclear energy. In contrast, it proposes an alternative future without nuclear energy, based on a resilient and circular system that balances economic stability, environmental quality and social justice.

The project is grounded in one overarching community: rural delta residents whose daily territories intersect with energy infrastructures. Within this group, three sub-communities are identified: village based residents, industrial workforce residents and transition-oriented communities. Each represents different values related to economic stability, environmental responsibility and governance. The aim is to develop a spatial framework that balances these perspectives.

The approach combines spatial analysis, stakeholder analysis and research by design. A phased strategy towards 2100 is developed across multiple scales and structured around three interconnected systems: industry, mobility and energy communities. Industrial clusters are reorganised into circular systems supported by renewable energy and hydrogen. Mobility systems improve regional accessibility and connect communities through hubs and networks. Energy communities range from local, self-sufficient systems to larger clusters that also produce energy for the wider region.

The results show how bundling infrastructure, organising flows and strengthening local systems can reduce spatial pressure while improving accessibility and energy resilience.

The project demonstrates that integrating industry, mobility and community-based energy systems can support a more balanced and socially and spatially just transition, in which economy, environment and society are more equally aligned.

Keywords: spatial justice, energy transition, territorial circularity, energy communities, industrial transformation, mobility systems

Table of contents

01. Introduction	8	05. Vision	78
1.1 General needs	10	5.1 Village based residents	80
1.2 Zeeland (system)	12	5.2 Industrial workforce residents	82
1.3 Policy	18	5.3 Transition-oriented	84
1.4 Urgencies	20	5.4 Community vision	86
02. Community	22	06. Strategy	90
2.1 Nuclear perspectives	24	6.1 Strategy	92
2.2 Stakeholder arena	26	6.2 Strategic framework	94
2.3 Defining the community	30	6.3 Phasing strategy	98
2.4 Communities in focus	32	6.4 Theme A - Mobility of the future	102
2.5 Media analysis	36	6.5 Theme B - Industrial transformation	116
2.6 Wishes and concerns	38	6.6 Theme C - Energy communities	124
03. Theory and methodology	42	6.7 Total strategy visuals	138
3.1 Problem statement	44	07. Conclusion & discussion	142
3.2 Research questions	46	7.1 Conclusion & discussion	144
3.3 Conceptual framework	48	08. Reflection	148
3.4 Theoretical framework	50	8.1 Group reflection	150
3.5 Methodology	52	8.2 Individual reflection	152
04. Analysis	54	09. Bibliography	156
4.1 Energy	56	10. Appendix	164
4.2 Economic and industries	66		
4.3 Spatial qualities	68		
4.4 Energy futures	70		
4.5 Analysis conclusion	76		

01.

Introduction

Introduction

- 1.1 General needs
- 1.2 Zeeland (system)
- 1.3 Policy
- 1.4 Urgencies

1.1 General needs

1.1.1 Climate change

Climate change is one of the most urgent global challenges, primarily driven by continued greenhouse gas emissions from fossil fuel use. Since the late 19th century, the global temperature has risen by around 1.1–1.2°C. This has led to rising sea levels, more frequent extreme weather events and mounting pressure on ecological systems (IPCC, 2021).

Delta regions such as Zeeland are particularly vulnerable to these changes due to their low-lying landscapes and exposure to rising sea levels and flooding. This creates an urgent need to address climate change by reducing emissions and to adapt spatial systems to increase resilience and protect communities and ecosystems.

Climate change therefore forms the underlying driver for large-scale transformations in energy systems, spatial planning and economic structures.



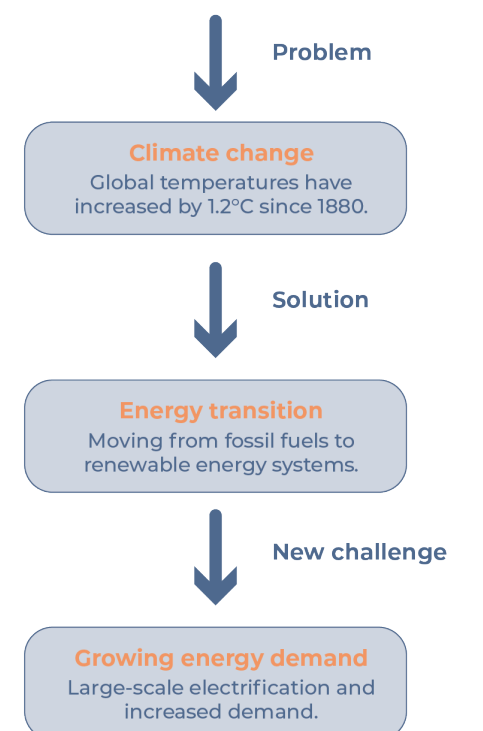
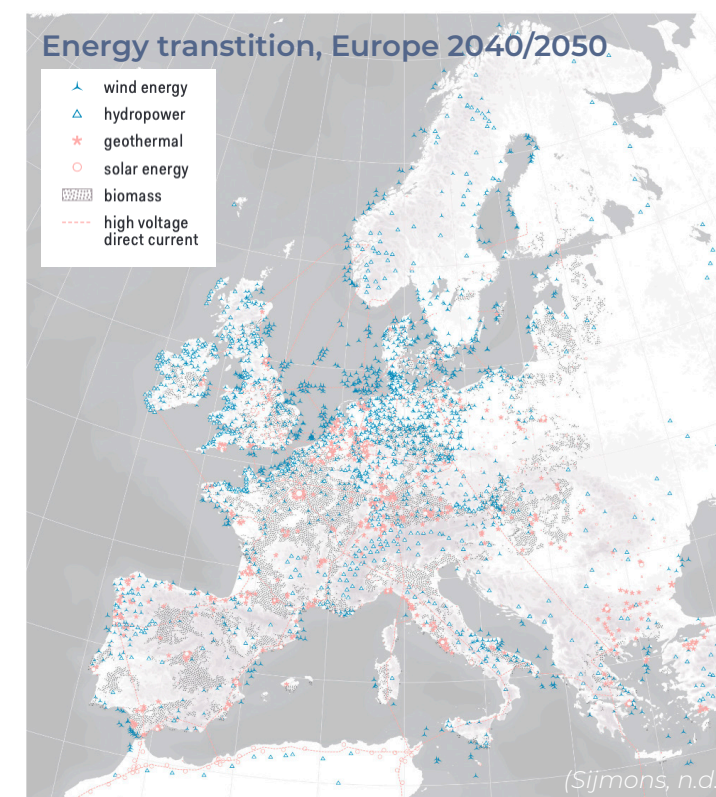
(Sijmons, n.d.)

1.1.2 Energy transition

In response to climate change, the global energy system is transitioning from fossil fuel-based sources to renewable, low-carbon energy systems. This transition is crucial for reducing greenhouse gas emissions and realising the climate goals defined in the Paris Agreement (European Commission, 2019).

However, the transition also introduces new spatial and societal challenges. The growing demand for electricity, driven by the electrification of industry, transport, and heating, necessitates the large-scale expansion of energy infrastructure, including wind farms, solar fields, hydrogen networks, and grid systems (IEA, 2022).

These developments are not evenly distributed across territories, often concentrating infrastructure in specific regions while the benefits are experienced elsewhere. This creates tensions between energy production, landscape quality and local communities. Therefore, the energy transition presents technical, spatial and social challenges, requiring place-based, integrated approaches.



1.2 Zeeland (system)

1.2.1 History

For a long time, Zeeland was characterised by a landscape of polders, dikes, and compact villages. It was a lived cultural landscape in which agriculture, settlement, and local identity were closely intertwined with the structure of the land. Each of the islands developed its own spatial character, and many of the villages that still exist today are rooted in medieval or early modern settlement patterns. Zeeland was therefore organised for centuries around agrarian production, small scale settlement, and a strong relationship between landscape and community life (Zeeuwse Ankers, n.d.-a; Rijksdienst voor het Cultureel Erfgoed, n.d.-a).

This landscape began to change fundamentally from the nineteenth century onward, when industrialisation emerged in the Netherlands. Industrial development did not occur evenly across the province, but instead concentrated along strategic infrastructures, most notably the Ghent–Terneuzen Canal.

Through the construction and later expansion of this canal, places such as Sas van Gent and Terneuzen became embedded in a new economic geography of extraction, processing, transport, and export. As a result, villages that had existed for centuries within an agrarian and regional logic gradually became part of an industrial corridor (Zeeuwse Ankers, n.d.-b; Zeeuwse Ankers, n.d.-c; Zeeuwse Ankers, n.d.-d).

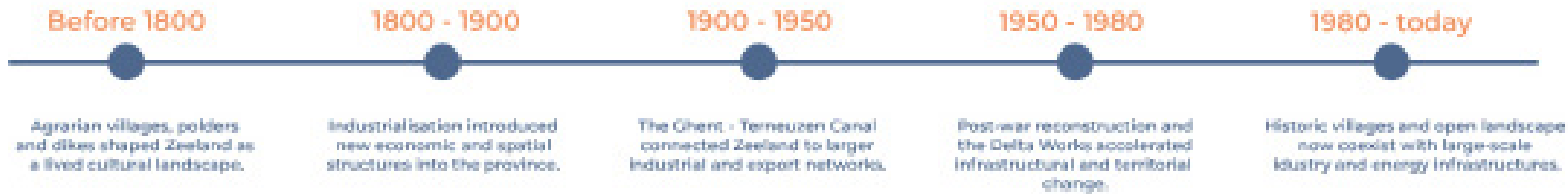
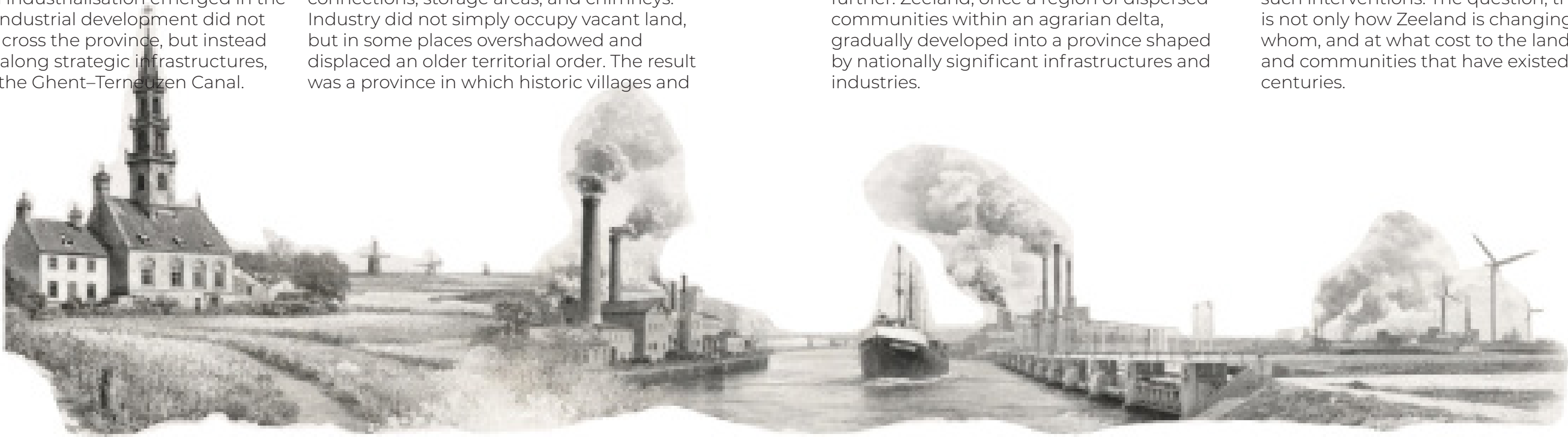
The addition of factories to the landscape did not merely alter its appearance; it also transformed the spatial logic of Zeeland itself. Whereas the historic landscape had long been structured by fields, village edges, and local roads, a new industrial landscape emerged, marked by canal branches, railway connections, storage areas, and chimneys. Industry did not simply occupy vacant land, but in some places overshadowed and displaced an older territorial order. The result was a province in which historic villages and

open agricultural landscapes increasingly came to coexist with, or stand in the shadow of, large-scale industrial systems.

After the Second World War, and particularly after 1953, this transformation accelerated. Through post-war reconstruction, infrastructural modernisation, and the Delta Works, Zeeland was restructured at the territorial scale. During this period, the landscape was reorganised: improved accessibility, larger infrastructures, and a modern planning logic made the province increasingly suitable for industrial growth and new economic functions (Zeeuwse Ankers, n.d.-a; Rijkswaterstaat, n.d.). In this post-war period, the balance between village landscape and productive landscape shifted even further. Zeeland, once a region of dispersed communities within an agrarian delta, gradually developed into a province shaped by nationally significant infrastructures and industries.

This layered history is crucial to understanding Zeeland today. The energy transition does not enter an empty landscape, but one with its own history, in which industry has more recently claimed a dominant position. At the same time, the open polders, historic village structures, and cultural identity of Zeeland have never fully disappeared. They remain visible and continue to shape how new interventions are perceived (Provincie Zeeland, 2022).

For this reason, the history of Zeeland is essential to the project: it demonstrates that every new national transition leaves spatial consequences behind. These consequences are often felt most strongly in places whose local structure and identity long predate such interventions. The question, therefore, is not only how Zeeland is changing, but for whom, and at what cost to the landscape and communities that have existed there for centuries.



1.2.2 Energy production

Zeeland’s energy production system is defined by its position between the industrial clusters of northern Belgium, the Port of Rotterdam, the Moerdijk industrial zone, and the North Sea. This location places the province at the intersection of major energy and logistics flows, allowing it to function as both a production hub and a distribution corridor. The regional energy mix is the most diverse in the Netherlands, with onshore and offshore wind, solar PV installations, gas-fired power generation, nuclear energy, and blue hydrogen production. The Port of Vlissingen further plays a key role in supporting the offshore energy sector, with facilities for the construction and maintenance of wind infrastructure.

Beyond its internal system, Zeeland operates as a net energy exporter within the Dutch and northwestern European energy network. Large-scale offshore wind generation feeds

into the national grid and supports demand in more densely populated regions such as the Randstad. At the same time Nuclear energy provides a baseline energy production, and industrial gas turbines produce flexible energy generation largely consumed locally by the industrial base, including chemical production, refining, and port-related activities. This creates a dual role for the province with it both being a production landscape supplying external demand and a high-intensity consumption zone driven by energy-dependent industry.



1.2.3 Industry

Zeeland is, in addition to being a landscape of villages, polders, and infrastructure, one of the most strategic industrial regions in the Netherlands. Its industrial profile is mainly concentrated around Vlissingen-Oost, Terneuzen, and the Ghent–Terneuzen Canal, where port facilities, cross-border connections, and strong infrastructures are clustered (North Sea Port, n.d.-a). Within this cluster, chemical industry, refineries, fertilizer production, tank storage, logistics, and energy infrastructure play a central role. As North Sea Port (n.d.-b) states, the region hosts a broad chemical ecosystem “from refining to biofuels, from plastics to hydrogen carriers.” This shows that Zeeland’s industry functions as an interconnected production landscape rather than a collection of separate sites.

This makes Zeeland highly relevant to the energy transition. The province combines

energy intensive industry, port infrastructure, offshore wind potential, hydrogen ambitions, and the Netherlands’ only operating nuclear power plant in one territory (Provincie Zeeland, 2025a). At the same time, this creates tension, as many of these industries still depend heavily on fossil energy and large-scale infrastructures. Zeeland is therefore both a crucial industrial region and a place where the pressure to decarbonize is especially high (Provincie Zeeland, 2025b). For this project, that makes Zeeland important not only as an economic cluster, but as a spatial condition in which industry, infrastructure, landscape, and nearby communities continuously shape one another.



1.2.4 Agriculture

Agriculture is one of the main forces shaping Zeeland’s landscape. The province is largely characterized by an open landscape of polders and fields, with provincial policy linking this spatial structure to the quality and identity of Zeeland. The Zeeuwse Omgevingsvisie considers sustainable agriculture to be one of the key components of the future physical living environment, while also safeguarding the importance of landscape quality and biodiversity (Provincie Zeeland, 2021). Agriculture in Zeeland is therefore not only an economic sector, but also a spatial system that determines the appearance, structure, and use of the land.

Zeeland is, to a large extent, sustained by arable farming. According to the Ambitiëdocument landelijk gebied, a wide variety of crops is cultivated on more than 85,000 hectares, making Zeeland one of

the largest arable farming provinces in the Netherlands. In addition to arable farming, dairy farming and fruit cultivation also represent important sectors (Provincie Zeeland, 2019). The dominance of arable farming is visible not only in economic figures, but also in the landscape itself, where the large-scale openness, rational parcel structures, and productive polders are directly connected to this form of land use.

The agricultural landscape of Zeeland shows that a productive landscape is never neutral, but rather one in which economy, spatial planning, and landscape identity continuously shape one another (Provincie Zeeland, 2021; Provincie Zeeland, 2023). For this project, that makes agriculture relevant not only as a productive sector, but also as a spatial condition that helps shape the identity, use, and experience of Zeeland.



(Provincie Zeeland, n.d.)



(Stichting Het Zeeuwse Landschap, n.d.)

1.3 Policy

1.3.1 National perspective

The Dutch National policy for energy production is set out in the Nota Ruimte by the Ministry of Housing and Planning (VRO) with contributions from other relevant ministries, in particular, the ministry for Economic Affairs (EZ).

A significant recurring topic between the VRO and EZ is the need to protect, strengthen, and make more sustainable the energy-intensive industrial clusters (EII). The EII are seen as vital for the Netherlands' earning capacity, resilience, and strategic autonomy, and therefore necessitate preferential treatment in terms of financing, policy, and physical space. This drives the need to develop large centralised energy production projects, specifically, further expansion of offshore wind energy, and the search for new locations for Nuclear powerplants.

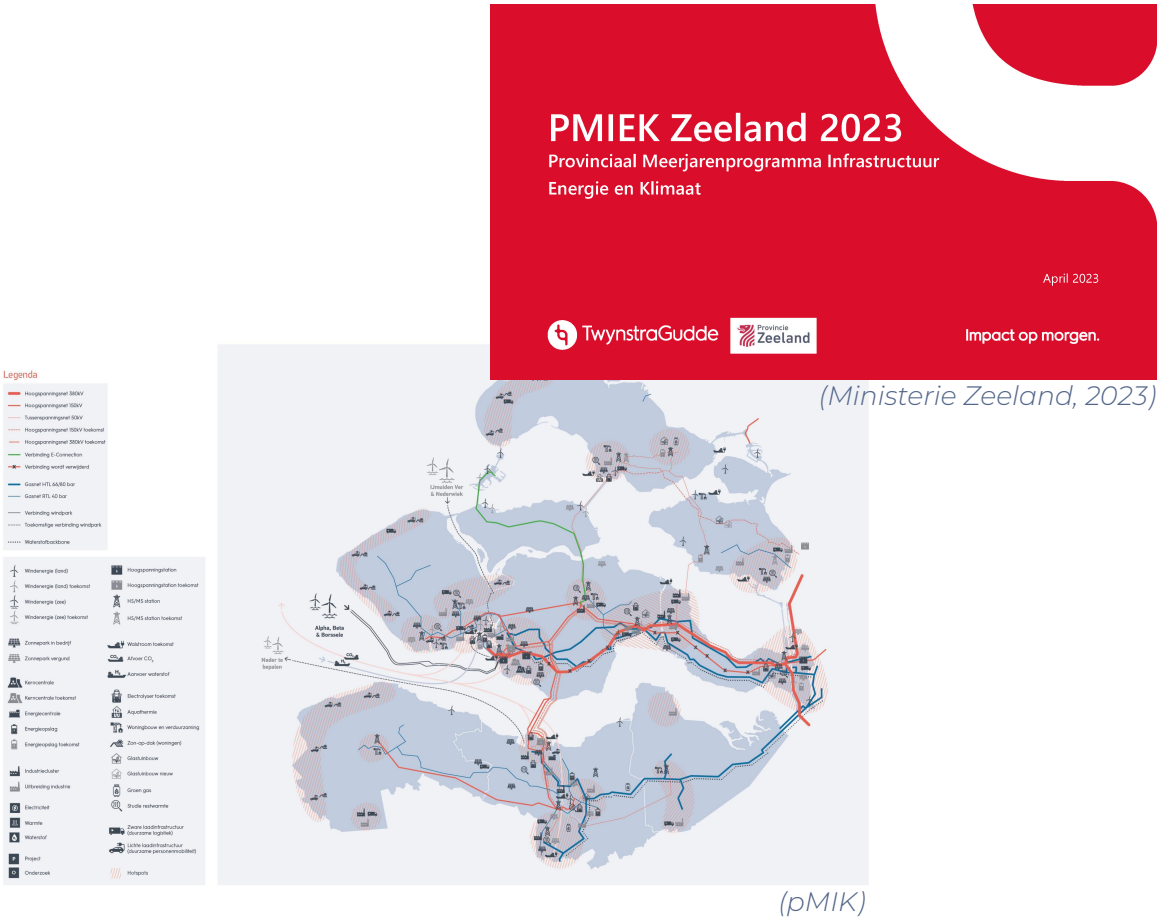
In Zeeland-West-Brabant this translates to the strengthening of the Chemical industry, new connections to off-shore wind energy, new 380 kV station, large scale electrolysis, and two potential locations for nuclear energy in the Sloegebied, and Terneuzen. The projection for two new nuclear powerplants in the region reveals a commitment to the development of the EII as well as the designation of Zeeland as an energy exporter.

1.3.2 Regional perspective

Provincial policies on energy production are described in individual Provincial Multi-Year Infrastructure Programme Energy and Climate documents (pMIEK), under guidance of the RVO. In this document the National policy is translated directly into various infrastructure projects, aimed at achieving targeted goals in an integrated programme.

The Zeeland pMIEK lays a strong focus on hotspots, where large demand and supply come together, creating locations which have a strong impact on national and regional energy systems. Infrastructure projects are clustered around the hotspots and connected where necessary by high voltage powerlines, and gas pipelines.

The aim is to ensure that the pMIEK connects to the National policy as smoothly as possible. The province, in this case, maintains little power over the direction of the projects that it must complete. Since the infrastructure plan is quite rigid and dictated in a top down fashion from the National government, less importance is given to local energy production projects, with these solely receiving attention along the tourist driven coastal areas. The spatial arrangement of projects along the central peninsula, which the powerlines bring to the forefront, further cement the region as a net exporter and carrier of the broader region in energy policy.



1.4 Urgencies

1.4.1 Government vs community

The imbalance in opportunities available to different actors at the local scale is clearly illustrated by the contrast between municipal policy approaches and those of industrial agglomerations.

Taking the municipality of Borssele as an example, local policy primarily revolves around vision-making for desired futures (“Welke gemeente willen wij zijn”), or the development of spatial visions in response to broader regional and national developments. This approach is evident in documents such as the Visie Sloerandzone, where community participation is used to formulate design guidelines for coexistence with expanding infrastructure. Implicit in this approach is the expectation that local communities must adapt to and accommodate large-scale developments, as reflected in strategies such as the “visual greening of infrastructure design”.

The industrial interests are advocated for by the Smart Delta Resources group (SDR). In a series of documents, the SDR both create visions for development, prognosis for growth, as well as plans for proposed energy transition projects. While the SDR comprises of a group of Industrial actors across the Vlissingen, Terneuzen, and Gent ports, with the support of Province of Zeeland and Oost-Vlaanderen, the

rhetoric within the policy documents shows desire for attracting new companies through beneficial schemes, and positive outlooks.

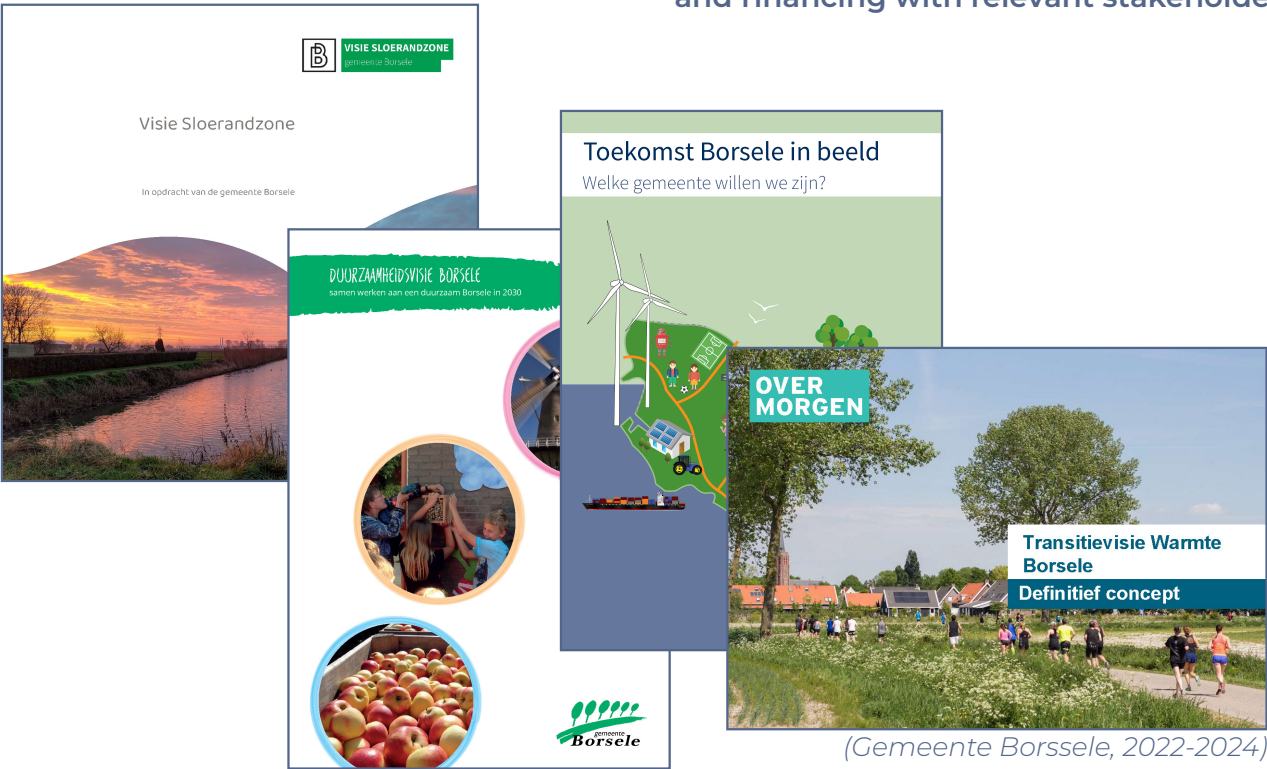
The municipalities and local residents can thus be seen as chasing the tail ends of development, while the industrial agglomerations seem to be leading and driving change, without keeping the local residents in their focus.

This contrast reveals a structural imbalance where municipalities and local communities operate in a reactive mode while industrial agglomerations appear to lead and shape the trajectory of change. In doing so, the interests and experiences of local residents risk being subordinated to broader economic and infrastructural agendas.



(Gemeente Borssele, 2025)

Local policy from **Industrial collaboration** focussing on integration of commercial desires and financing with relevant stakeholders



(Gemeente Borssele, 2022-2024)

Local policy from **Municipal collaboration** focussing on local participation and bottem-up visions



(SDR, 2022-2024; NPVI, 2024)

02

Community

Community

- 2.1 Nuclear perspectives
- 2.2 Stakeholder arena
- 2.3 Defining the community
- 2.4 Communities in focus
- 2.5 Media analysis
- 2.6 Wishes and concerns

2.1 Nuclear perspectives

The debate on nuclear energy reflects broader societal concerns about safety, economic feasibility, environmental risks and energy security. These concerns are often framed as technical or scientific issues, yet they are deeply embedded in social values and spatial realities.

Incidents such as Fukushima have reinforced perceptions of risk and long-term uncertainty, while questions about financial viability and public investment raise concerns about who ultimately carries the burden of large-scale energy projects. At the same time, nuclear energy is often positioned as a stable and low-carbon source, contributing to national energy security and climate goals.

These contrasting perspectives reveal that the debate is not only about energy production, but about how risks, costs and benefits are distributed across society and space. In regions such as Zeeland, where energy infrastructures are physically present, these abstract debates become tangible in everyday life.

As a result, different communities develop distinct positions towards the energy transition, shaped by their proximity to infrastructure, their socio-economic context and their role within the energy system..

Risks & concerns

Safety concerns (Fukushima)

BACKGROUND

Nuclear Power Safety Concerns

Damage to Japan's Fukushima Daiichi nuclear power plant has reignited debate over the safety of nuclear power and highlighted questions over aging power plants, safety procedures, and waste disposal.

(Johnson, 2011)

Environmental risks

ENERGY

The Nuclear Waste Disposal Dilemma

BY MARTINA IGINI | AMERICAS ASIA EUROPE | SEP 12TH 2022 | 5 MINS

EARTH.ORG IS POWERED BY OVER 150 CONTRIBUTING WRITERS

(Igini, 2022)

Economic & system

Financial costs

New nuclear would be too late and too costly

Dr Paul Dorfman is sceptical about the new nuclear renaissance

The new nuclear renaissance on which you report ([Tide is turning in Europe and beyond in favour of nuclear power, 1 June](#)) may well turn out to be like the last frail one due to a set of inconvenient truths.

The Guardian (Dorfman, 2025)

Burden on taxpayers

Nuclear power’s financial problems exposed in new report

Greenpeace European Unit
19/06/2024

Brussels, 19 June 2024 – Nuclear power is a risky gamble with taxpayers’ cash, according to a comprehensive review of financing models published as the European Investment Bank prepares to discuss new support for nuclear energy at a meeting on 21 June.

(Greenpeace European Unit, 2024)

Energy security doubts

Steep decline in nuclear power would threaten energy security and climate goals

News
27 May 2019

VANCOUVER – With nuclear power facing an uncertain future in many countries, the world risks a steep decline in its use in advanced economies that could result in billions of tonnes of additional carbon emissions, according to [a new report](#) by the International Energy Agency.

Nuclear is the second-largest low-carbon power source in the world today, accounting for 10% of global electricity generation. It is second only to hydropower

(IEA, 2019)

2.2 Stakeholder arena

2.2.1 Understanding actors

In order to develop a robust strategy for achieving a Just Zeeland, it is essential to understand the complex stakeholder landscape that shapes the local energy transition. A stakeholder can be broadly defined as any individual, group, or organization that is affected by, or capable of influencing, the process of change. One way to assess the relevance of an actor is to consider whether they can be directly engaged or are able to articulate a meaningful response or opposition. However, this definition can be expanded to include actors with limited or no formal power, such as more-than-human

entities or future generation, whose interests remain critical within a justice-oriented framework.

Understanding stakeholders in a way that enables meaningful engagement requires a layered approach. While initial categorisation into groups such as communities, operators, or regulators provides a useful starting point, it risks oversimplifying internal differences. Further analysis is therefore necessary to identify divergent interests, power dynamics, and potential conflicts within and between these categories.

- Communities (CO)
- CO1

Village-based residents
- CO2

Industrial workforce residents
- CO3

Agricultural community
- CO4

Transition-oriented community
- CO5

Future community
- Environmental groups (E)
- E1

Environmental NGOs (e.g. WISE Netherlands)
- E2

Citizen initiative: Borsele tot de Kern
- Customers (CU)
- CU1

Residents (energy consumers)
- CU2

Agricultural sector
- CU3

Industrial users
- CU4

Businesses
- CU5

Trade
- Operators (O)
- O1

Gas infrastructure operators (PZEM, Dow)
- O2

Electricity grid operators (TenneT, Stedin)
- O3

Energy storage operators
- O4

Hydrogen infrastructure operators (future)
- O5

Wind energy operators
- O6

Solar energy operators
- O7

Tidal energy operators (Tidal Bridge)
- O8

Nuclear operator (EPZ)
- Knowledge generators (K)
- K1

Research institutes (e.g. TNO)
- K2

Universities (e.g. TU Delft)
- K3

Future research institutions
- Government & regulators (G)
- G1

European Union
- G2

Dutch National Government
- G3

Province of Zeeland
- G4

Municipal governments (e.g. Borsele)
- G5

Ministry of Economic Affairs
- G6

Ministry of Climate & Green Growth
- Land owners (L)
- L1

Farmers
- L2

Stichting Zeeuwse Landschap
- L3

Natura 2000 land owners
- L4

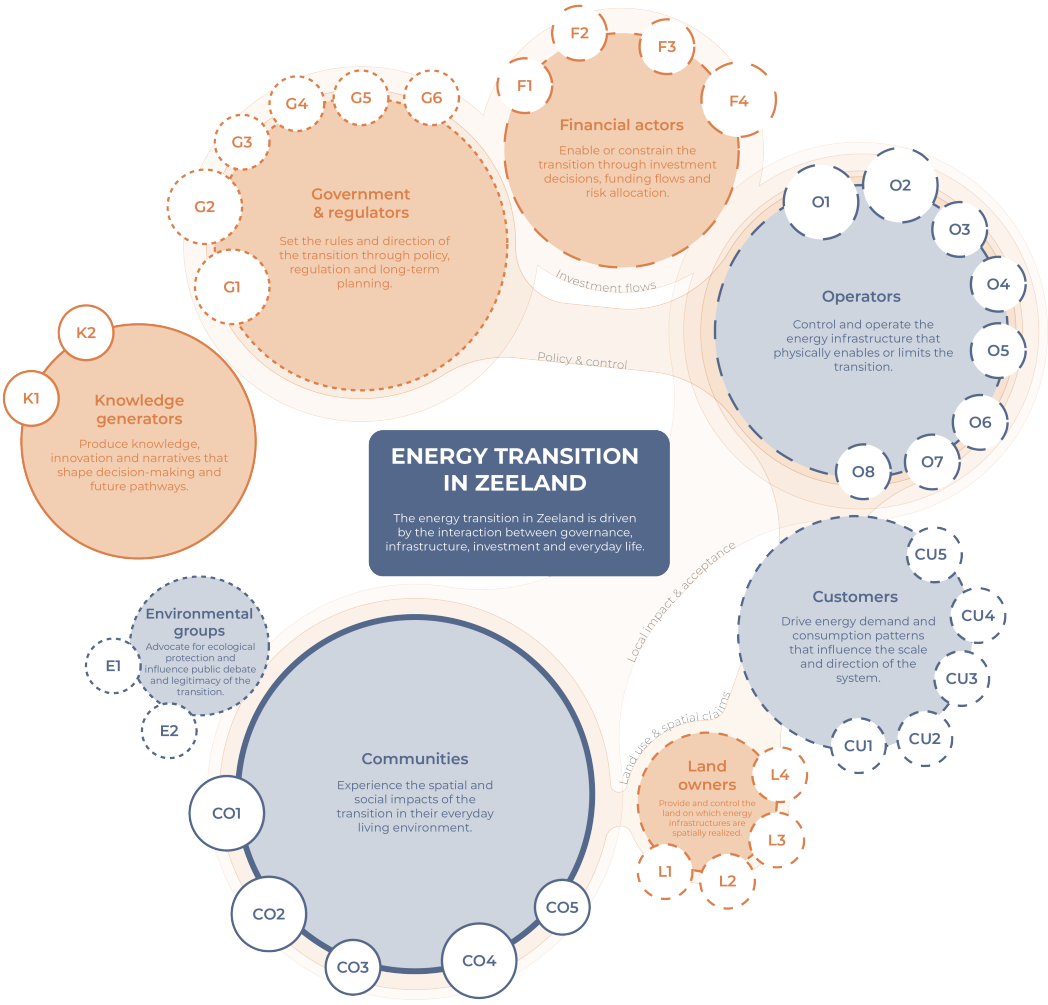
State
- Financial actors (F)
- F1

Public investment
- F2

Private partnerships
- F3

Insurance & financial institutions
- F4

NEO NL (nuclear investment)



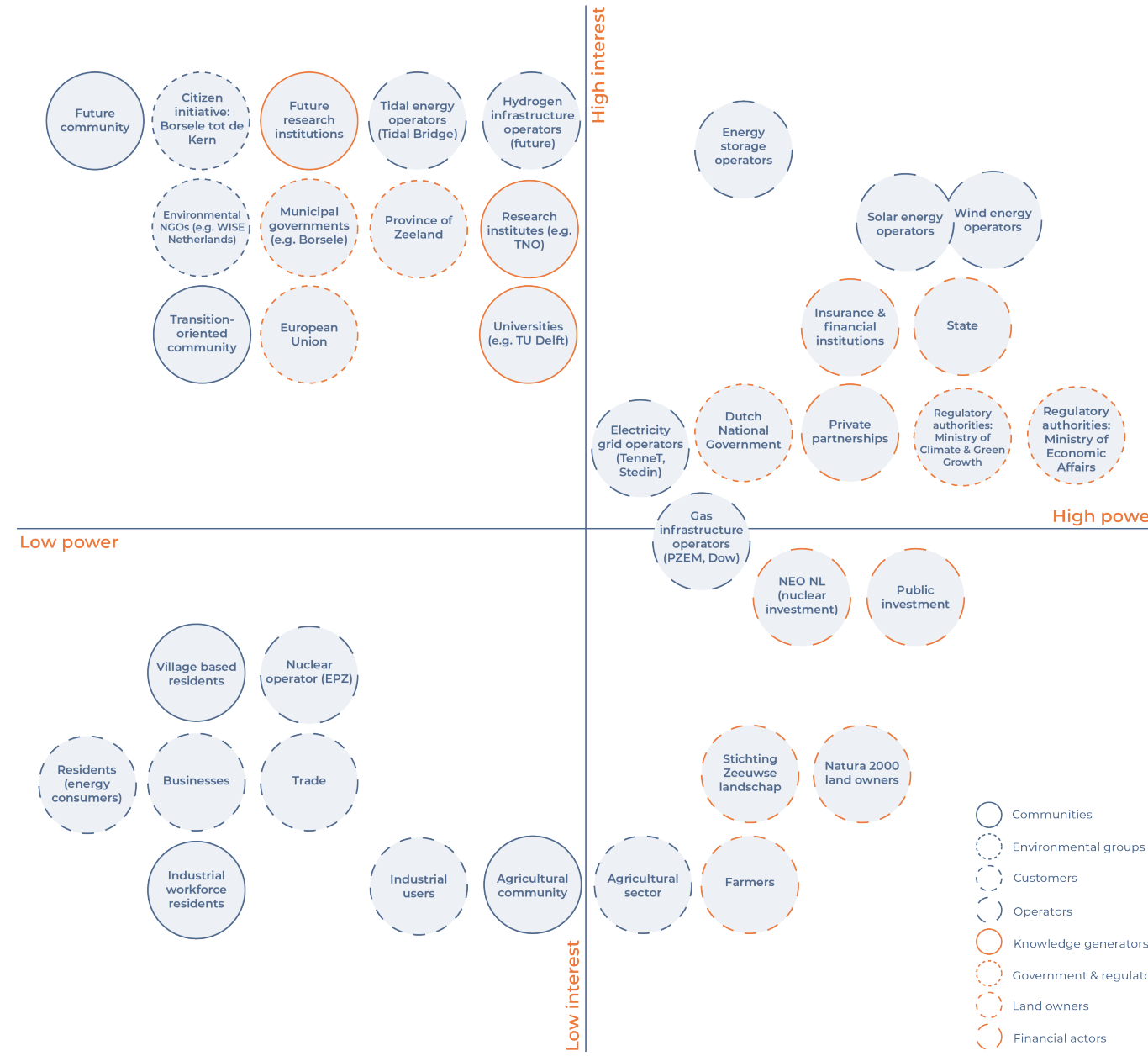
2.2.2 Power - interest

The power-interest matrix is used here to profile stakeholders according to both their level of interest in participating in the energy transition and their capacity to influence its outcomes. Power is understood in a broad sense, encompassing governance authority, financial resources, spatial ownership, the ability to create production capacity, and the potential to enable or block developments.

Within this framework, stakeholders are distributed across the matrix in a way that reveals both alignments and tensions. Actors

with similar levels of interest and power begin to form clusters that cut across traditional stakeholder categories. This enables a more strategic understanding of how different groups relate to one another.

Importantly, the matrix also serves as a tool for identifying pathways for change. By analysing what constrains or enables stakeholders, it becomes possible to consider how actors might shift from passive or low-power positions toward more active roles as enablers of the energy transition.



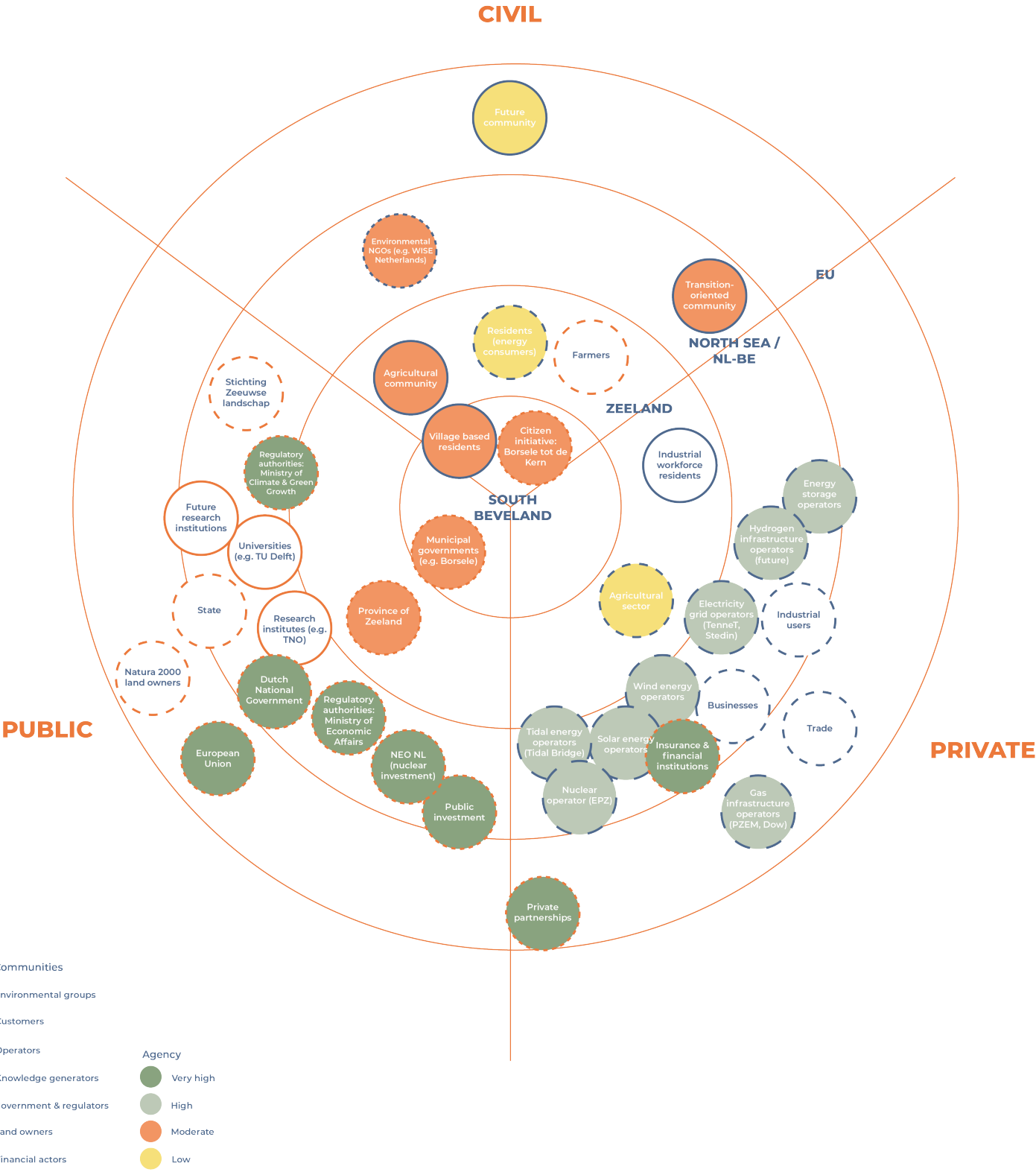
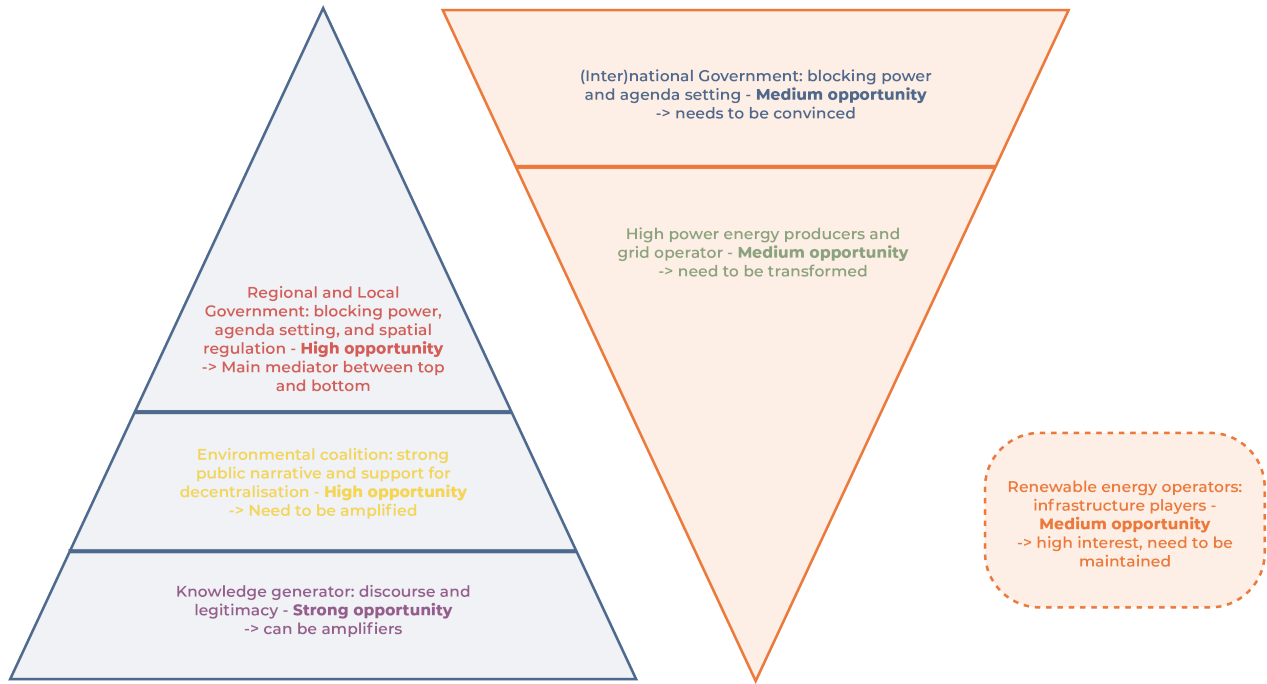
2.2.3 Actor positioning

When mapping actors across scales and levels of agency, a clear pattern emerges. National governments and large infrastructure actors hold significant decision-making power, while local communities experience the spatial consequences of these decisions with limited direct influence.

This imbalance highlights the importance of bridging top-down and bottom-up dynamics. Strengthening the role of local actors and knowledge networks can create more inclusive and spatially balanced transition processes.

A method for meaningful enactment of local change that is beneficial to local communities, can therefore, be performed in a multi scale approach. Starting with knowledge generators, who can create discourse and legitimacy and act as amplifiers for the environmental

environmental groups. These have support for decentralisation, and can form strong public narrative, in order to convince regional and local governments who have blocking power. This can change top level legislation in (in-ter)national governments who have agenda setting power which can turn local opposition into positive change through different schemes.



2.3 Defining the community

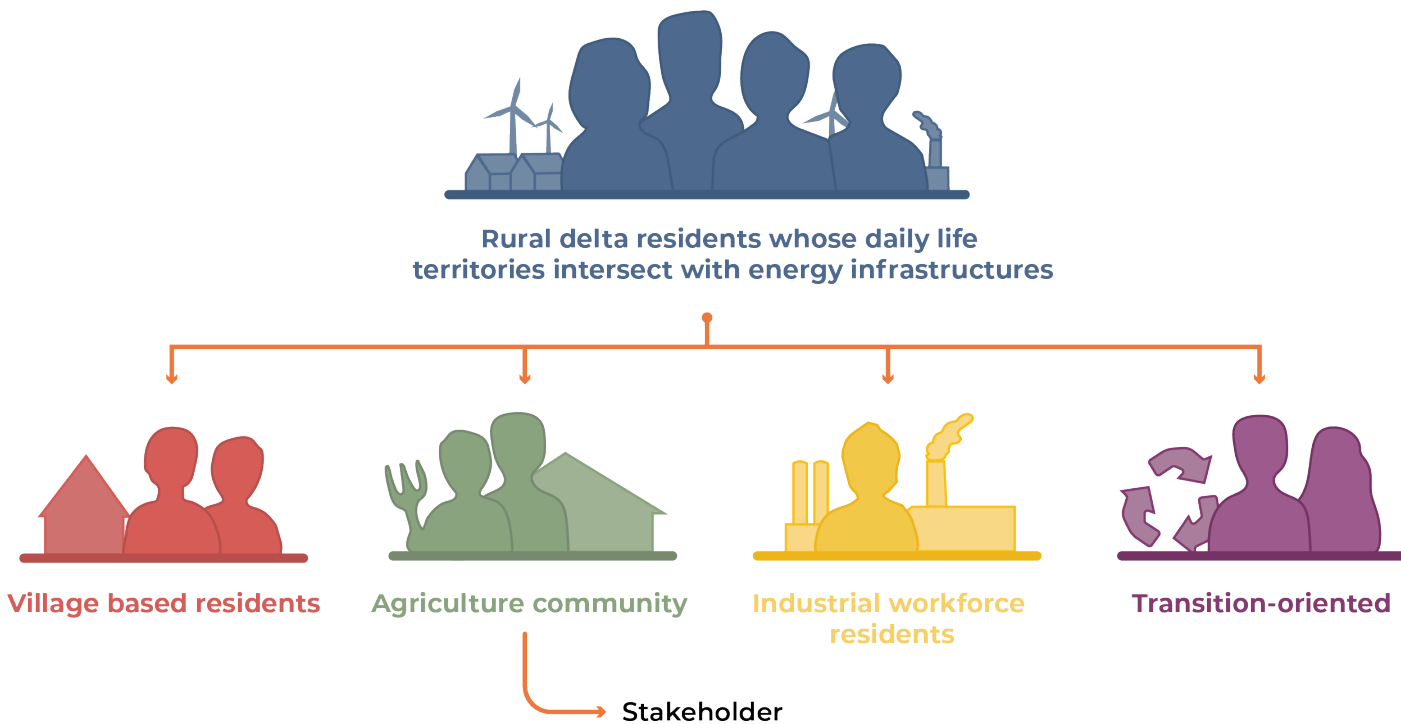
2.3.1 Framework communities

This project addresses a specific transition community in Zeeland: *rural delta residents whose everyday environments are directly shaped by large-scale energy infrastructures*. Rather than treating the community as a single, homogeneous group, it is understood as a variety of subgroups with different roles, relationships and perspectives within the energy transition.

Four subcommunities are identified: *village based residents; industrial workforce residents; transition-oriented community; and the agricultural community*. Although they are all situated within the same territorial system, their relationship with energy infrastructure varies, from direct economic dependency to spatial exposure and governance involvement.

The agricultural community is considered a key stakeholder rather than a primary subcommunity because their role is more strongly defined by land ownership, spatial control and production systems than by residential identity. This allows for a clearer understanding of how interests, responsibilities and impacts are distributed across the territory.

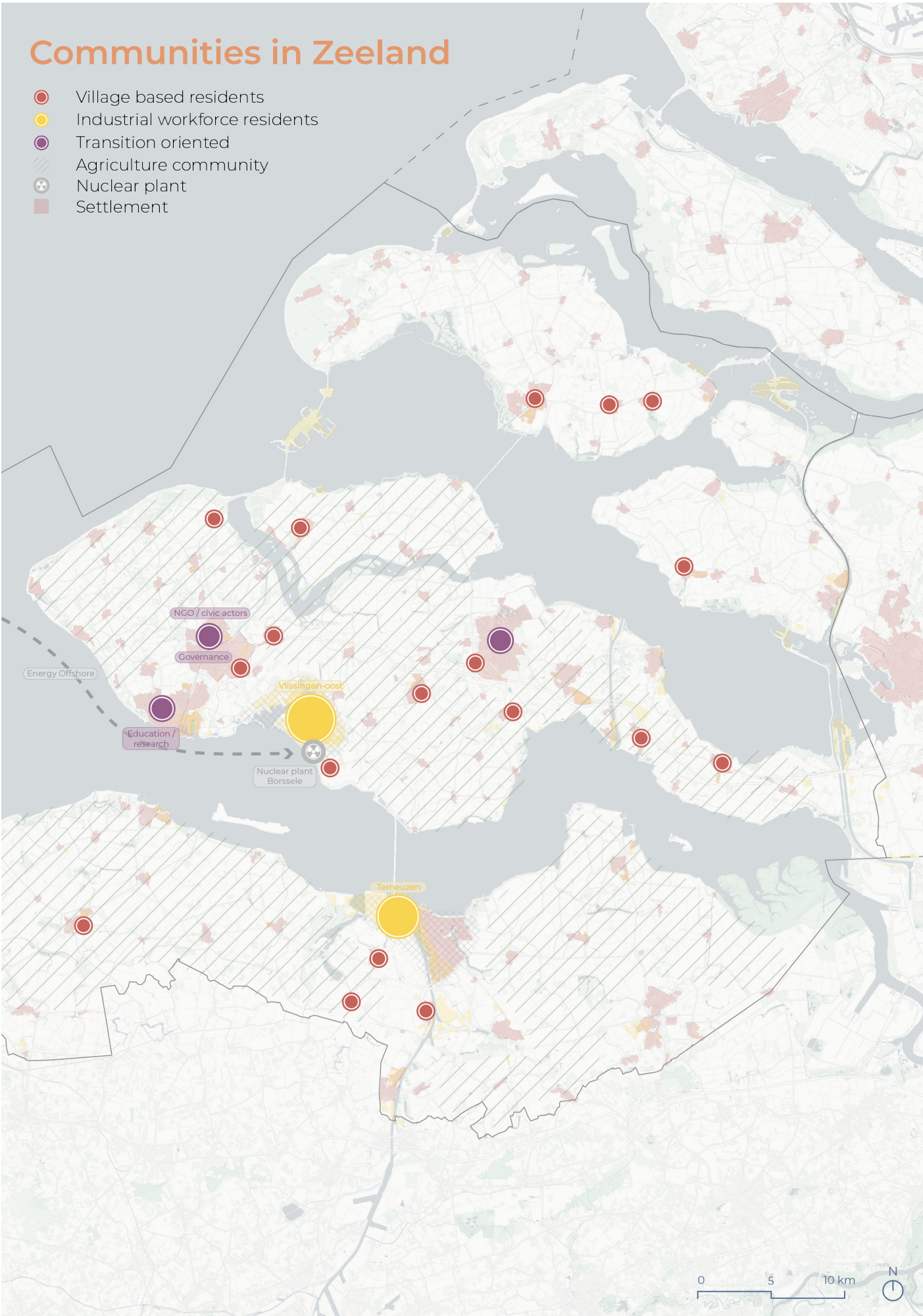
The map illustrates the spatial distribution of these communities across Zeeland, showing their proximity to industrial clusters, energy infrastructures and rural landscapes. This spatial positioning plays a crucial role in shaping how the benefits and burdens of the energy transition are distributed across different subcommunities.



The community is structured into distinct subgroups with different spatial relationships to the energy system.

Communities in Zeeland

- Village based residents
- Industrial workforce residents
- Transition oriented
- /// Agriculture community
- ☢ Nuclear plant
- Settlement



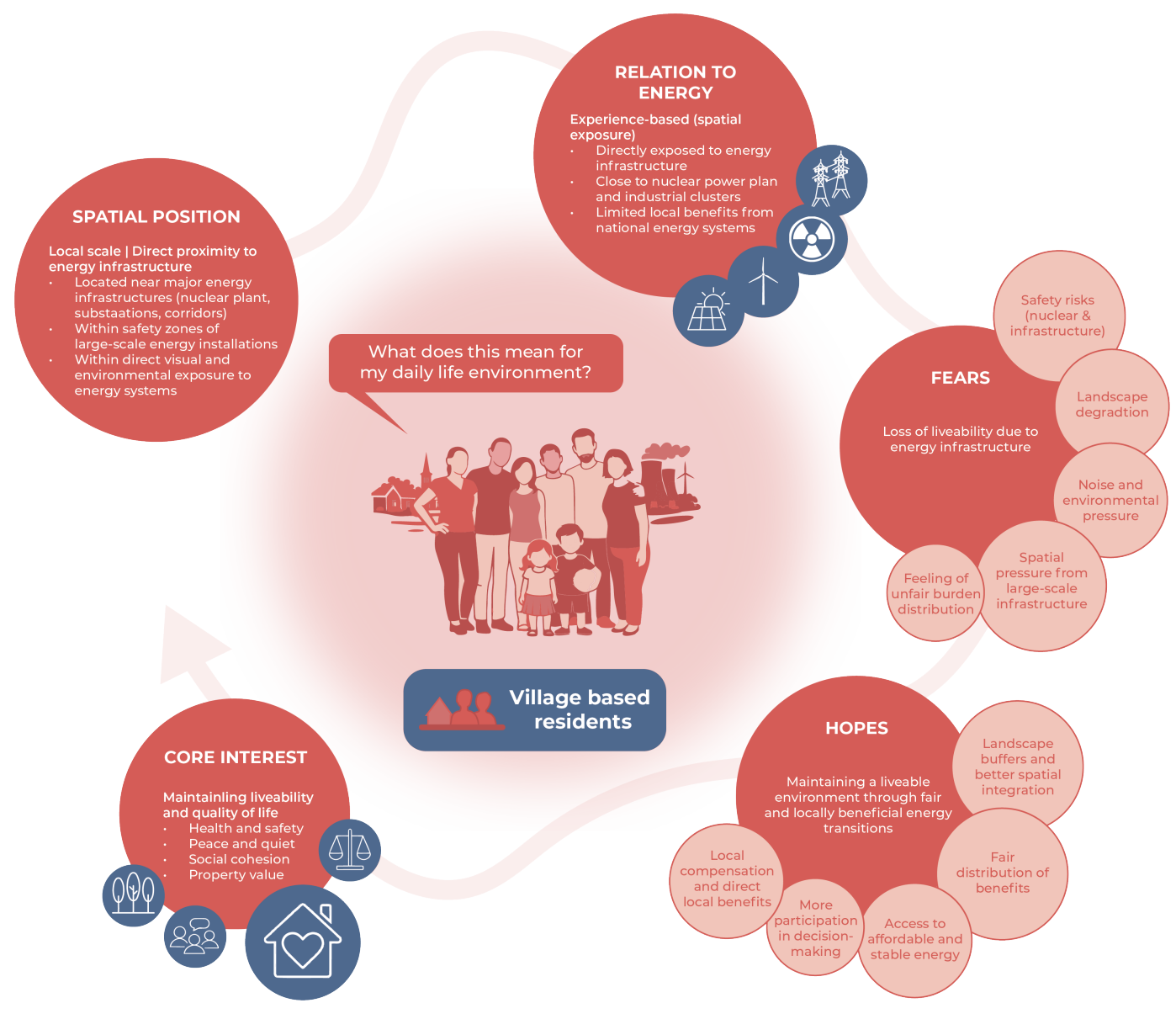
2.4 Communities in focus

2.4.1 Village based residents

Village based residents experience the local scale of the energy transition in their everyday lives, where impacts are directly felt. Living in close proximity to energy infrastructure such as nuclear power plants, industrial clusters and energy corridors, this group is mostly concerned about the effect of these developments on their environment. Their perspective is strongly focused on liveability, safety, and landscape quality.

Although they are directly exposed to the spatial effects of the transition, they often benefit little from national energy systems.

This gives them reason to question the fairness and transparency of the process, particularly when new projects increase pressure on their environment without visible improvements to daily life. As a result, they are mainly interested in maintaining a liveable and socially cohesive environment, and in encouraging a more balanced distribution of benefits, stronger spatial integration and greater involvement in decision-making processes.

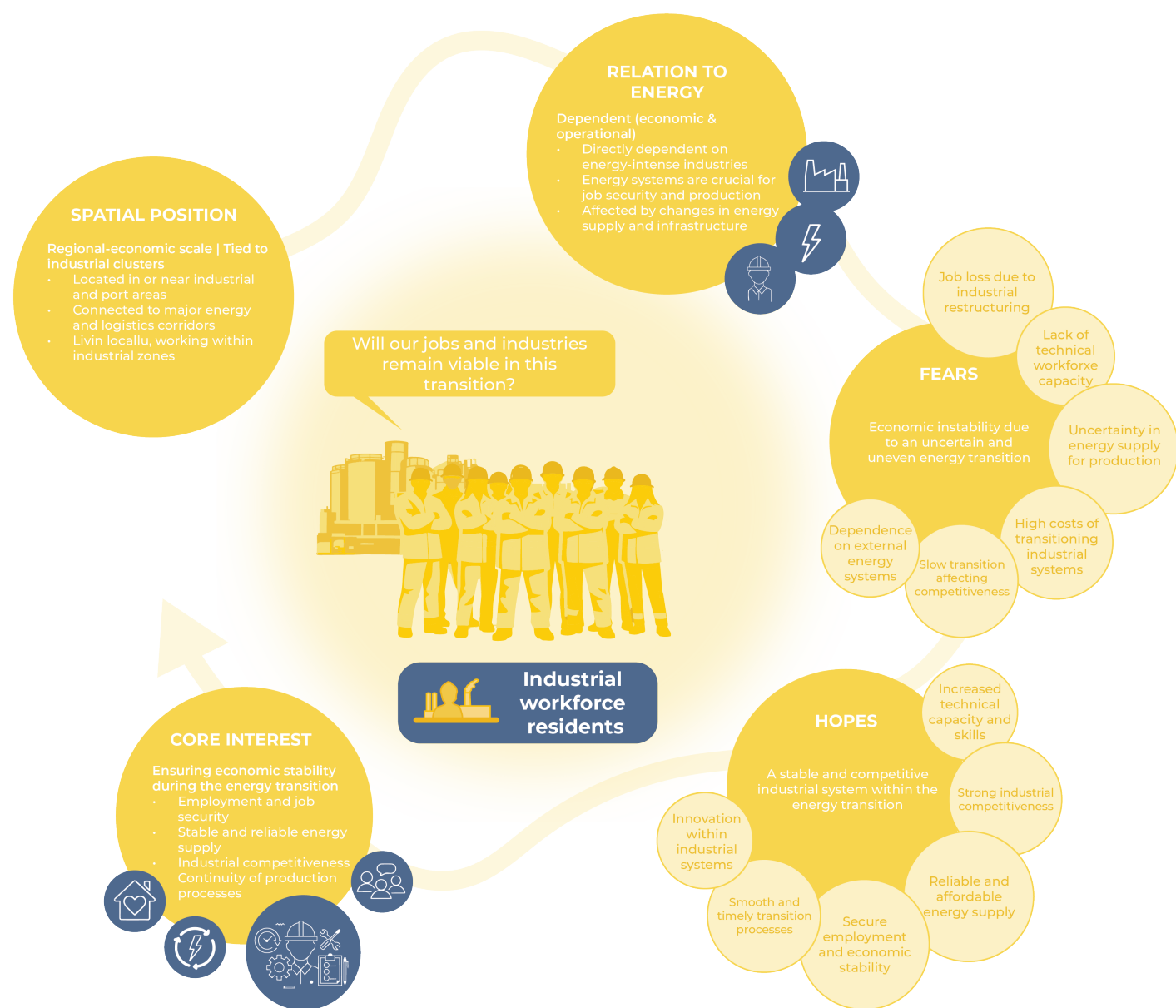


2.4.2 Industrial workforce residents

The industrial workforce is based at a regional economic level, where the energy transition is closely related to employment, production and economic stability. This group is dependent on existing energy-intensive industries and infrastructure, which makes them sensitive to changes in energy supply, costs, and system configurations.

For this group, the transition is not only an environmental challenge, but also an economic and logistical one. Their concerns focus on job security, the ability to maintain industrial processes and the capacity of

industries to adapt to new energy systems. However, they also recognise the need for transition and see opportunities in innovation, reskilling, and developing future-proof industries. Their main interest is in ensuring a stable and economically resilient industrial system supported by a reliable energy supply.

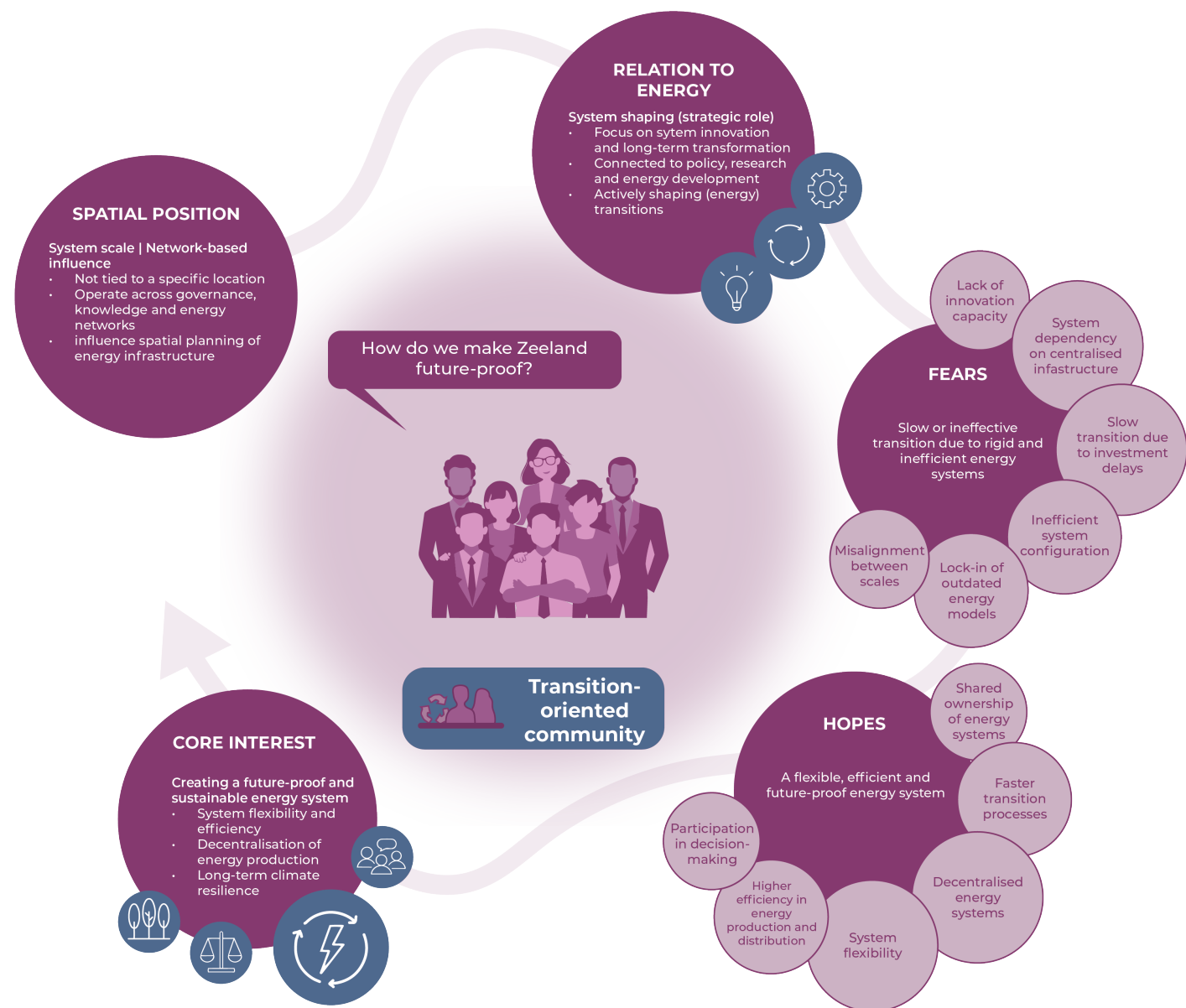


2.4.3 Transition-oriented community

The transition-oriented community has a systems-level focus and is dedicated to the long-term transformation of the energy system. Rather than being based in a particular location, this group is involved in networks of policy, research and innovation, and plays an active role in shaping the direction of the transition.

Their perspective is less influenced by immediate spatial impacts and more influenced by systemic performance, efficiency and resilience. They support decentralisation, system flexibility, and the integration of

energy and spatial planning. However, they also recognise structural challenges, such as rigid infrastructure, slow decision-making processes, and the risk of becoming locked into outdated systems. Their primary interest is in creating a future-proof energy system that is adaptable, efficient, and socially inclusive while enabling faster, more effective transitions at all scale levels.



2.4.4 User personas

To make these community perspectives more understandable and accessible, user personas were developed. These personas combine the key characteristics, concerns and ambitions of each community into individual profiles, making the concept of system dynamics more understandable on a human level.

By presenting the energy transition through personal narratives, the personas reveal how different groups experience, understand and react to spatial and systemic changes. They serve as a tool for reflection on which interests are being addressed and ensure that design decisions remain grounded in the lived realities of affected communities.

In the next stage, the vision phase, these personas will be used to evaluate proposed strategies and interventions. This allows for a more inclusive and balanced approach, where spatial development responds not only to technical and systemic demands, but also to the needs, values and expectations of different user communities.

Yvonne Kelder (45)
Village based resident

QUOTE
"I want to live in an open landscape, not in the shadow of energy infrastructure."

CORE VALUES

- Quality of life
- Fairness & justice
- Participation & governance
- Landscape & spatial quality

FEARS

- Loss of **liveability** due to increasing spatial pressure from energy infrastructure
- Unequal distribution of energy **burdens and benefits** across regions
- Safety risks** related to proximity to energy infrastructure (nuclear, industrial)
- Landscape degradation** caused by large-scale energy developments
- Limited local influence** in decision-making on energy projects

HOPES

- A **fair distribution** of energy benefits and burdens at the local scale
- Improved spatial integration** of energy infrastructure within the landscape
- Local compensation and **direct benefits** from nearby energy systems
- Greater **participation** in energy-related decision-making processes
- Access to affordable** and stable energy for households

Willem van den Baan (56)
Industrial workforce resident

QUOTE
"You can't talk about the transition without talking about jobs. For me, this is my future."

CORE VALUES

- Economic stability & knowledge
- Quality of life
- Fairness & justice
- Energy system transformation

FEARS

- Job loss** due to instability in the transitioning energy system
- Uncertainty** in energy supply affecting industrial production continuity
- High costs** of adapting industrial systems to new energy infrastructures
- Dependency on external energy systems affecting **regional economic stability**
- Lack of technical capacity** to transition towards new energy systems

HOPES

- A **stable and competitive** industrial system within the energy transition
- Reliable and affordable energy** supply for continuous production
- Investment in training and reskilling** for future-proof jobs
- Innovation** in industrial processes linked to new energy systems
- Secure employment and long-term economic stability** in the region

Frederique Nouwens (32)
Transition-oriented

QUOTE
"The transition should not only affect us, but also create opportunities for us."

CORE VALUES

- Energy system transformation
- Fairness & justice
- Participation & governance
- Landscape & spatial quality

FEARS

- Slow transition** due to rigid and inefficient energy system structures
- Continued dependency** on centralized and fossil-based energy systems
- Misalignment** between spatial planning and energy system development
- Lock-in of **outdated** energy infrastructures limiting innovation
- Insufficient participation** and ownership in energy decision-making

HOPES

- A **flexible and resilient** energy system adapted to future demands
- Decentralised energy production with **local ownership and control**
- Faster and more efficient** transition processes across scales
- Strong **integration** between spatial planning and energy systems
- Active participation** in governance and decision-making

2.5 Media analysis

Following the community chapter, this media analysis builds on the wishes, concerns, and perspectives identified within Zeeland's communities. While the previous chapter defined who the community is and which values matter to them, this analysis examines how these themes return in the public debate on nuclear energy around the Borssele nuclear power plant. Articles in Trouw, BN DeStem, and regional newspapers show that the debate is not only about supporters and opponents of nuclear energy, but also about its effects on local communities, landscape, and daily life in Zeeland.

The community

The media analysis shows mixed reactions within Zeeland's communities. The Sankey diagram indicates that concerns are mostly linked to neutral or negative sentiment, while wishes are more often framed positively. This corresponds with CBS figures discussed in BN DeStem, which suggest that nuclear energy around Borssele has become relatively normalized for part of the local population. As a result, support for more nuclear energy is often moderate rather than clearly positive. At the same time, articles such as those in Trouw show that this support is not unconditional. Concerns remain about landscape quality, liveability, construction impacts, and whether local communities will also benefit.

Energy and policy

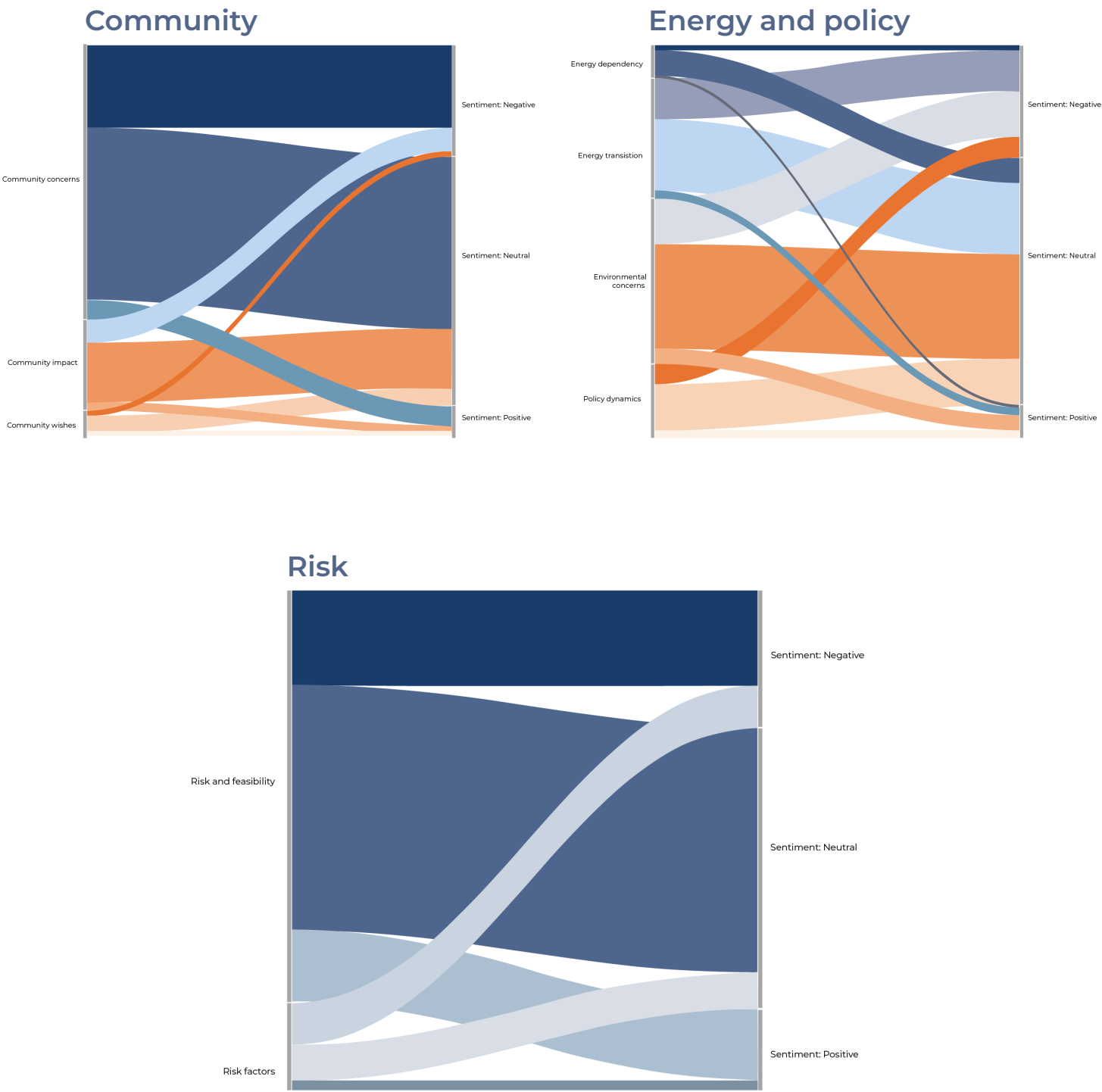
The articles present new nuclear energy as a national policy issue with local and spatial consequences. The diagram shows that energy transition and environmental concerns are dominant themes, mostly discussed in a neutral sentiment. This suggests a debate that remains open and conditional rather than purely supportive or oppositional. Newspapers such as the Provinciale Zeeuwse Courant and the Reformatorisch Dagblad frame Zeeland as a logical location for expansion because of its existing plant, available space, water access, and energy infrastructure. However, this discussion is strongly shaped by conditions such as employment, infrastructure

investment, safe waste storage, compensation, and the protection of landscape and environment.

Risk

Risk is one of the strongest themes in the media analysis. The diagram shows that "risk and feasibility" is dominant and mainly associated with neutral and negative sentiment. This suggests that risk is discussed not only as a direct threat, but also as an issue of feasibility and responsibility. In BN DeStem, support for additional nuclear energy becomes less stable when questions arise about environmental impacts, cooling towers, radioactive waste, and future disasters. Articles in Trouw also show that emotions intensify when worst-case scenarios such as Fukushima and Chernobyl are discussed.

Overall, the media analysis shows that the debate on nuclear energy in Zeeland is not only about whether new power plants should be built, but also under which conditions such a transition can be considered acceptable. Themes such as public concern, risk perception, and policy negotiation show that the energy transition is closely tied to landscape, local identity, and everyday life. These form important starting points for our research.



This diagram is based on a structured analysis of media articles retrieved through Nexis Uni, combined with policy documents, stakeholder reports, and academic literature. The data was coded and analysed using Atlas.ti to identify recurring themes, values, wishes, and concerns across communities.

2.6 Wishes and concerns

2.6.1 Values

The core values identified here are the result of combining the findings of previous analyses, which included media analysis, policy documents, stakeholder perspectives and spatial observations. Rather than representing abstract principles, these values represent the concerns, interests and goals that have been found to be common across the different communities involved in the energy transition in Zeeland.

By grouping individual concerns and wishes into broader categories, six core values were defined. These values structure diverse and

sometimes conflicting perspectives, revealing the underlying drivers of spatial and societal tensions, into a clear framework. At the same time, they highlight shared ambitions that can guide future spatial strategies.

The values function as a translation from fragmented insights into a more integrated understanding of what is important in the transition. This forms the basis for the wishes and concerns addressed in the next section.



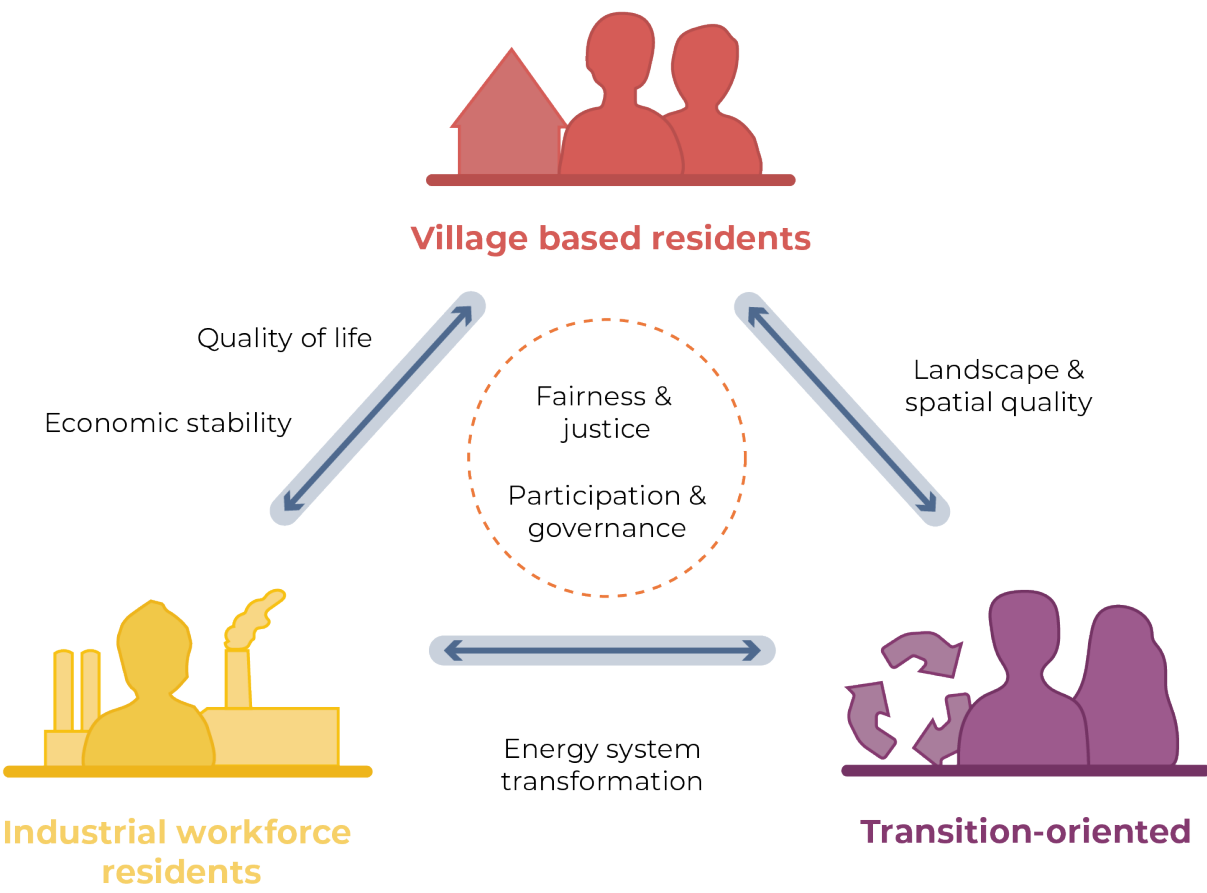
2.6.1 Connections

The connections diagram shows that the identified core values are strongly connected and shared across different communities.

Although each community operates at a different scale and has specific concerns, several values emerge as shared priorities, such as fairness and justice, and participation and governance.

These overlapping values highlight opportunities for synergy, whereby addressing one issue can support multiple communities at the same time. For example, more inclusive decision-making could strengthen trust among local residents while also improving the effectiveness of system-level transitions.

Understanding these connections enables the project to move beyond isolated perspectives towards an integrated approach, where spatial and energy interventions can create mutual benefits and reinforce one another.



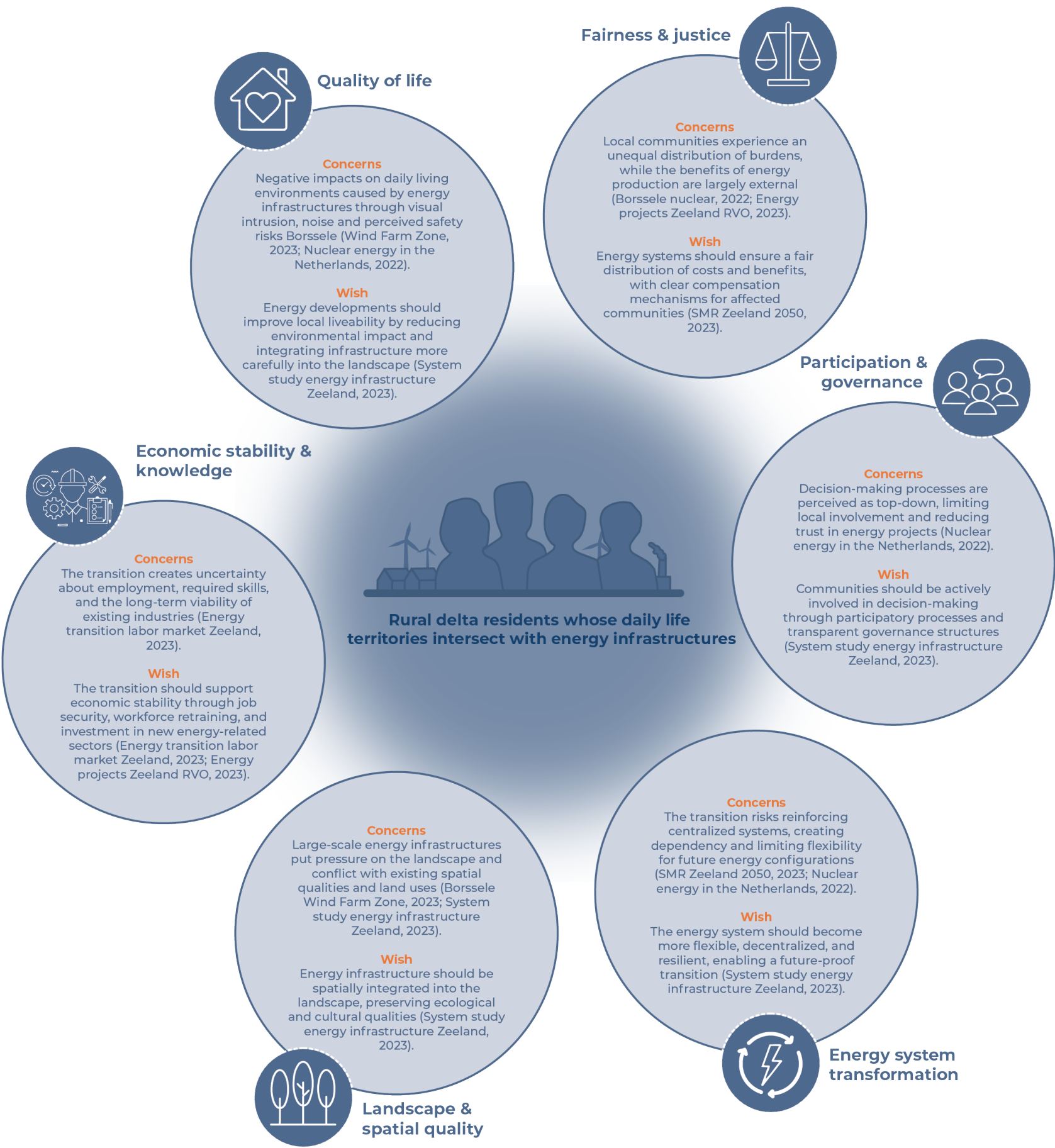
2.6.3 Wishes and concerns

Building on these shared and sometimes conflicting values, the following diagram translates them into concrete wishes and concerns for the overall community.

Rather than focusing on individual perspectives, it highlights the collective tensions and ambitions that result from the interaction of local experiences, regional economies and system-level transitions.

The concerns reflect the current challenges related to spatial pressure, unequal distribution of burdens and limited local influence, while the wishes express a strong desire for a more balanced, inclusive and future-proof energy transition.

Together, these wishes and concerns form a crucial foundation for the vision, ensuring that future spatial strategies respond not only to technical and economic demands, but also to the lived experiences and values of the communities involved.



03.

Theory and methodology

Theory

- 3.1 Problem statement
- 3.2 Research questions
- 3.3 Conceptual framework
- 3.4 Theoretical framework
- 3.5 Methodology

3.1 Problem statement

The energy transition in Zeeland is characterised by complex spatial and social imbalances relating to where energy is produced, where its impacts are experienced and where its benefits are distributed.

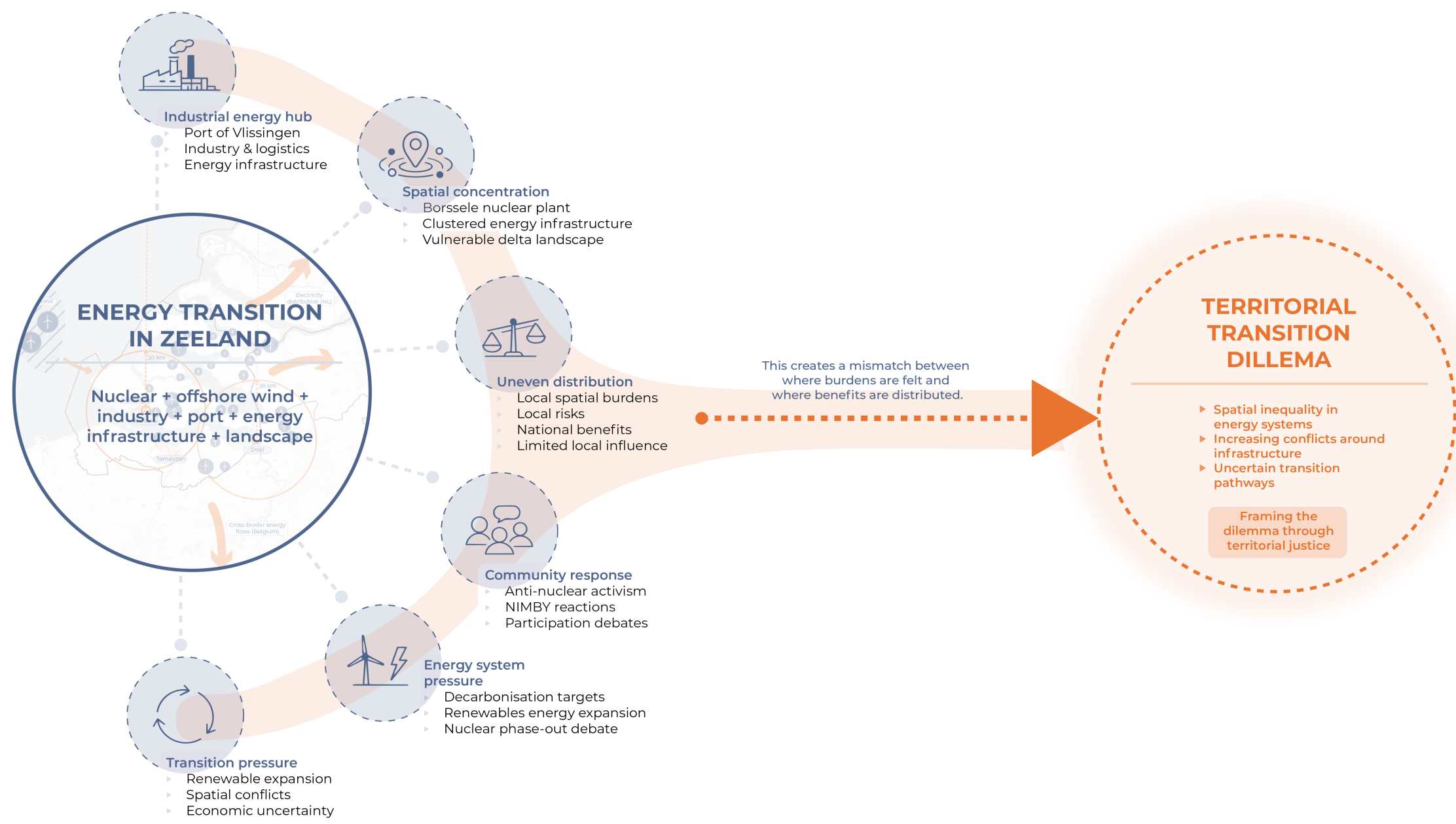
Zeeland has become a crucial location within the Dutch energy transition due to national climate goals and large-scale infrastructure developments, such as offshore wind, nuclear energy, and industrial energy systems.

However, this transformation is both spatially and socially imbalanced. Energy infrastructure is increasingly concentrated in specific areas, particularly around industrial clusters and coastal zones. This is putting growing pressure on the landscape and surrounding communities. At the same time, the benefits of these developments are distributed nationally, while local communities primarily experience the environmental, spatial, and social impacts.

This creates a territorial mismatch between local exposure and broader system benefits, resulting in tensions relating to liveability, fairness, participation, and economic stability. The different ways in which this mismatch is experienced are as follows: village-based residents are directly affected in their daily environments; industrial workers depend on the stability of energy systems for their livelihoods; and transition-oriented actors focus on long-term system transformation.

If this imbalance is not addressed, it could lead to the reinforcement of spatial inequalities, increased resistance towards energy projects and a slower overall transition process. The current situation also reveals an underlying dilemma: how to balance large-scale energy system transformation with local spatial quality, social justice, and inclusive governance.

The aim of this project is to understand and address this territorial transition dilemma, exploring how spatial and energy systems can be more balanced, inclusive and place-based.



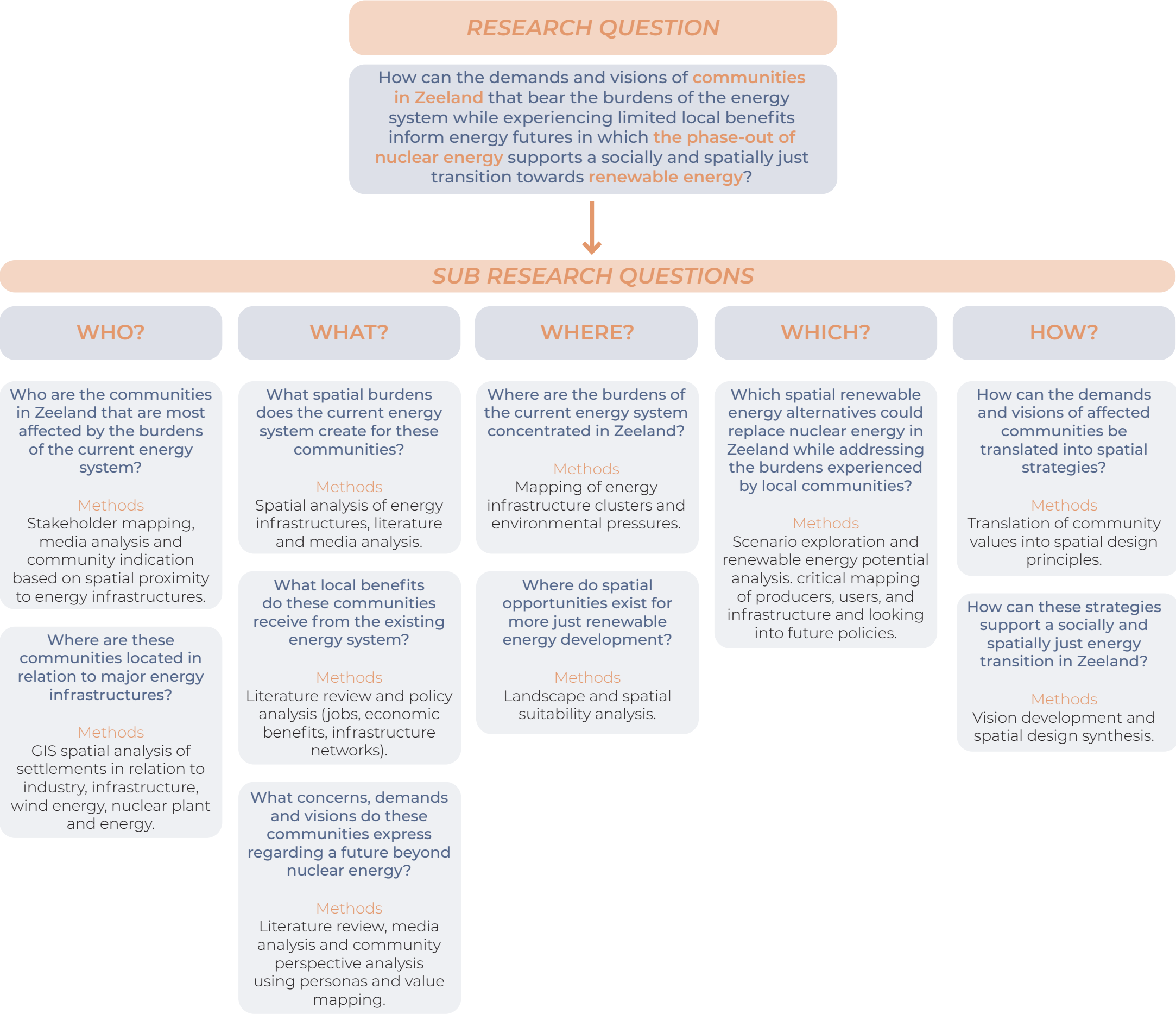
3.2 Research questions

Building on the identified territorial transition dilemma, this research aims to explore how these spatial and social imbalances can be understood and addressed further. Rather than focusing only on technical solutions, this project approaches the energy transition as a spatial and societal challenge.

This research is organised into a set of interconnected questions divided into five dimensions: *who*, *what*, *where*, *which* and *how*. This framework allows for a structured understanding of the relationships between communities, energy infrastructures, and spatial conditions.

The ‘*who*’ dimension focuses on identifying the communities most affected by the current energy system and their relationship to energy infrastructures. The ‘*what*’ examines the spatial burdens, benefits and community perspectives that emerge from this system. The ‘*where*’ dimension investigates the geographical distribution of these impacts and identifies potential areas for more balanced energy development.

Building on this, the ‘*which*’ dimension explores alternative energy configurations and spatial strategies that could replace or complement existing systems while responding to local conditions. Finally, the ‘*how*’ translates these insights into spatial strategies, bridging the analysis and design processes to support a socially and spatially just energy transition.



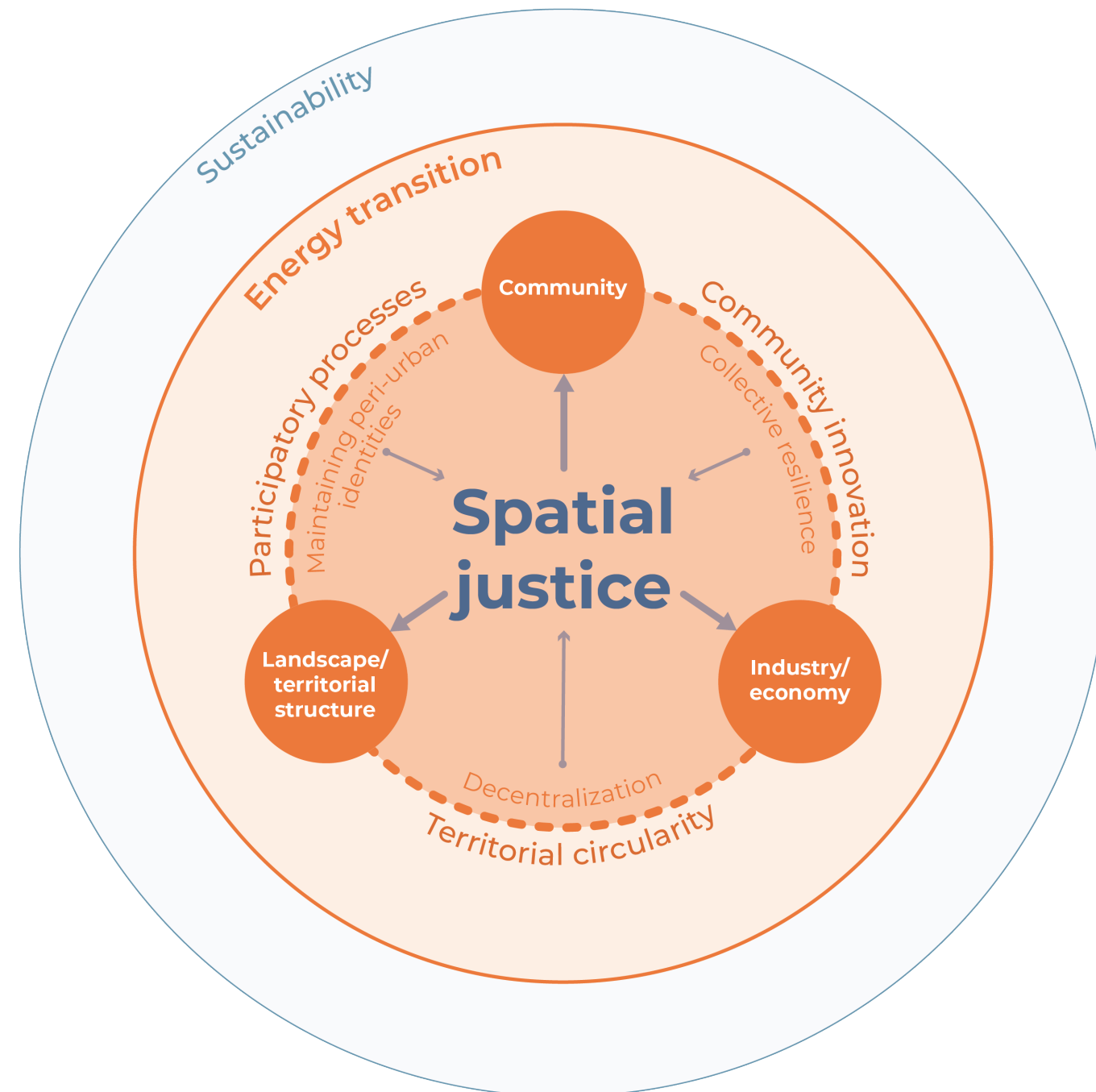
3.3 Conceptual framework

The conceptual framework forms the basis of this project. It provides a structured way to understand the research problem and guides both the analysis and the design process. Throughout the project, it is used as a reference for interpreting spatial conditions and developing strategies for the energy transition.

The framework is centred around spatial justice as the main objective. This principle defines how spatial inequalities are understood and addressed. It is explored through three spatial perspectives: community, landscape and territorial structure, and industry and economy.

To operationalise spatial justice, three theoretical concepts are applied: territorial circularity, community innovation, and participatory processes. These concepts define how the project approaches system organisation, governance, and social dynamics. Each concept is further specified through related sub-concepts.

Together, the perspectives define what is analysed, while the concepts define how spatial justice is interpreted and applied. The framework connects theory to design and supports the development of more balanced, inclusive, and context-sensitive energy transition strategies within the broader context of sustainability.



3.4 Theoretical framework

The theoretical framework provides the academic foundation of the project. It builds on the conceptual framework and explains the key concepts used to analyse spatial conditions in the energy transition. Spatial justice is the central principle and is supported by territorial circularity, community innovation, and participatory processes. Together, these concepts guide the analysis and show how spatial justice is addressed in the project.

3.4.1 Spatial Justice

Spatial justice is the central guiding principle of this project. It refers to the relationship between space and social inequality, and the way spatial planning can either reinforce or reduce these inequalities (Rocco et al., 2025).

Within this framework, spatial justice is understood through three interconnected dimensions: distributive, procedural, and recognitional justice. Distributive justice concerns the spatial distribution of benefits and burdens, such as access to infrastructure, environmental quality, and economic opportunities. Procedural justice focuses on decision-making processes, emphasising participation, transparency, and the distribution of power. Recognitional justice highlights the importance of acknowledging different identities, needs, and territorial contexts (Rocco et al., 2025).

In the context of Zeeland, these dimensions reveal structural imbalances. Energy infrastructures are planned at national and international levels, while local communities experience the spatial impacts. This creates a mismatch between decision-making power and lived realities. At the same time, Zeeland is often treated as a production landscape, overlooking its peri-urban identity and local values.

In this project, spatial justice functions as both a guiding principle and an analytical lens. It enables a critical understanding of how spatial interventions affect different communities and supports the development of more balanced, inclusive, and context-sensitive energy systems.

3.4.2 Territorial circularity | Decentralisation

Territorial circularity refers to the application of circular economy principles within a specific geographic area. It focuses on reducing, reusing, and recycling resources to create sustainable and localised systems (Tapia et al., 2021). The approach integrates physical, economic, and social dynamics. It aims to keep material and energy flows in use and to reduce dependency on external resources (Furlan et al., 2022).

Within this framework, decentralisation plays a key role. It shifts decision-making and resource management from national to regional and local levels (Ankamah, 2012). This allows strategies to better reflect local conditions and values. It also enables stronger involvement of local actors in shaping energy and resource systems.

Together, territorial circularity and decentralisation represent a shift from centralised and linear systems towards more localised and adaptive systems. Production, consumption, and infrastructure are organised at the regional scale. This strengthens synergies between sectors and improves the efficiency of resource flows.

In Zeeland, this approach supports decentralised energy systems such as local energy production and regional distribution networks. At the same time, connections to national and international systems are maintained. This helps balance economic activity with environmental sustainability and spatial quality.

3.4.3 Community innovation | Collective resilience

Community innovation refers to forms of social innovation that focus on transforming social relations and enabling collective action (Moulaert et al., 2013). It becomes particularly relevant in situations where existing institutional frameworks are not able to respond to local needs or spatial pressures. In the context of energy transitions, community innovation allows local actors to actively shape changes in their environment instead of being passive recipients.

This concept is closely linked to collective resilience. Resilience is understood as the capacity of socio-ecological and socio-technical systems to adapt, reorganise, and transform in response to change (Meerow et al., 2016; Folke, 2006). It is not about returning to a previous state. Instead, it focuses on the ability to adjust and develop over time.

In this project, community innovation supports the embedding of energy infrastructure within local contexts. It enables cooperation between actors and strengthens the capacity of communities to deal with spatial and environmental changes. Shared spaces and infrastructures can be understood as common resources that require collective management (Montelongo Arana & Wittek, 2016). This highlights the importance of collaboration, shared goals, and local involvement in shaping more resilient and inclusive energy systems.

3.4.4 Participatory processes | Peri-urban identity

Participatory processes refer to methods that involve a wide range of stakeholders in defining, designing, and implementing spatial and energy-related interventions (Goussous et al., 2025). These processes aim to create more inclusive and transparent decision-making structures. They help ensure that different perspectives are considered and that local communities are actively involved in shaping their environment.

In the context of the energy transition, participatory processes are essential for addressing spatial justice. They enable a more balanced distribution of power and support collaboration between governments, institutions, and local actors. This aligns with broader planning approaches that emphasise inclusive governance, equitable access to infrastructure, and integrated spatial development (United Nations, 2017).

Within this project, participatory processes are closely linked to maintaining peri-urban identities. Peri-urban areas are often characterised by a mix of rural, industrial, and infrastructural functions. These areas are particularly vulnerable to spatial pressure and large-scale transformations. By involving local communities in decision-making, their social, cultural, and spatial identities can be recognised and preserved.

This approach supports more context-sensitive and socially embedded energy systems. It ensures that spatial interventions do not only respond to technical demands, but also to the lived realities of the communities involved.

3.5 Methodology

The process began with a problem field focused on the urgency of the climate transition and its socio-spatial impact on Zeeland, with particular attention to the justice of energy infrastructure and development. This led to the main research question: *How can the demands and visions of communities in Zeeland that bear the burdens of the energy system while experiencing limited local benefits inform energy futures in which the phase-out of nuclear energy supports a socially and spatially just transition towards renewable energy?*

The research unpacked this question through five sub-questions, which were explored through the different analytical phases.

The analysis combined multiple methods, including community identification, policy and literature review, media and discourse analysis, spatial analysis, and mapping in QGIS.

Together, these methods provided insight into Zeeland as both an energy region and a lived landscape. They helped reveal how different communities are positioned in relation to current and future energy transitions.

The results of this phase were brought together in a synthesis, in which the analytical findings were translated into core values, spatial tensions, and identified burdens, benefits, and opportunities. This formed the basis for the development of three distinct community visions: village-based residents, industrial workforce residents, and transition-oriented residents. These perspective-based visions were then merged into one combined vision, focused on shared local benefits, local resilience, and spatial justice.

After the midterm evaluation, the project was further developed through a stakeholder arena and four position papers. These steps were

used to analyse actor relations, stakeholder positions, support and resistance, and the conditions for implementation. In this way, the project moved beyond perspective-building alone and incorporated the institutional and political dimensions of spatial change.

In the final phase, these insights were translated into spatial strategies around the themes of mobility, industry, and energy communities, at both the regional and local scale. Timelines were used to indicate phasing and spatial development over time. The process concluded with a group reflection, conclusion, and discussion, in which the design outcomes and the overall methodology were critically evaluated in relation to the research question.



04.

Analysis

Analysis

- 4.1 Energy
- 4.2 Economic and industries
- 4.3 Spatial qualities
- 4.4 Energy futures
- 4.5 Analysis conclusion

4.1 Energy

4.1.1 Energy systems

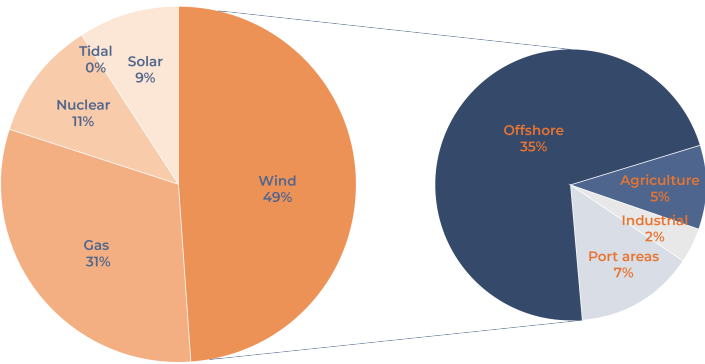
The current energy system in Zeeland is a mix of large-scale, centralised infrastructure and a growing presence of renewable energy sources. Existing energy production is concentrated in a limited number of locations, in particular the nuclear power plant in Borssele and various gas-fired power stations. These are supported by an extensive network of high-voltage power lines and underground cables connecting Zeeland to the national and international energy system.

At the same time, renewable energy production is expanding across the whole province. Wind turbines are spread widely, both on land and at sea, particularly along the coastlines and in open landscapes. Solar energy is also increasingly present, often integrated into agricultural or industrial areas. This results in a more distributed energy production system, although it remains largely connected to centralised infrastructure systems.

Despite this variety, the energy system remains focused on large-scale production and export. Zeeland plays a big role in the national energy network, but a lot of the spatial impacts, such as changes to the landscape and pressure on infrastructure, are felt locally.

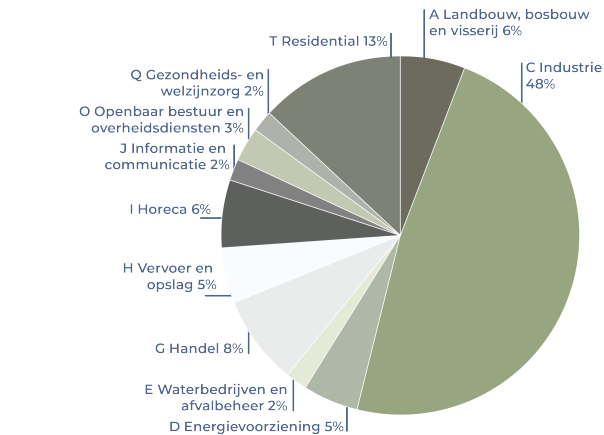
In addition to the existing system, there are plans to further expand nuclear energy production in Zeeland through the construction of a new nuclear power plant. This will strengthen the region’s role as a major energy hub, but will also intensify discussions regarding spatial impacts, safety and the distribution of benefits and burdens within the energy transition.

Electricity production MW - Zeeland

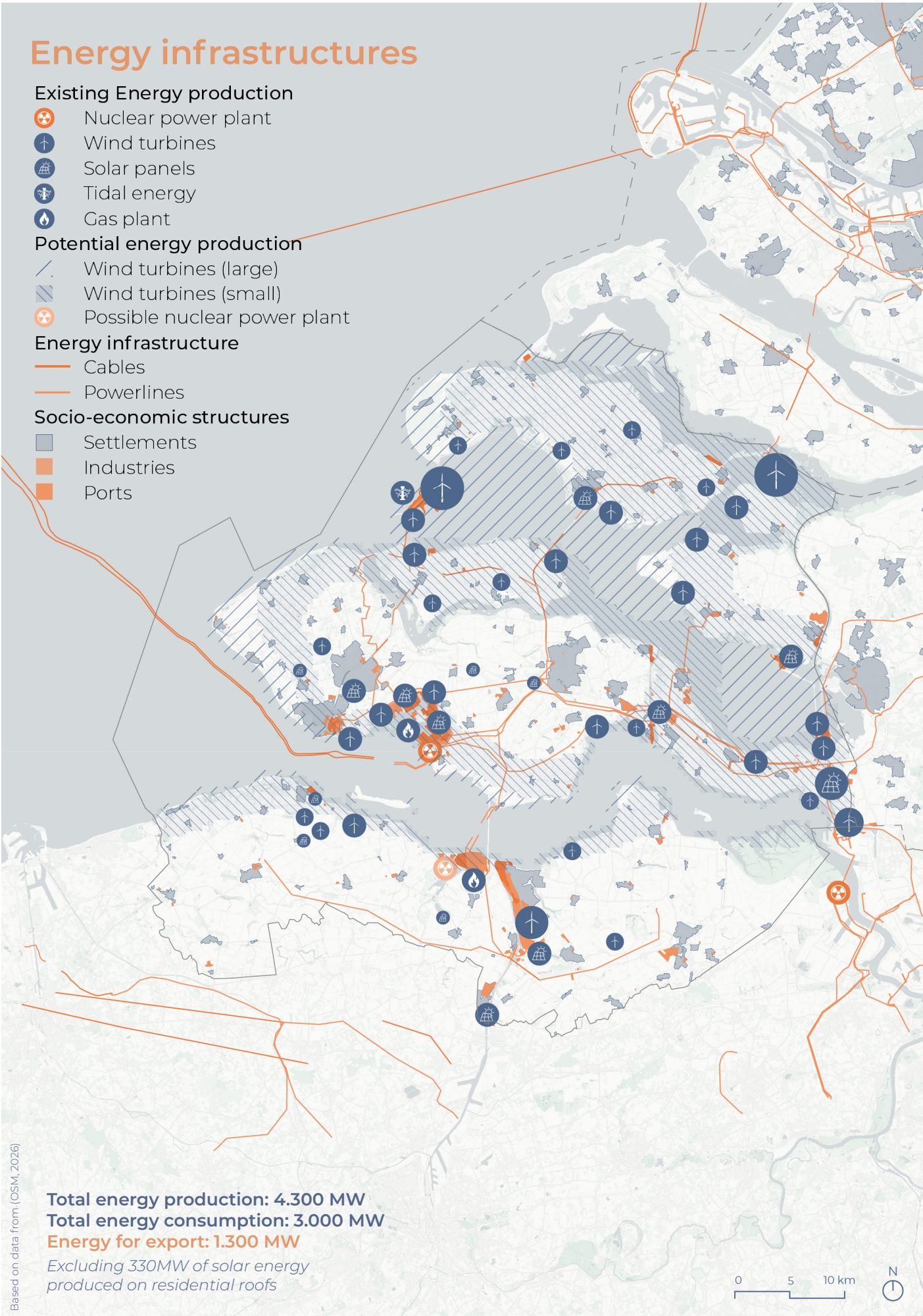


Based on data from (OSM & RIVM, 2026)

Electricity consumption MW



Based on data from (CBS, 2024)



4.1.2 Prognosis energy consumption

Current residential and industrial energy consumption can be analysed at multiple spatial scales using data from the CBS.

Residential energy consumption is available at neighbourhood level and can be disaggregated into a 500 × 500 m grid by assigning average consumption values to individual residences. This results in a high-resolution spatial representation of demand, ranging between 0 and 300 kW. Such granularity enables the identification of local demand clusters, which may be addressed through decentralised energy production.

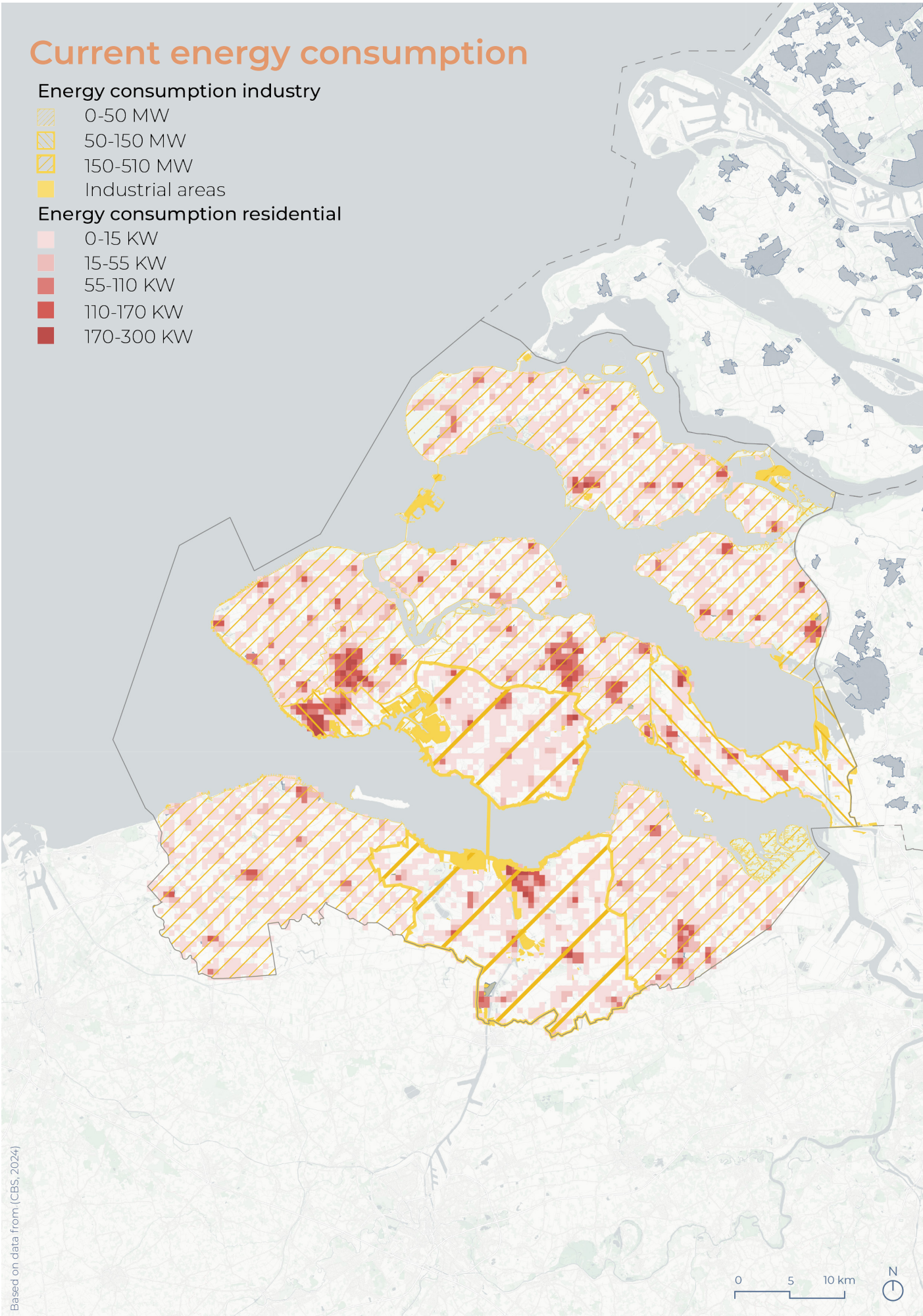
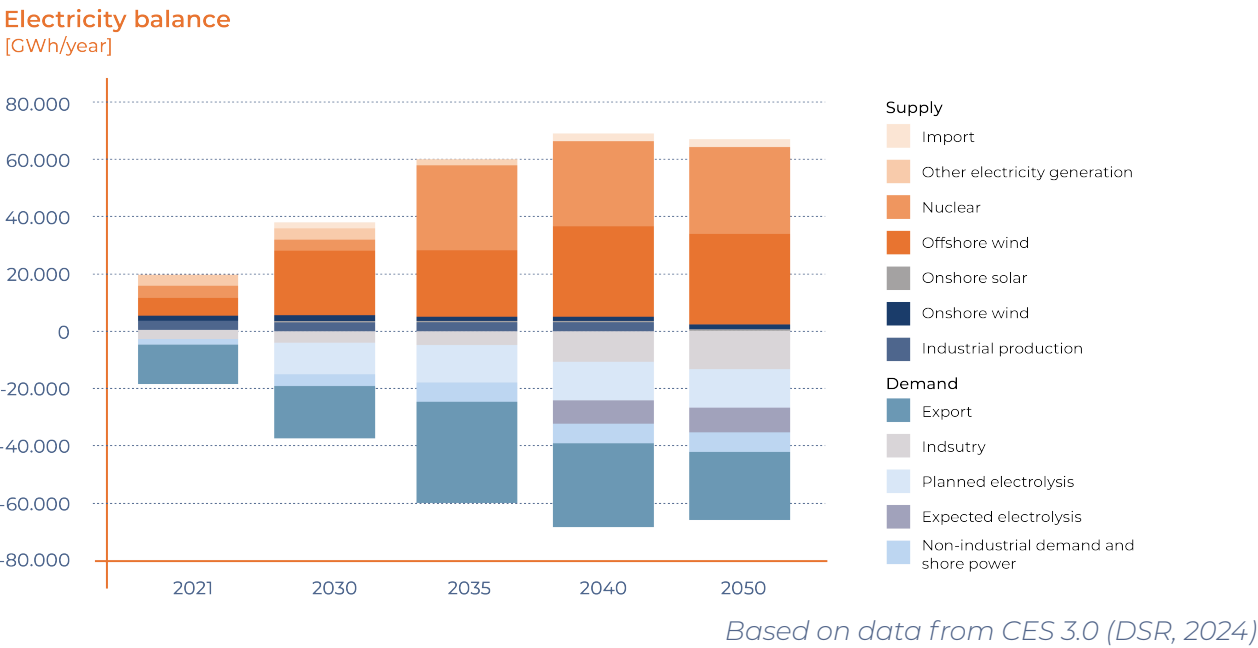
Future demand scenarios can also be modelled by accounting for the electrification of gas-based heating and other functions, using conversion factors for natural gas consumption.

Heavy industrial energy use is only available at municipal level, allowing us to only understand an indication of relative spatial implications, however, further precision is not necessary as these uses are clustered in industrial zones, which can be accounted for in planning of infrastructure and high voltage powerlines.

Projections for future energy demand are provided by SDR, which frames the regional

energy balance through scenarios of supply and demand. These projections indicate a potential tenfold increase in total energy demand, primarily driven by industrial growth. At the same time, the share of energy exported from the region is expected to decline from approximately 75% in 2021 to 50% in 2035, and further to 30% by 2050 assuming industrial consumption increases by up to 1000%.

However, these projections can be interpreted as a form of exaggerated compliance with climate regulations. The proposed expansion of energy supply capacity appears to be aligned with a favourable timeline that supports industrial growth, despite uncertainties in implementation pathways. While Zeeland is projected to remain a net energy exporter, with green hydrogen production via electrolysis positioned as an initial driver of growth, industrial expansion seems contingent on the prior availability of abundant and affordable energy, rather than acting as its primary catalyst. Furthermore, national energy policies aimed at subsidising industrial demand reinforce a system in which future electricity demand is overwhelmingly attributed to industrial use, with limited consideration given to other sectors.

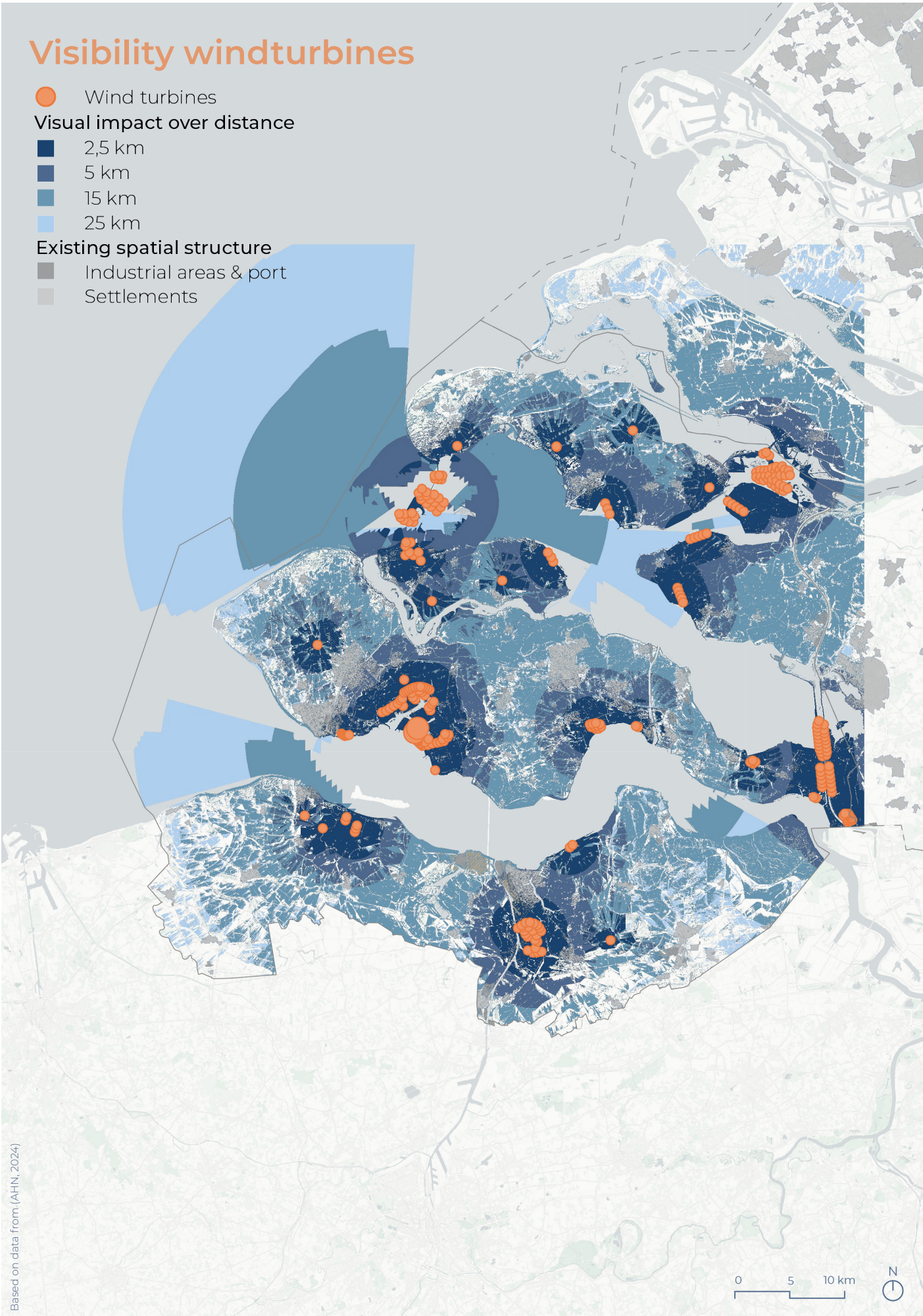


4.1.3 Energy visibility windturbines

Wind turbines have a clear spatial impact on the Zeeland landscape, as they are both visible and audible over considerable distances. Depending on weather conditions, wind turbines can be visible from distances of up to 35 km. In open landscapes such as Zeeland, this means that the visual influence of a wind turbine extends far beyond its immediate surroundings. This affects both landscape quality and the quality of the horizon (CLO, 2025).

The acoustic impact is less constant over distance and depends on factors such as wind direction, weather conditions, and turbine type. Low-frequency sound becomes relatively more important at greater distances, while turbine noise can be more clearly audible in

quiet rural conditions (RIVM, 2020). Research also shows that modern wind turbines can produce a sound level of approximately 33–40 dB(A) at a dwelling located around 500 m away (Pedersen et al., 2007). Wind turbines therefore form a burden not only because of their physical size, but also because of their continued visual and acoustic presence in the landscape.



4.1.4 Energy visibility powerlines

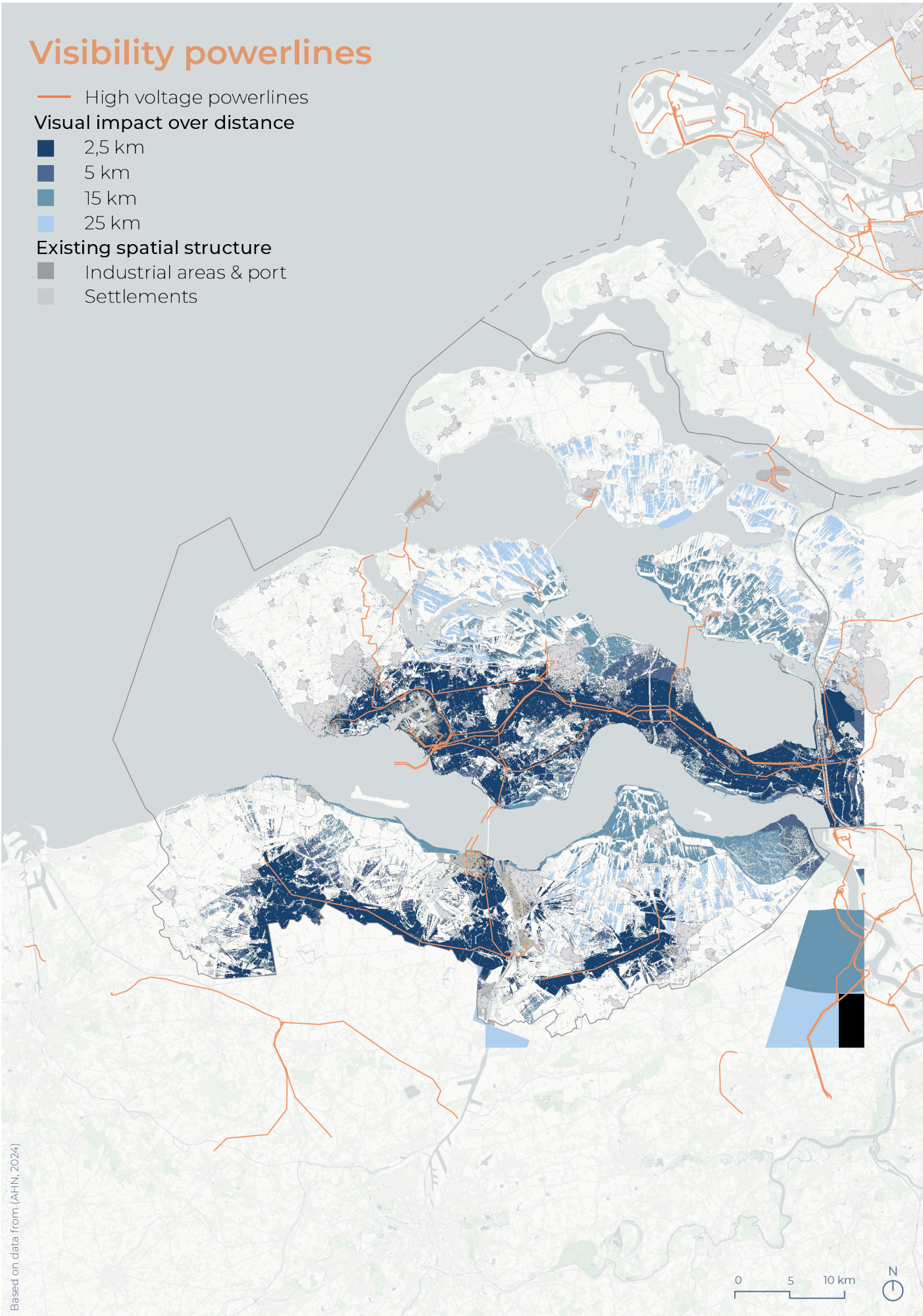
High voltage power lines, like wind turbines, also have a clear spatial impact on the Zeeland landscape. They introduce strong linear structures into an otherwise open and horizontal landscape. According to the CLO, high-voltage power lines are visible from around 5 km under average visibility conditions (CLO, 2014). In Zeeland, this means that they not only affect the perception of openness and horizon quality but also intensify the visual presence of infrastructure within the landscape through their continued overhead appearance.

In addition to their visual impact, high-voltage power lines also create spatial constraints because of the magnetic fields they generate. In the Netherlands, the indicative calculation

distances along high-voltage power lines range from approximately 30 to 158 meters on either side of the line, depending on the line configuration and maximum capacity (CLO, 2024). The RIVM applies a precautionary policy based on a magnetic field zone of more than 0.4 microtesla, which serves as a guideline for spatial planning around overhead high-voltage power lines (RIVM, 2024; RIVM, 2023). High-voltage power lines therefore form a burden not only through their physical and visual presence, but also through the spatial constraints they impose on surrounding land use and development.



(Omroep Zeeland, n.d.)



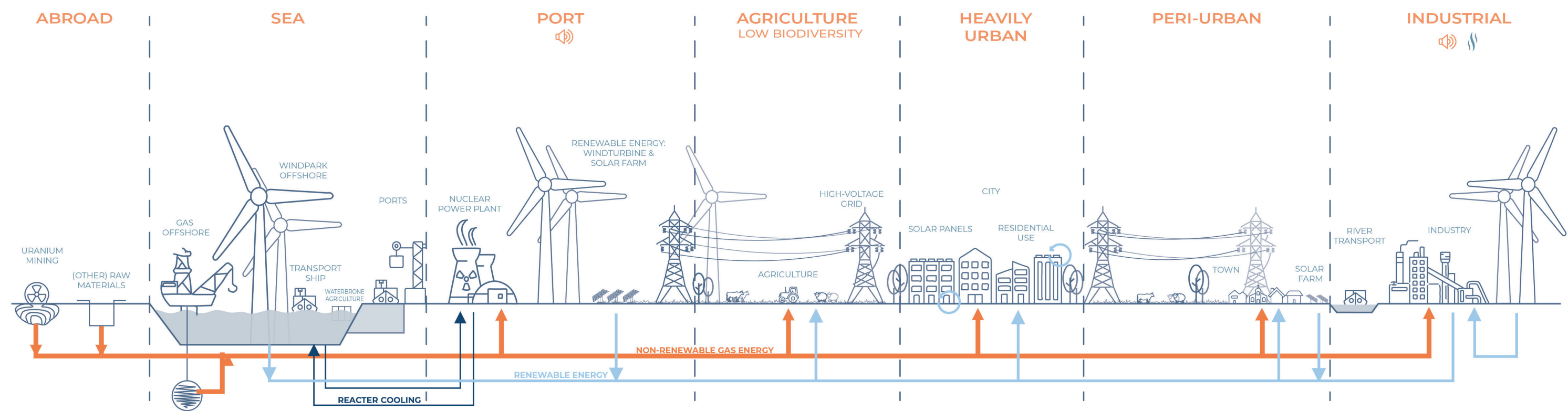
4.1.5 Systemic section

The current situation in Zeeland is characterised by a strongly centralised energy system. The section shows how the sea, port, agriculture, urban areas, and industry are connected through a limited number of dominant energy flows. The thick horizontal lines indicate that energy is still primarily organised through large-scale linear distribution, entering and moving through the province via major infrastructural corridors.

Within this system, the port and industrial zones form the strongest energy nodes. Offshore wind farms, port infrastructure, industrial facilities, and the nuclear power plant are concentrated here, giving these areas key roles in production, conversion, and redistribution. The vertical arrows suggest that these zones have a much higher energy intensity than the surrounding areas.

By contrast, agricultural and peri-urban areas are more spatially extensive but less energy-intensive, while urban and industrial areas concentrate a higher level of demand. Although renewable sources such as wind and solar energy are already present, the section makes clear that Zeeland is still characterised by a centralised infrastructure with largely one-directional flows. This results in a landscape in which infrastructure, land use, and energy demand are closely intertwined.

Current situation



4.2 Economic and industries

Industry in Zeeland plays a significant role in the industrial clusters of the Netherlands. Despite its continuous decline of population, Zeeland has one of the highest shares of industrial employment in the Netherlands, reaching approximately 14% in 2023 (CBS, 2023). This highlights the regions dependance on industrial activities compared to other provinces, where employment might be more oriented towards other services.

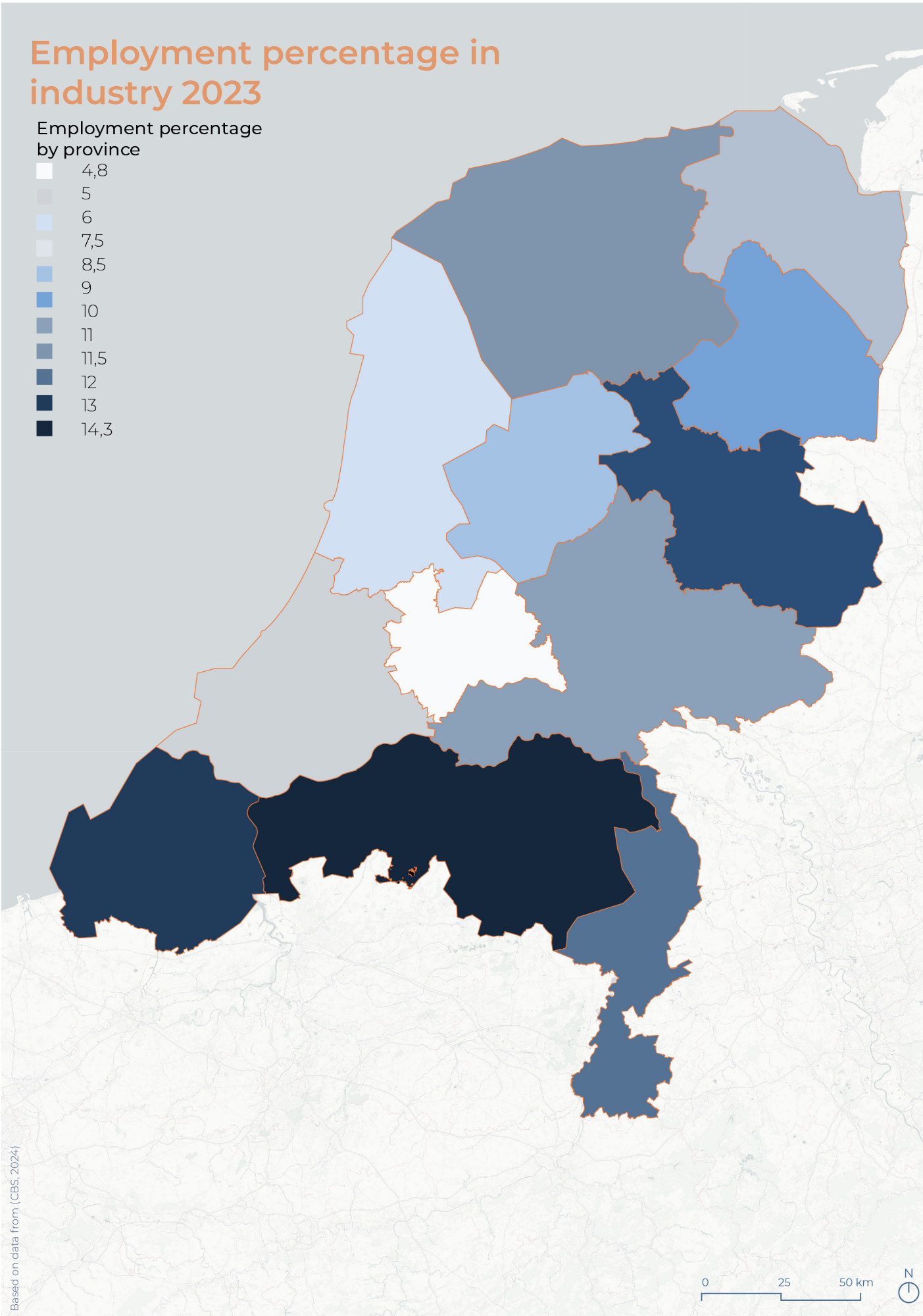
Zeeland's economy is dominated by energy-intensive sectors like chemical industry, oil refining and logistics which are mostly located around Vlissingen and Terneuzen ports. These ports are part of the North Sea Port, a transnational industrial connection between the Netherlands and Belgium (North Sea Port | North Sea Port, 2026). The chemical industry, is characterized by high gas consumption and rely strongly on fossil fuels (). This makes it a key component in the research of energy transition away from fossil fuels. Zeeland holds one of the largest chemical industry clusters in Northwestern Europe, hosting companies such as DOW, Yara and Trsinseo (De Blois Anne-Peter Alberda En Harm Jan Boonstra, 2024c)

Zeeland's economic structure is dominated by energy-intensive sectors, particularly the chemical industry, oil refining, and port-related logistics. These sectors are concentrated in the Vlissingen–Terneuzen industrial axis, which forms part of the North Sea Port and connects to major European industrial regions. The chemical industry, in particular, is characterized by high natural gas consumption, significant heat demand, and strong reliance on fossil fuels. This makes it a key contributor to both regional economic output and greenhouse gas emissions.

Fossil-based based materials constitute a significant share for over a third of the total commodity weight used, reflecting the presence of energy-intensive industries such as chemical productions and refineries. A significant share of goods handled in the province consists of transit flows, with up to

two-thirds of goods leaving Zeeland classified as transit trade (CBS, 2023). This reflects the importance of the region as a critical node in European logistics and supply chains.

Overall, Zeeland's economy can be understood as a highly specialized, energy-intensive system that is both economically significant and environmentally impactful. This duality positions the region at the forefront of the energy transition, where the challenge lies in transforming fossil-based industry into circular systems.



4.3 Spatial qualities

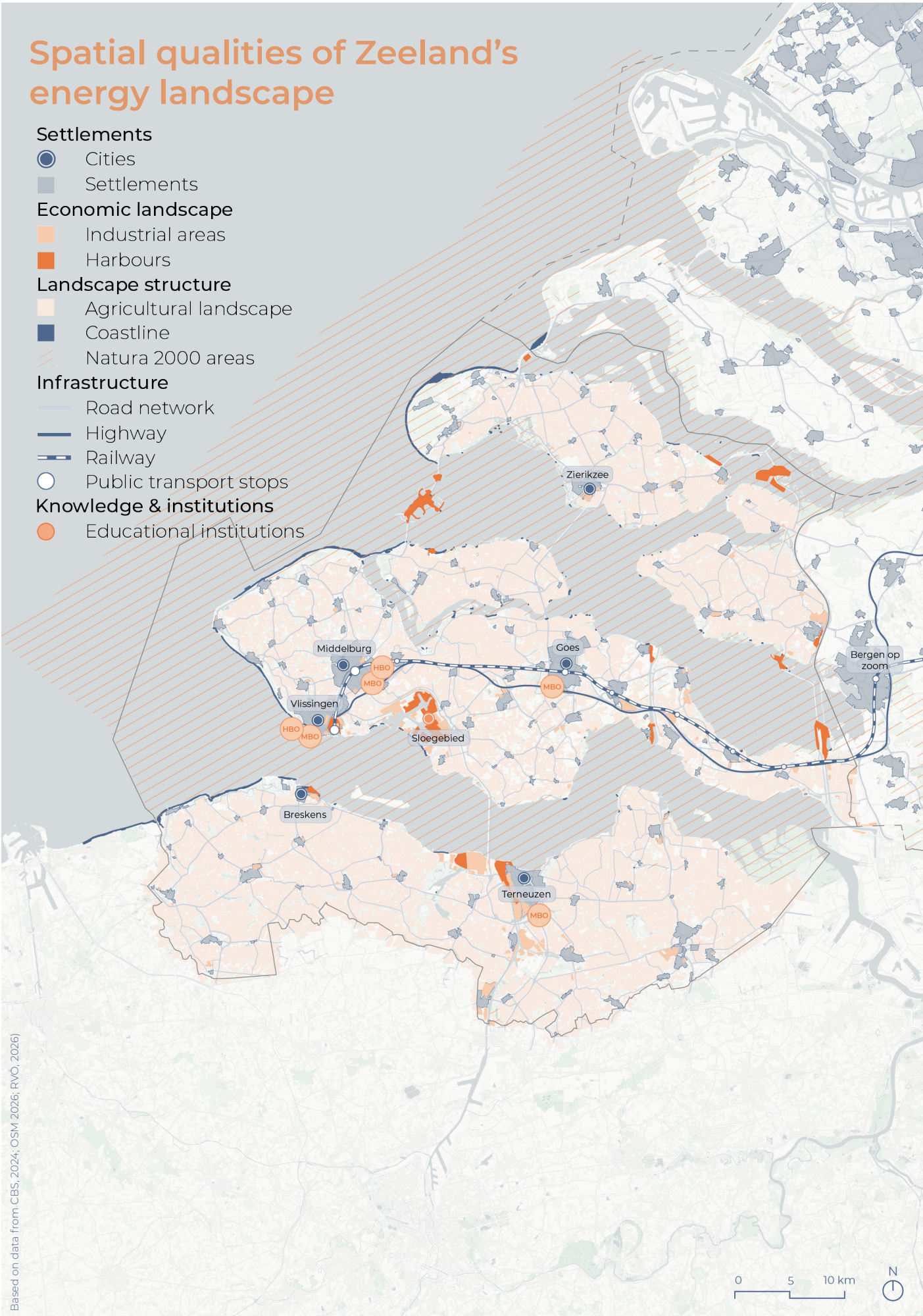
Zeeland is characterised by a fragmented delta landscape, where land and water constantly shape spatial structures and patterns. Settlements are relatively small and spread out, often organised along dykes and historic linear structures, whilst larger urban centres remain limited. Middelburg and Vlissingen are the main urban centres, where residential areas mix with industrial and commercial functions.

The rural areas are mostly agricultural and consist of small villages. Agriculture is the main use of land in Zeeland and defines the open polder landscape and its spatial structure. At the same time, industrial areas and ports are concentrated in specific locations, creating important economic clusters within the region.

Due to the openness of the landscape, spatial interventions and infrastructure have a strong visual presence over long distances. This increases the impact of large-scale developments, particularly with relation to energy infrastructure.

At the same time, Zeeland is rich in valuable nature areas, including Natura 2000 sites, which underline the region's ecological importance and impose additional spatial constraints.

Together, these qualities reveal a landscape that is both highly productive and environmentally sensitive, where spatial interventions must carefully balance economic functions, ecological values, and local identity.



4.4 Energy futures

4.4.1 Centralised energy system

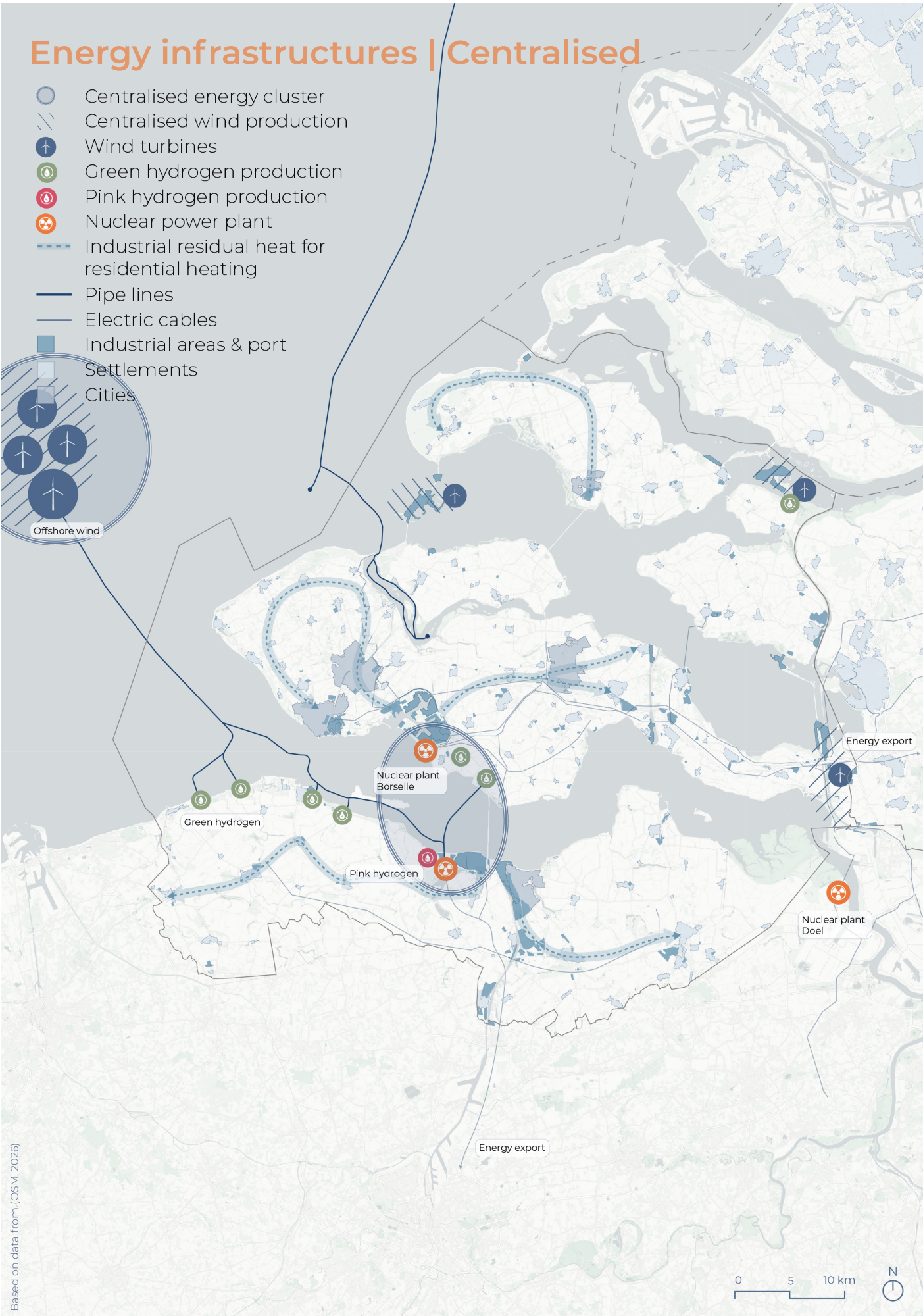
A centralised energy future for Zeeland would, in several respects, build upon the existing system while introducing key structural changes. In this scenario, large-scale offshore wind developments in the North Sea, alongside new nuclear power plants in the Sloegebied and Terneuzen, would form the backbone of energy production. At the same time, onshore wind generation would be gradually reduced, reflecting a transition toward fewer but significantly larger production clusters.

Energy generation would be spatially concentrated around the industrial clusters of Vlissingen and Terneuzen, where subsea cables from offshore wind farms make landfall and where nuclear facilities are located. These areas would function as primary energy hubs, directly supplying nearby industrial consumers and feeding into the national grid and energy export.

A critical component of this system would be the large-scale development of both pink and green hydrogen. Hydrogen production would serve a dual purpose maintaining a stable demand for nuclear baseload generation and absorbing surplus electricity from variable wind production, balancing supply and reducing net congestion. This positions hydrogen as a key intermediary in aligning constant and variable energy sources.

Increased industrial activity would enable the expansion of residual heat networks, allowing waste heat from industrial processes to be reused for residential heating in areas where building-level energy efficiency measures are insufficient or infeasible.

Overall, a centralised energy future would concentrate production and conversion infrastructure within a limited number of strategic clusters, primarily port and industrial areas, as well as offshore sites. This spatial concentration could, in turn, reduce pressure on other parts of the landscape, enabling the preservation or development of infrastructure free natural areas.



4.4.2 Decentralised energy system

A decentralised energy future in Zeeland would represent a significant structural shift from both the current landscape and the prevailing centralised development strategy. In this scenario, existing renewable energy production would be maintained, while additional capacity, especially onshore wind and solar would be expanded across both dry and wet landscapes. This expansion would be necessary to compensate for the complete phaseFout of nuclear and gas-fired generation, resulting in a system that relies predominantly on distributed and variable renewable sources.

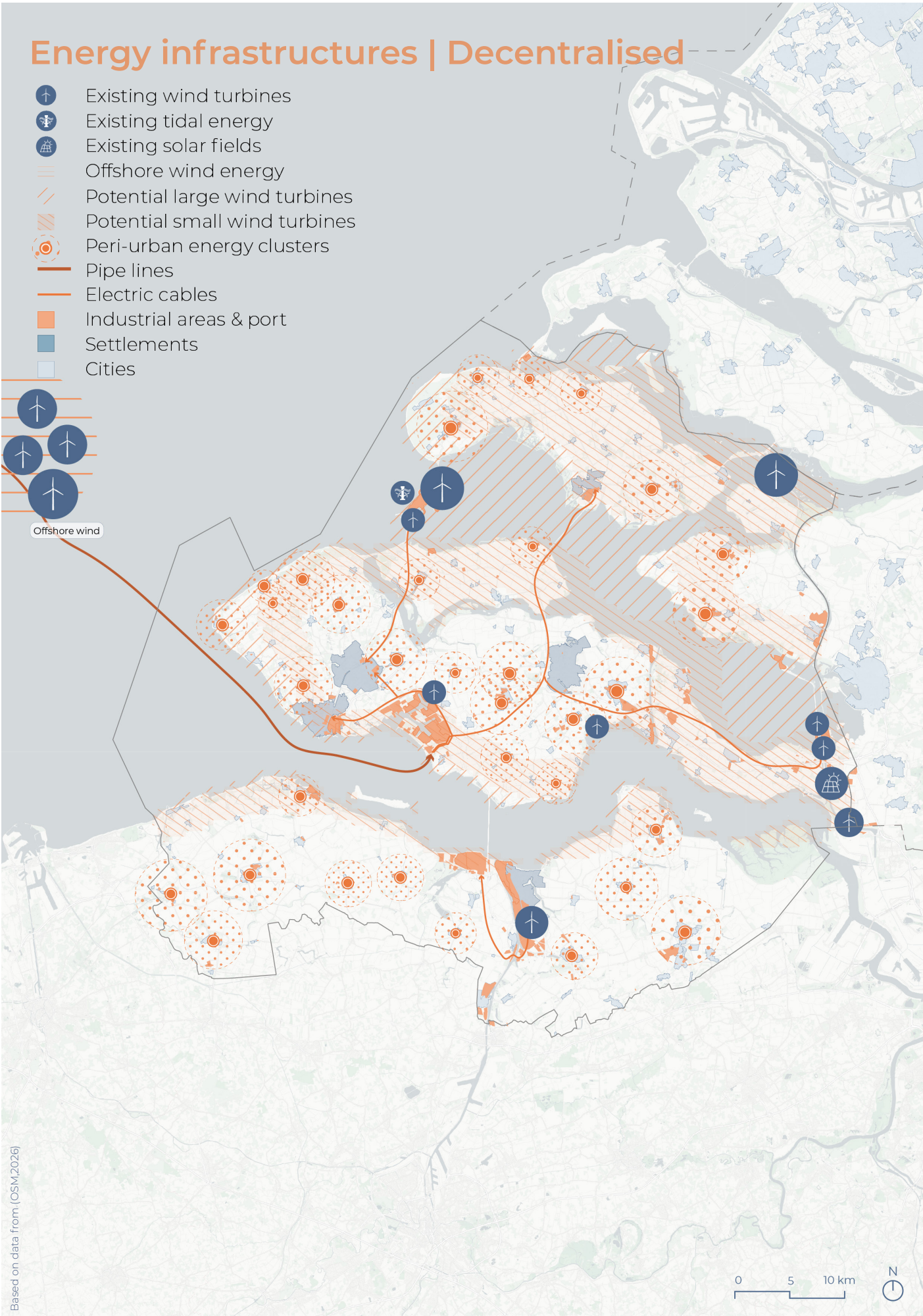
Energy production would become more spatially dispersed, moving closer to areas of consumption. Peri-urban and rural areas would play a key role in hosting new generation capacity, supplying both local residential demand and nearby commercial activities. Dense urban areas, however, would remain partially dependent on external supply due to spatial limitations, requiring a continued reliance on centralised grid infrastructure.

As a result, the spatial footprint of energy production would increase significantly. This expanded footprint could create opportunities for community ownership models and cooperative energy systems. At the same time, the visible and spatial impact of energy infrastructure may heighten awareness of energy consumption, potentially encouraging energysaving behaviour and the adoption of circular practices.

A key constraint in this scenario is the limited

availability of large-scale centralised storage solutions, such as hydrogen production or batteries. Without these buffering mechanisms, maintaining system reliability would require either an overcapacity of generation or more flexible demand patterns, particularly for industrial users. This introduces trade-offs between land use, system stability, and ecological impact, necessitating more deliberate and spatially differentiated planning strategies.

Overall, a decentralised energy future redistributes both the benefits and burdens of energy production across the landscape. Compared to a centralised system, it reduces dependence on a few large infrastructure nodes but increases the spatial integration of energy systems into everyday environments, requiring more active engagement from local communities.



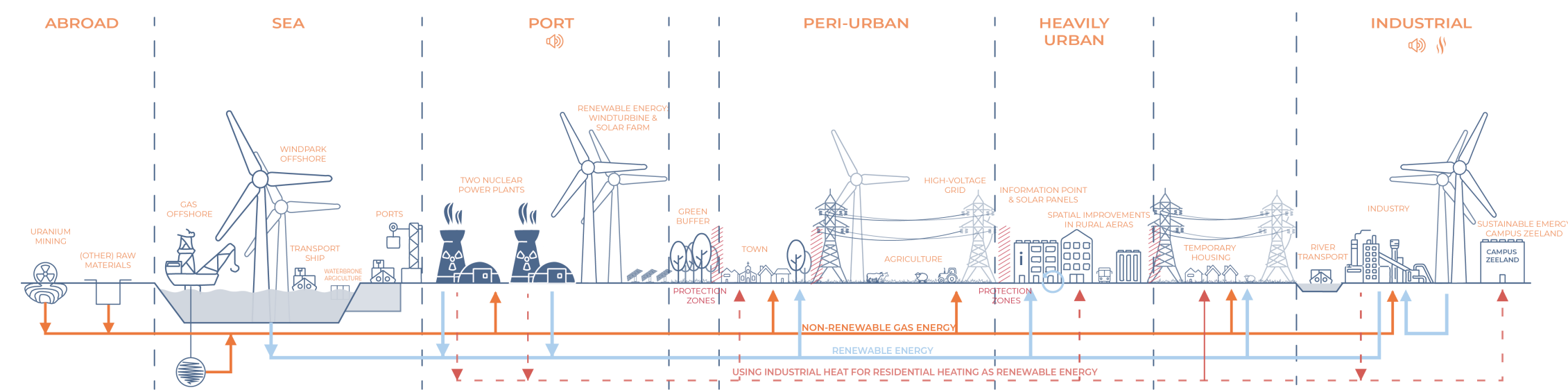
4.4.3 Systemic sections

The first scenario outlines a future in which village-based residents accept the arrival of an additional nuclear power plant, but only under clear conditions. A second nuclear power plant is introduced to increase the production of low-carbon electricity, while industrial residual heat is reused to provide heating for nearby homes. At the same time, spatial improvements such as green buffer zones, improved mobility, and additional public amenities help reduce the burden on surrounding communities. This scenario shows that acceptance of additional nuclear infrastructure becomes possible when local communities are not only exposed to the energy system, but also benefit from it.

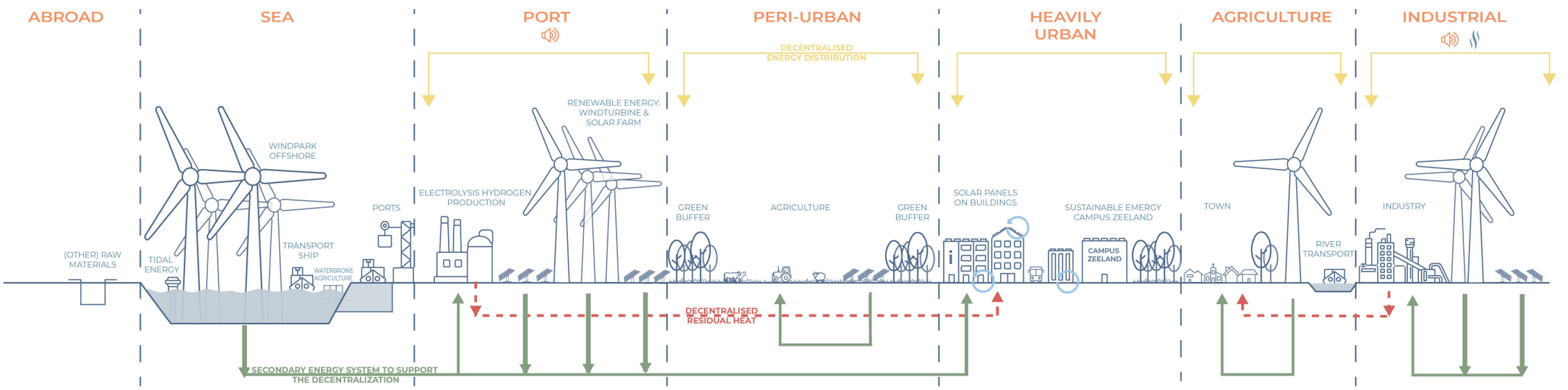
The second scenario presents a future in which nuclear energy is phased out and renewable energy takes on a central role in the regional energy supply. Energy is generated through clusters of solar and wind power, located both offshore, on industrial land, and around villages and urban areas. This energy is not only produced at a large scale, but is also directly connected to local communities, allowing them to benefit more directly from the system. By distributing these energy clusters more widely across the territory, a more locally embedded energy system emerges, in which the benefits of the energy transition become part of the everyday life of surrounding communities.

The difference between the two scenarios therefore lies not only in the energy source, but also in the way benefits are distributed. Whereas the first scenario is based on the acceptance of additional nuclear infrastructure in exchange for local conditions and compensations, the second shows how a more decentralised system can generate more direct benefits for villages and towns themselves.

Future scenario: Acceptance of nuclear energy with conditions from the village-based residents



Future scenario: Phasing out of nuclear energy



4.5 Analysis conclusion

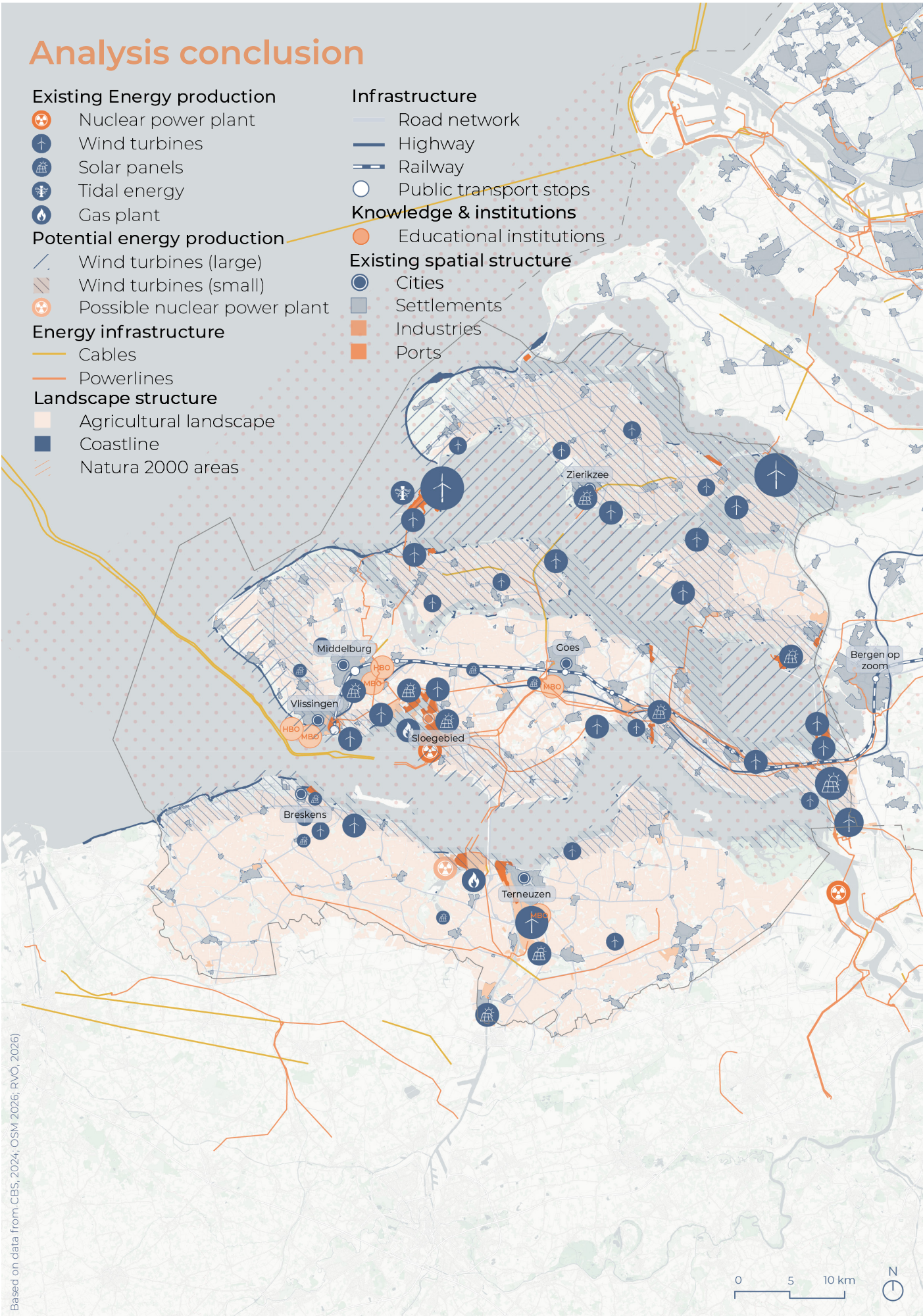
BURDENS	BENEFITS
▶ Visual impact (windturbines, powerlines) ▶ Safety risks (nuclear, industry) ▶ Land-use pressure ▶ Noise & pollution ▶ Loss of landscape quality	▶ Employment (industry, energy sector) ▶ Energy supply & security ▶ Economic activity (ports, industry) ▶ Potential heat networks ▶ National energy contribution

The analysis shows that there is a clear imbalance in the distribution of burdens and benefits within Zeeland’s energy system. While economic gains such as employment, energy security and infrastructural investment are concentrated in industrial clusters and port areas, the spatial and environmental burdens, including visual impact, land-use pressure and safety risks, are dispersed across rural landscapes and local communities. This uneven distribution draws attention to issues of spatial justice, whereby those who benefit are not necessarily those most affected.

At the same time, the system remains highly fragmented. Energy production, infrastructure and consumption are organised in separate layers with limited spatial connection or overlap. This results in inefficiencies, missed opportunities for exchange and a lack of connection to the landscape and everyday life. Energy infrastructures are often imposed on the landscape rather than being part of it.

However, the analysis also reveals important potential. The concentration of industrial clusters, agricultural systems and settlements creates opportunities for new forms of exchange and interaction. For example, residual heat could be redirected towards towns, agricultural waste streams could support industrial processes, and decentralised energy production could strengthen local communities. These spatial relationships suggest the possibility of transitioning to a more circular and interconnected system.

Together, these findings indicate the need for a fundamental shift from a centralised, sector-based energy system to an integrated, spatially coordinated energy landscape. Aligning energy flows with landscape structures and everyday environments enables spatial pressures to be reduced while benefits are redistributed more fairly. This transition forms the basis of the vision of how Zeeland could transition to a more resilient, inclusive and interconnected energy system.



05.

Vision

Community vision

- 5.1 Village based residents
- 5.2 Industrial workforce residents
- 5.3 Transition-oriented community
- 5.4 Community vision

5.1 Village based residents

5.1.1 Core values



Quality of life



Landscape & spatial quality



Fairness & justice



Participation & governance

5.1.2 Vision statement

" Village based residents picture a Zeeland in 2100 where village life remains **liveable, safe and socially inclusive** within the **delta landscape**. Historical village identities and cultural landscapes are carefully protected, while energy infrastructures are concentrated in clearly defined clusters and separated from residential areas. **Inclusive decision-making** and a **fair spatial distribution** of the energy infrastructure allow local communities to maintain confidence in the transition while safeguarding the **quality of the landscape** and the **liveability** of everyday life."

Community profile highlighting key values and lived perspectives.



Borssele, Zeeland

Yvonne Kelder (45)
Village based resident

QUOTE

"I want to live in an open landscape, not in the shadow of energy infrastructure."

CORE VALUES

Quality of life

Fairness & justice

Participation & governance

Landscape & spatial quality

Livability

Territorial fairness

Inclusion

Landscape stewardship

Safety

Fair distribution of burdens/benefit

Co-decision

Spatial balance

Health

Integrational justice

Trust

Ecological protection

VALUES

Social cohesion

Compensation

Transparency

Vision village based residents

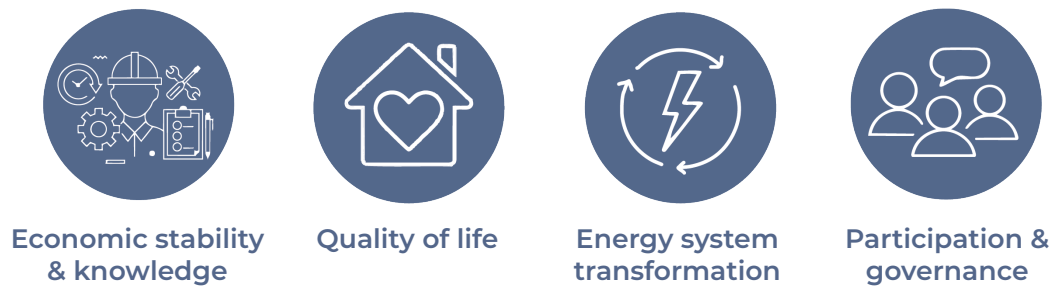
- Protected villages zones
- Cultural landscape protection area
- Landscape buffers around industry
- Controlled energy cluster
- Settlement
- Industry

80 |

Just Zeeland? | 81

5.2 Industrial workforce residents

5.2.1 Core values



5.1.2 Vision statement

"The industrial workforce envisions a Zeeland in 2100 where **industrial clusters** remain the backbone of the regional economy, while gradually transforming to low-carbon and circular production systems. Stable **job opportunities**, the development of **technical knowledge** and **innovation** are essential to ensure that workers can actively participate in and benefit from the energy transition. Supported by improved **mobility networks, hydrogen infrastructure and industrial innovation hubs**, industry in Zeeland is evolving into a competitive and sustainable economic system that secures both livability and regional prosperity."

Community profile highlighting key values and lived perspectives.

Middelburg, Zeeland
Willem van den Baan (56)
Industrial workforce resident

QUOTE
"You can't talk about the transition without talking about jobs. For me, this is my future."

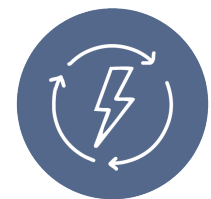
CORE VALUES

 Economic stability & knowledge	 Quality of life	 Fairness & justice	 Energy system transformation
 Stable employment	 Health	 Inclusion	 Industrial transformation
 Regional competitiveness	 Safety	 Trust	 System flexibility
 Innovative capacity	 Social cohesion	 Transparency	 Energy security
 Skills & technical knowledge	 Multi-level governance		



5.3 Transition-oriented

5.3.1 Core values



Energy system transformation



Landscape & spatial quality



Participation & governance



Fairness & justice

5.3.2 Vision statement

"The transition-oriented community envision Zeeland in 2100 as an integrated energy transition landscape where **governance institutions, knowledge networks** and **industrial hubs** collaborate to accelerate the shift towards a carbon-neutral energy system. **Energy infrastructures, public transport networks and regional innovation clusters** are strategically coordinated to support sustainable industry while restoring **ecological landscapes** through expanded wetlands, biodiversity corridors and regenerative agricultural systems. Through **shared responsibility**, transparent governance and multi-level cooperation, Zeeland becomes a resilient living environment for a spatially balanced energy transition."

Community profile highlighting key values and lived perspectives.

Heikenszand, Zeeland

Frederique Nouwens (32)

Transition-oriented

QUOTE

"The transition should not only affect us, but also create opportunities for us."

CORE VALUES

Energy system transformation

Fairness & justice

Participation & governance

Landscape & spatial quality

Carbon neutrality

Territorial fairness

Inclusion

Multifunctionality

Decentralisation

Fair distribution of burdens/benefit

Co-decision

Integration of infrastructure

System flexibility

Integrational justice

Trust

Ecological protection

VALUES

Energy security

Circularity

Transparency

Vision industrial workforce residents

- ★ Governance & knowledge nodes
- Energy infrastructure corridors
- Energy transition clusters
- ▨ Expanded biodiversity areas
- ▨ Expanded wetlands / floodplains
- Regional public transport node
- Regional public transport corridor
- Local public transport node
- ▨ Regenerative agricultural systems

84 |

Just Zeeland? | 85

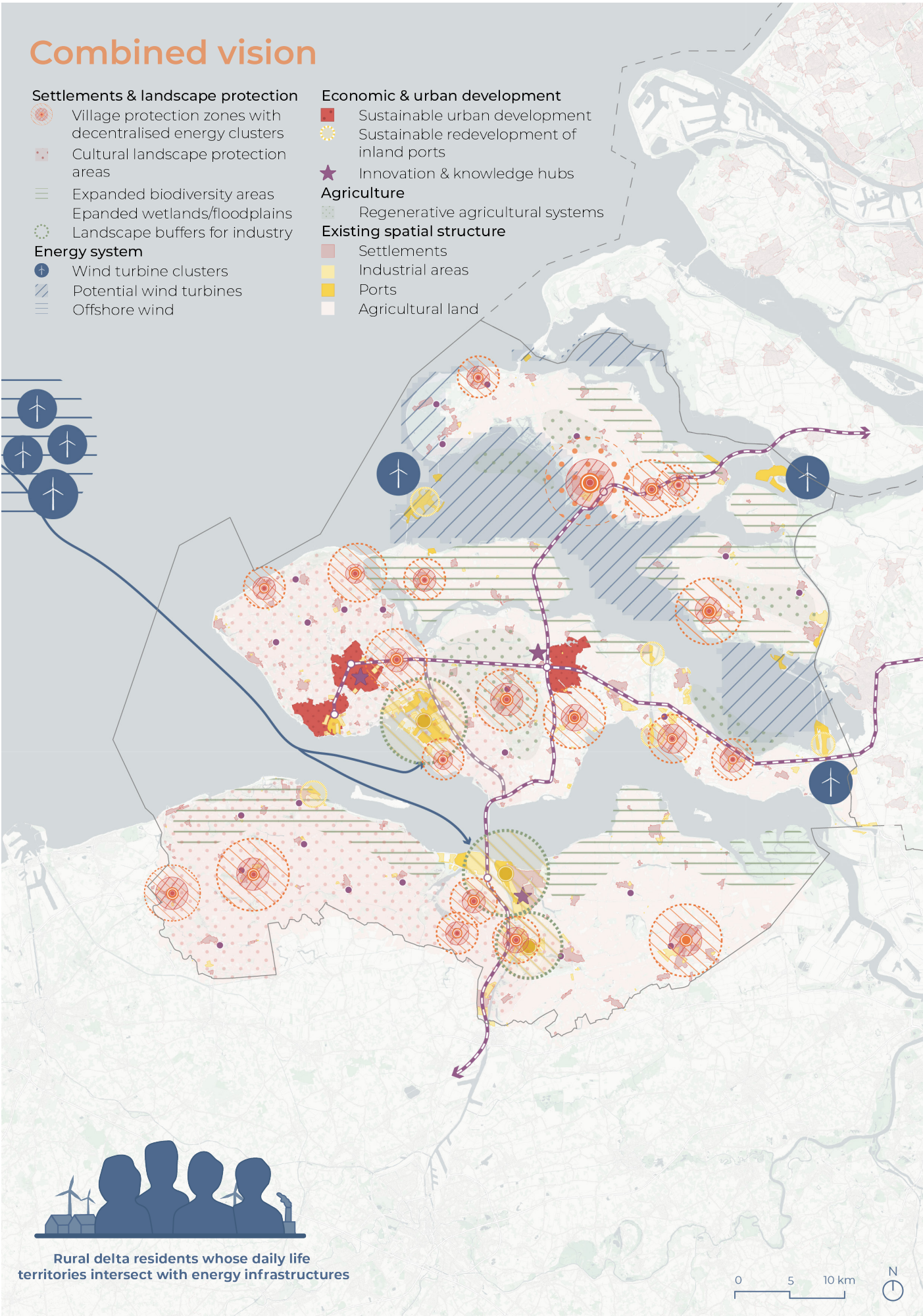
5.4 Community vision

5.4.1 Community core values and concerns

The combined community vision is based on the core values and concerns identified during the analysis. Translating these values into guiding questions brings together the perspectives of different communities into a shared vision for the future.

These questions reflect the main tensions within the energy transition, covering everything from daily living conditions and landscape quality to economic stability, participation and system transformation. Rather than providing definitive solutions, they highlight the issues that a socially and spatially just transition should address.

Together, they bridge the gap between the identified challenges and the envisioned future, ensuring the community vision remains grounded in local experiences while guiding the development of spatial strategies that will make Zeeland more resilient and inclusive.



5.4.2 Vision statement

"The combined community envisions a Zeeland in 2100 as a resilient and spatially just energy landscape, where energy transition becomes a driver for **spatial quality, economic development, and strong local communities**. Rather than a single, centralised system, energy is organised through a network of interconnected local and regional clusters, combining **decentralised production** with shared infrastructures.

This system enables communities to generate **energy locally**, while larger clusters support industry and contribute to national and international networks. By aligning scales and functions, the energy system becomes multi-functional, embedded in the landscape, and supportive of both everyday life and economic activity.

Across all communities, common values such as quality of life, participation, and fairness form the foundation of this transition. Through inclusive governance and collaboration between communities, industry, and institutions, Zeeland develops into a balanced system where **benefits and responsibilities are shared**.

Spatially, this results in a shift from dispersed and mono-functional infrastructures towards clearly **organised energy clusters, integrated within the landscape and connected through strong infrastructural and ecological networks**. In this way, Zeeland is developing into a resilient and inclusive delta landscape where energy, the economy and communities live together in a system in which these elements strengthen each other."



06.

Strategy

Theory

- 6.1 Strategy
- 6.2 Strategic framework
- 6.3 Phasing strategy
- 6.4 Theme A - Mobility of the future
- 6.5 Theme B - Industrial transformation
- 6.6 Theme C - Energy communities
- 6.7 Total strategy visuals

6.1 Strategy

The strategy translates the combined vision into a spatial and operational framework at the regional scale. It proposes a shift from fragmented systems towards an integrated energy landscape, where energy, mobility and industry are interconnected through shared infrastructures and spatial clustering.

The strategy map illustrates how this transition is organised spatially. It focuses on the developing of a system of energy and industrial clusters, connected through bundled energy corridors and supported by a strengthened mobility and logistics network.

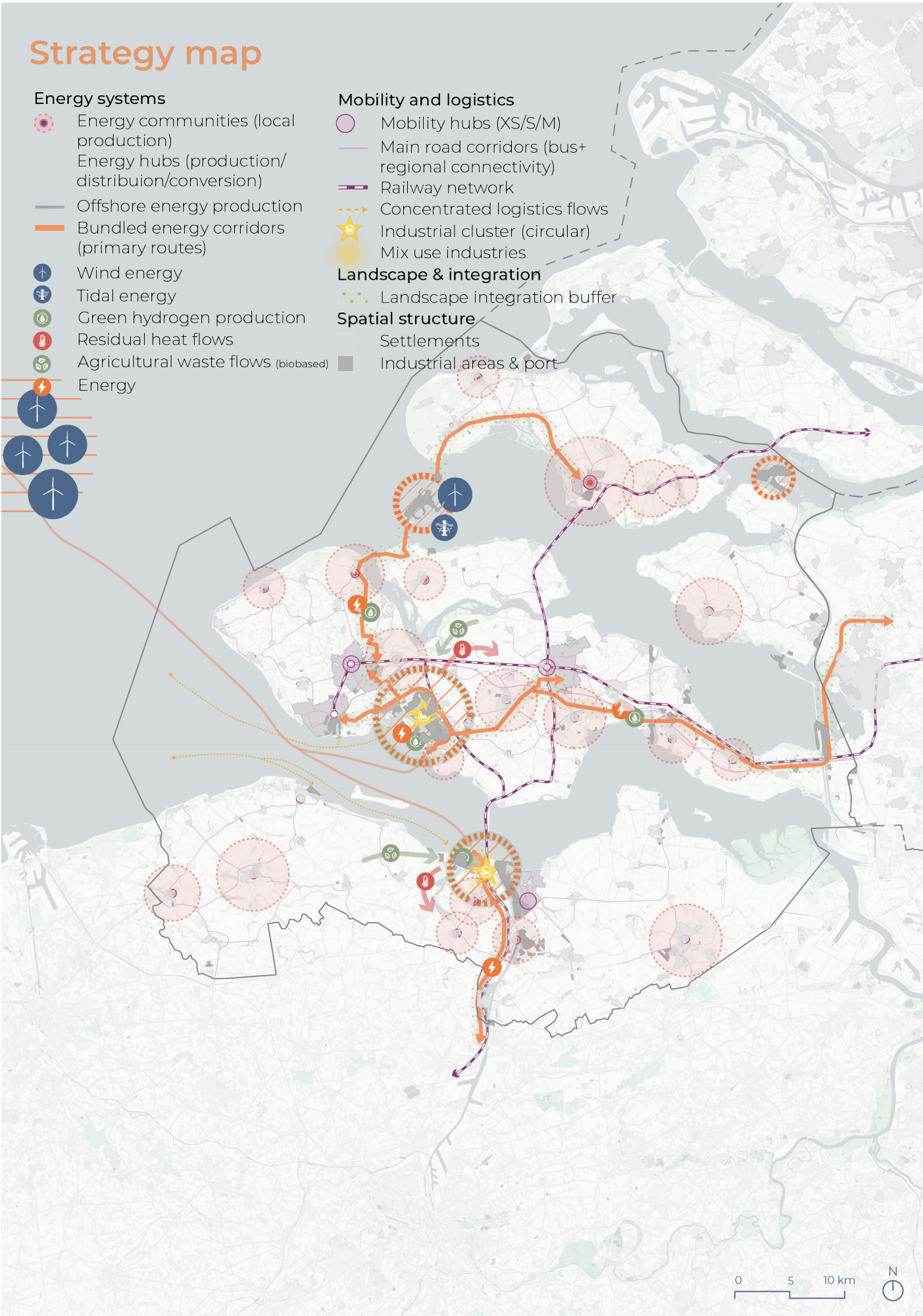
Energy production is structured through a combination of offshore wind, hydrogen production and local energy communities. Hydrogen becomes a key carrier within the system, forming a backbone that connects offshore production to industrial areas such as the Sloe area and further inland. Around these nodes, energy hubs emerge where production, conversion and distribution take place.

At the same time, industrial areas transition towards circular and mixed-use clusters. Rather than operating as isolated production sites, industries become part of a broader system in which material and energy flows are exchanged. Residual heat from industrial processes is redistributed towards surrounding settlements, while agricultural waste streams are reused as input for bio-based production, creating new relationships between rural and industrial areas.

Mobility and logistics play an important role in making this system possible. The strategy focuses on concentrating logistics flows along strategic corridors, reducing pressure on local landscapes, while improving regional and local accessibility. A network of mobility hubs (XS/S/M) is introduced to connect villages and urban areas to these larger systems, ensuring that the transition also improves everyday accessibility and quality of life.

Spatially, this results in a landscape where infrastructures are no longer mono-functional, but embedded within ecological and social systems. Energy corridors are integrated into the landscape through buffers and spatial transitions, while clusters are carefully positioned in relation to settlements and environmental qualities.

Overall, the strategy creates a system in which energy, materials and people flows are aligned, creating the conditions for a transition towards a resilient, circular and interconnected delta landscape.



6.2 Strategic framework

6.2.1 Framework

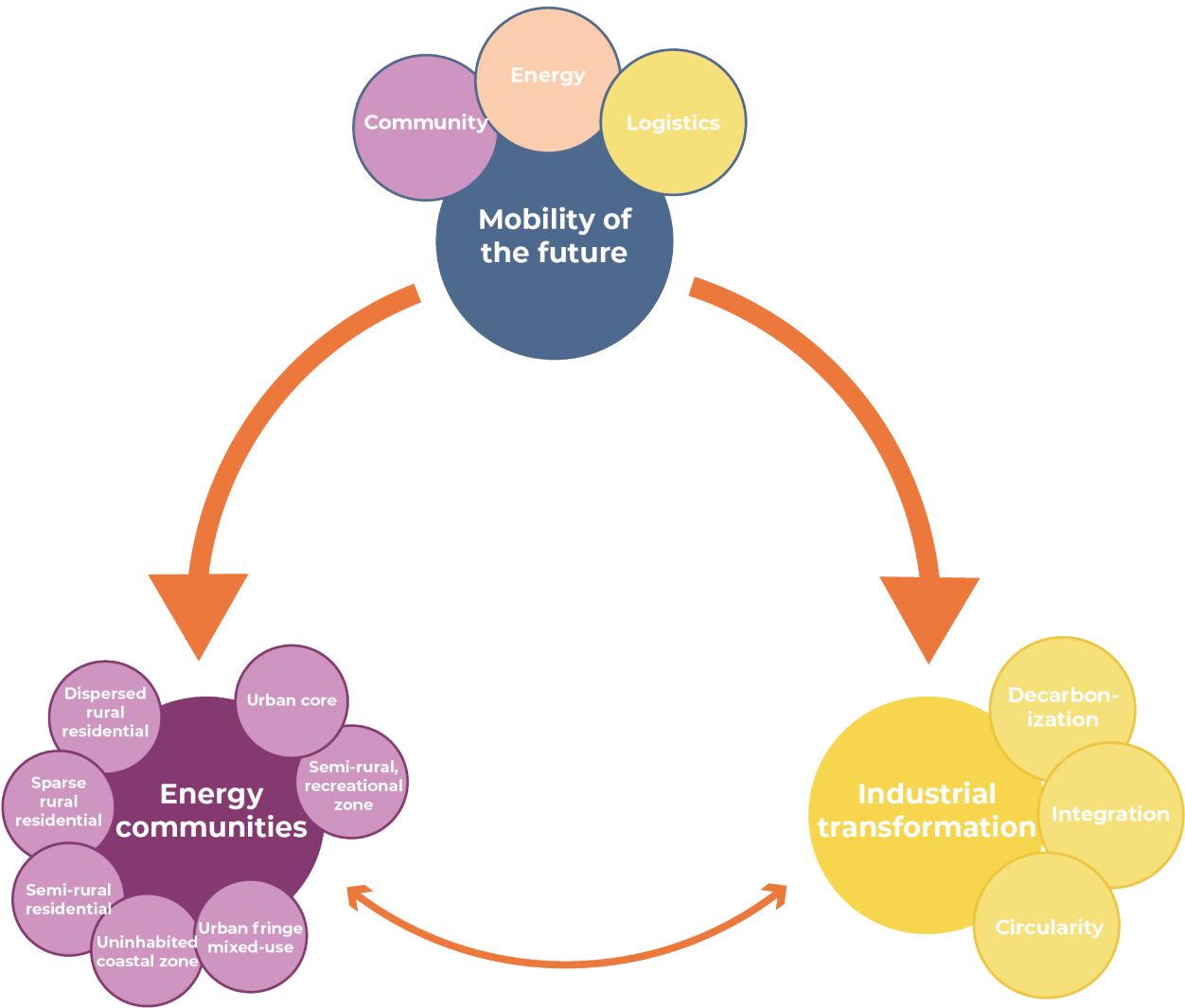
To structure the strategy, three main themes are defined: *mobility of the future, industrial transformation and energy communities*.

These themes represent the main systems driving the transition, but they do not operate independently. Instead, they are strongly interconnected and strengthen each other.

Mobility plays a central role in this framework, acting as the connecting system between energy and industry. Through infrastructural corridors and logistics networks, mobility allows the exchange of energy, materials and resources, connecting local communities to regional and international systems.

Within each theme, further subsystems are identified. Mobility is structured through energy, logistics and community-related accessibility. Energy communities are organised into different spatial clusters, reflecting varying settlement types and local conditions. Industrial transformation focuses on decarbonisation, circularity and integration with surrounding systems.

The diagram illustrates how these themes overlap and interact, forming a coherent framework in which spatial, economic and energy systems are aligned.



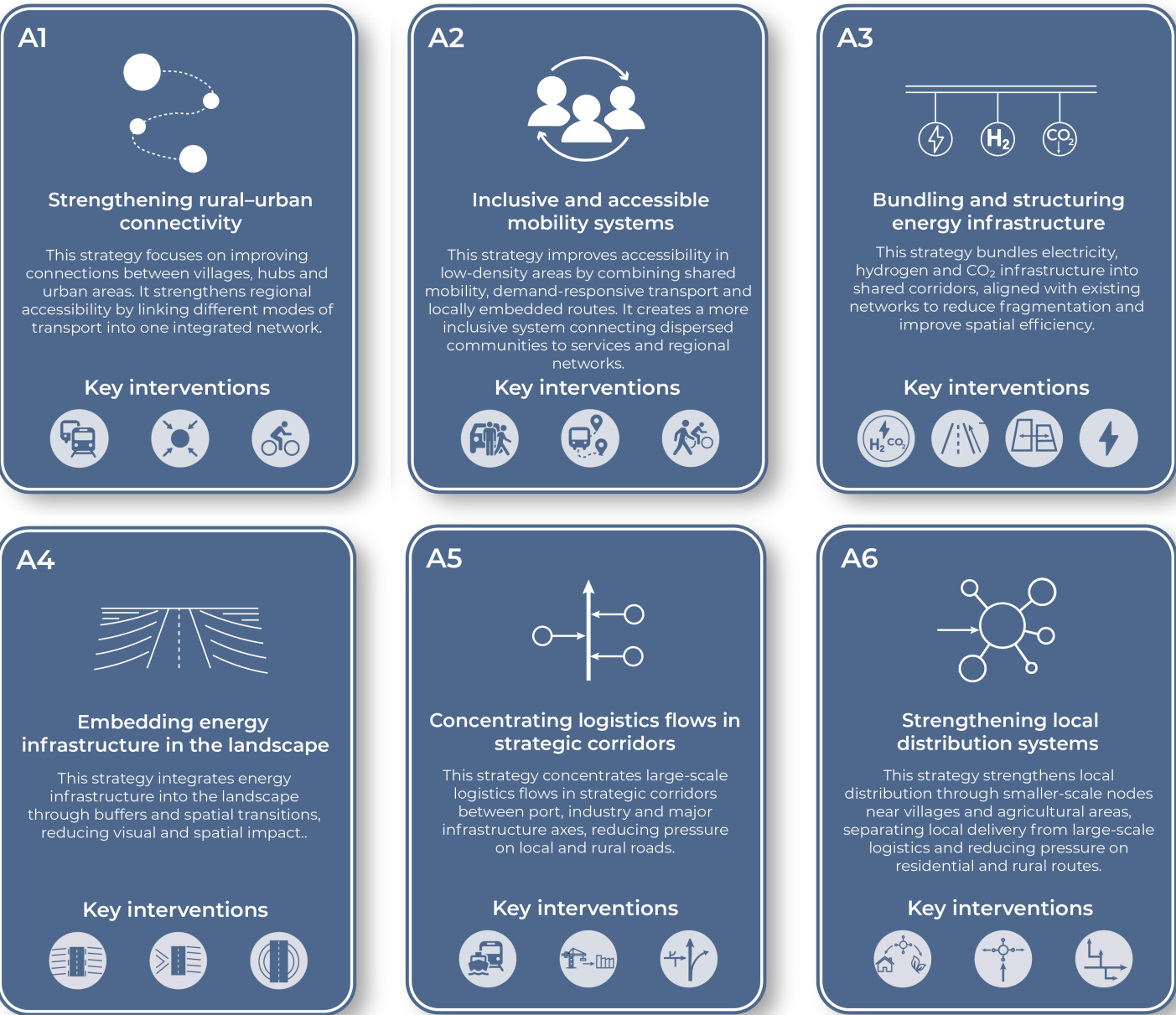
6.2.2 Strategies mobility of the future

The mobility strategy focuses on strengthening connectivity across scales, while supporting the transition towards a more sustainable and integrated system. Mobility is no longer only about movement, but becomes a key structuring element that connects energy systems, industrial processes and everyday life.

The strategies are divided into three sub-themes: community, energy and logistics. Each sub-theme addresses a different aspect of the mobility system, but together they form a coherent network.

For communities, the focus is on improving accessibility and strengthening rural-urban connections (A1-A2). Within the energy system, mobility supports the integration and spatial embedding of energy infrastructures (A3-A4). For logistics, the main focus is on concentrating flows and strengthening distribution systems to reduce pressure on local environments (A5-A6).

Each strategy is supported by key interventions, which translate these ambitions into concrete spatial and infrastructural actions



6.2.3 Strategies industrial transformation

The industrial transformation strategy focuses on the transition towards a low-carbon and circular industrial system. It builds on the existing industrial structure of Zeeland, while gradually transforming production processes and resource flows.

Three main strategies are defined: decarbonisation, circularity and integration. Decarbonisation aims to reduce emissions by transitioning towards renewable energy sources and hydrogen-based production. Circularity focuses on closing material loops and reusing waste streams, such as biomass and residual heat. Integration connects industrial systems with their surrounding landscape and communities, ensuring that industrial development contributes to spatial quality and regional coherence.

Together, these strategies transform industry from an isolated system into an integrated part of the regional energy landscape.

B1



Decarbonization
This strategy focuses on reducing industrial CO₂ emissions by transitioning from fossil fuels to renewable energy sources. Through electrification, offshore wind integration, and the development of hydrogen systems, industrial processes are restructured to operate within a low-carbon energy framework.

Key interventions


B2



Circularity
This strategy transforms linear industrial production into circular systems by replacing fossil-based inputs with renewable and secondary resources. Biomass from agriculture and recovered materials are reintegrated into production, enabling biobased industry and reducing waste across the system.

Key interventions


B3



Integration
This strategy connects industry with surrounding systems to create mutually beneficial exchanges of energy and materials. Residual heat, waste, and resources are redistributed between industry, settlements, and agriculture, forming an integrated territorial system.

Key interventions


6.2.4 Strategies energy communities

The strategy for energy communities focuses on organising the energy transition at a local level, linking it to larger regional systems. Different types of energy communities are identified, each with their own spatial characteristics and energy potential.

A specific strategy is assigned to each type of energy community, reflecting its role within the overall system. Although several community types are explored, the focus is on C5 (semi-rural residential areas), C7 (mixed-use areas on the urban fringe) and C9 (urban centres), as these are the most representative of the conditions within the region.

These clusters allow for decentralised energy production and remain connected to shared infrastructure. Organising energy systems at the community level strengthens local ownership, participation and spatial integration.

Each community strategy is supported by focused interventions that respond to local conditions and contribute to the regional energy network.

C1



Dispersed rural residential
Fully decentralised self-consumption
Low density countryside creates difficulty in forming meaningful energy community. Change starts at the household level, with the municipality acting as an enabler rather than driver.

Key interventions


C3



Sparse rural residential
Conditional local energy production and export by 2040
Low density farmsteads and large parcels allow households to become active in the energy transition by forming agri-PV agreements, however, there remains low community potential.

Key interventions


C6



Uninhabited coastal zone
Conditional energy export from 2035
High-potential for wind and solar energy production can support demand in adjacent regions. Unclear land tenure and environmental obligations require careful coordination by responsible parties.

Key interventions


C8



Semi-rural, recreational zone
Seasonally driven independence
Coastal positioning creates high solar and wind potential with low base energy demand and increased seasonal surge. Local consumption and partial export can create a unique energy producing role.

Key interventions


C5



Semi-rural residential
Local energy independence by 2050
Semi-adjacency to higher density areas creating potential for future development and increasing demand, which requires infrastructure to be introduced earlier.

Key interventions


C7



Urban fringe mixed-use
Anchor-led independence by 2050
The presence of several large commercial energy users creates potential for a resident-driven bilateral PPP. Fringe spatial configurations maintain capacity for multiple forms of energy generation.

Key interventions


C9



Urban core
Connected to decentralised periphery by 2100
Exponentially larger demand and low energy generation potential results in a need for reducing demand first, and connecting to decentralised producing regions in a phased manner once these are operational.

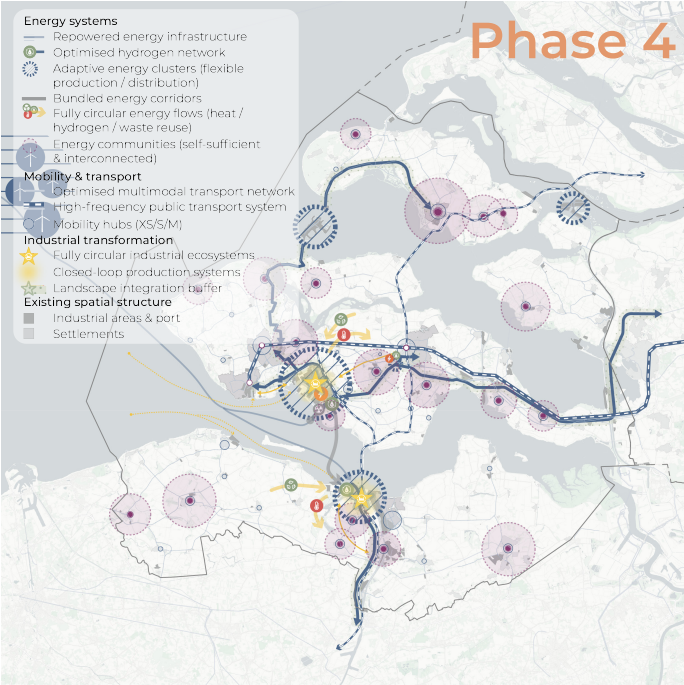
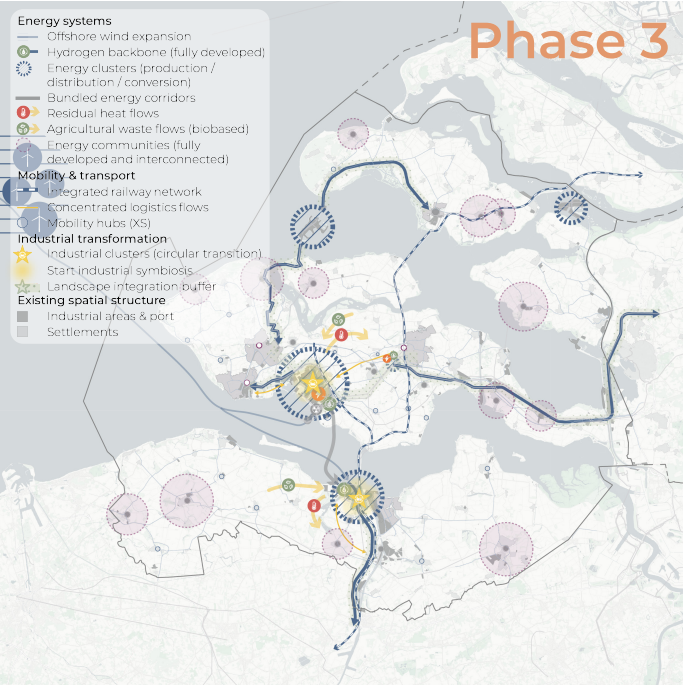
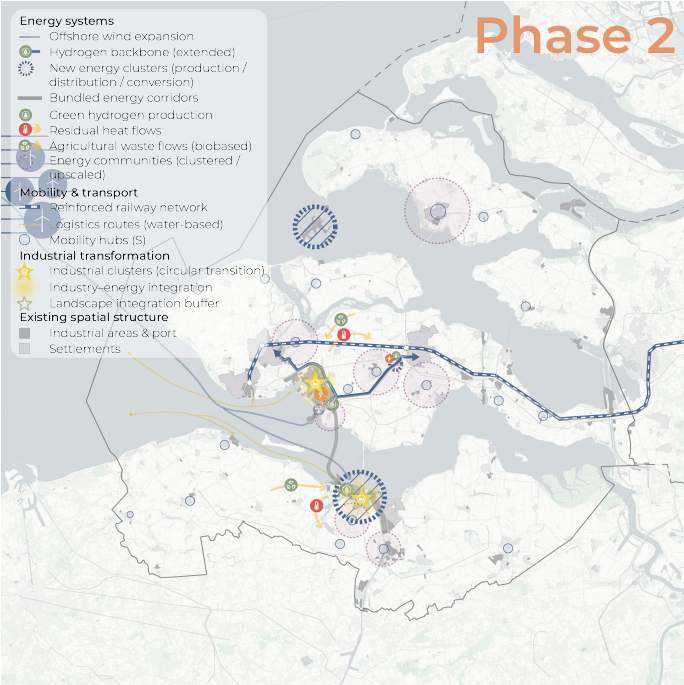
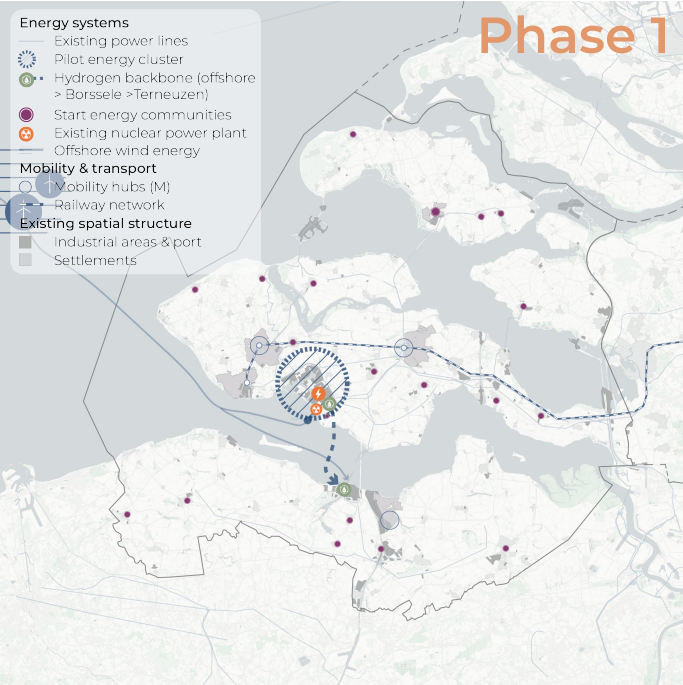
Key interventions


6.3 Phasing strategy

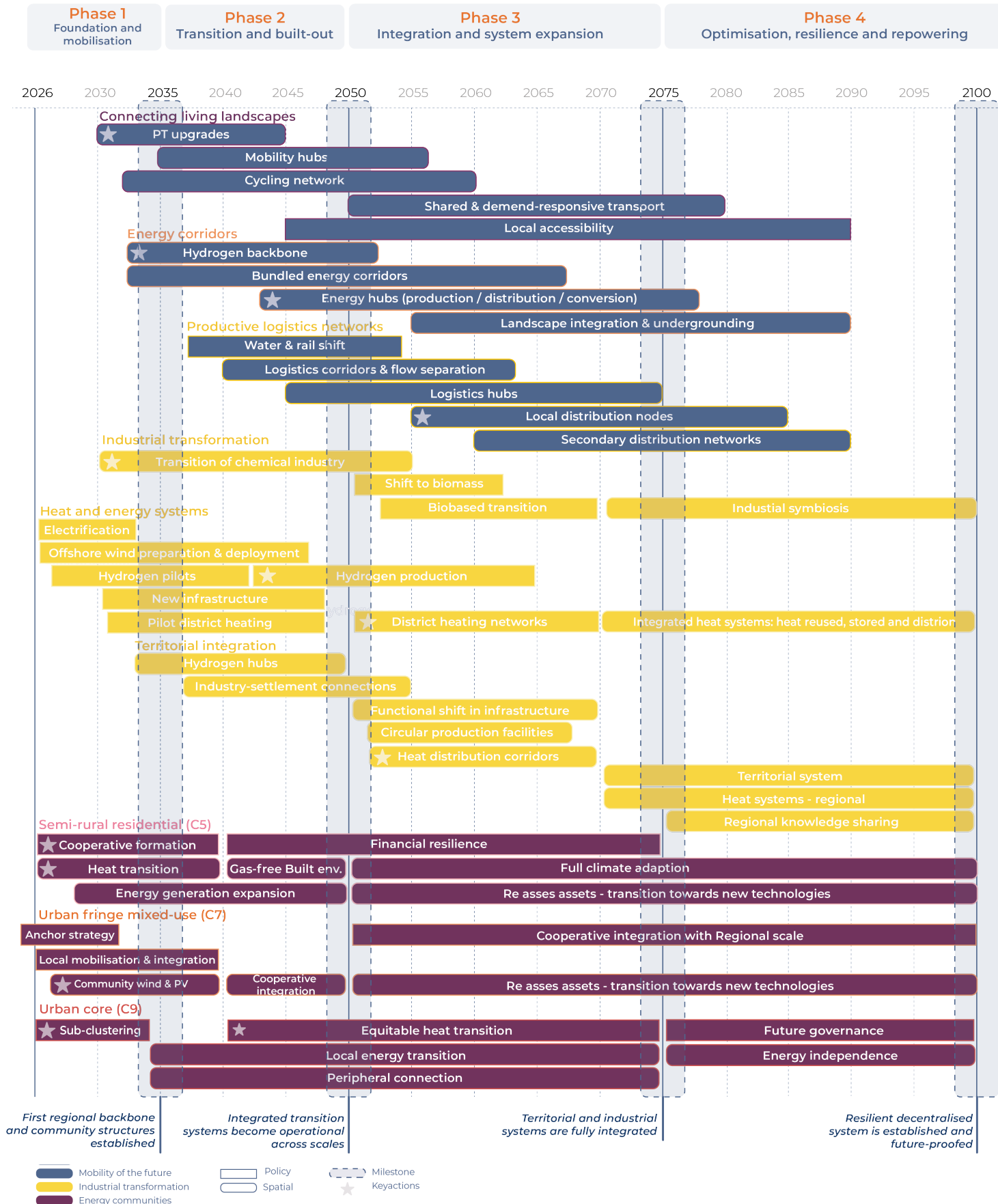
6.3.1 Spatial phasing

The transformation of Zeeland’s energy landscape is structured in four phases, moving from initial mobilisation to a fully integrated and adaptive system. Each phase represents a shift in scale and complexity, gradually building from local pilots and backbone infrastructures towards a decentralised yet interconnected regional network. In Phase 1, the foundations are established through initial energy corridors, pilot

clusters and local communities. Phase 2 focuses on expansion, where networks are extended and energy, mobility and industrial systems begin to interact. In Phase 3, these systems become fully integrated, forming a coherent regional structure. Finally, Phase 4 emphasises optimisation, resilience and repowering, where the system evolves into a flexible, circular and future-proof energy landscape.



6.3.2 Timeline



6.3.3 Stakeholder transformation towards 2100

The stakeholder model illustrates how the system is evolving from a fragmented, sector-based structure towards a more spatially integrated and interdependent system. The diagram does not introduce an entirely new group of actors, but shows how the power and interests of existing stakeholders shift over time, as indicated by the movement of stakeholders.

A crucial transformation is visible in the role of actors involved with land. Farmers and agricultural stakeholders are growing in importance and influence, as energy production, infrastructure and circular material flows increasingly take place within the landscape they manage. This shift reflects the growing importance of land in the transition and its direct link to decision-making authority.

Industrial users are also shifting towards a more central position within the system. As their power and importance grow, they are moving from being passive energy consumers to active participants in energy production, hydrogen networks and circular processes.

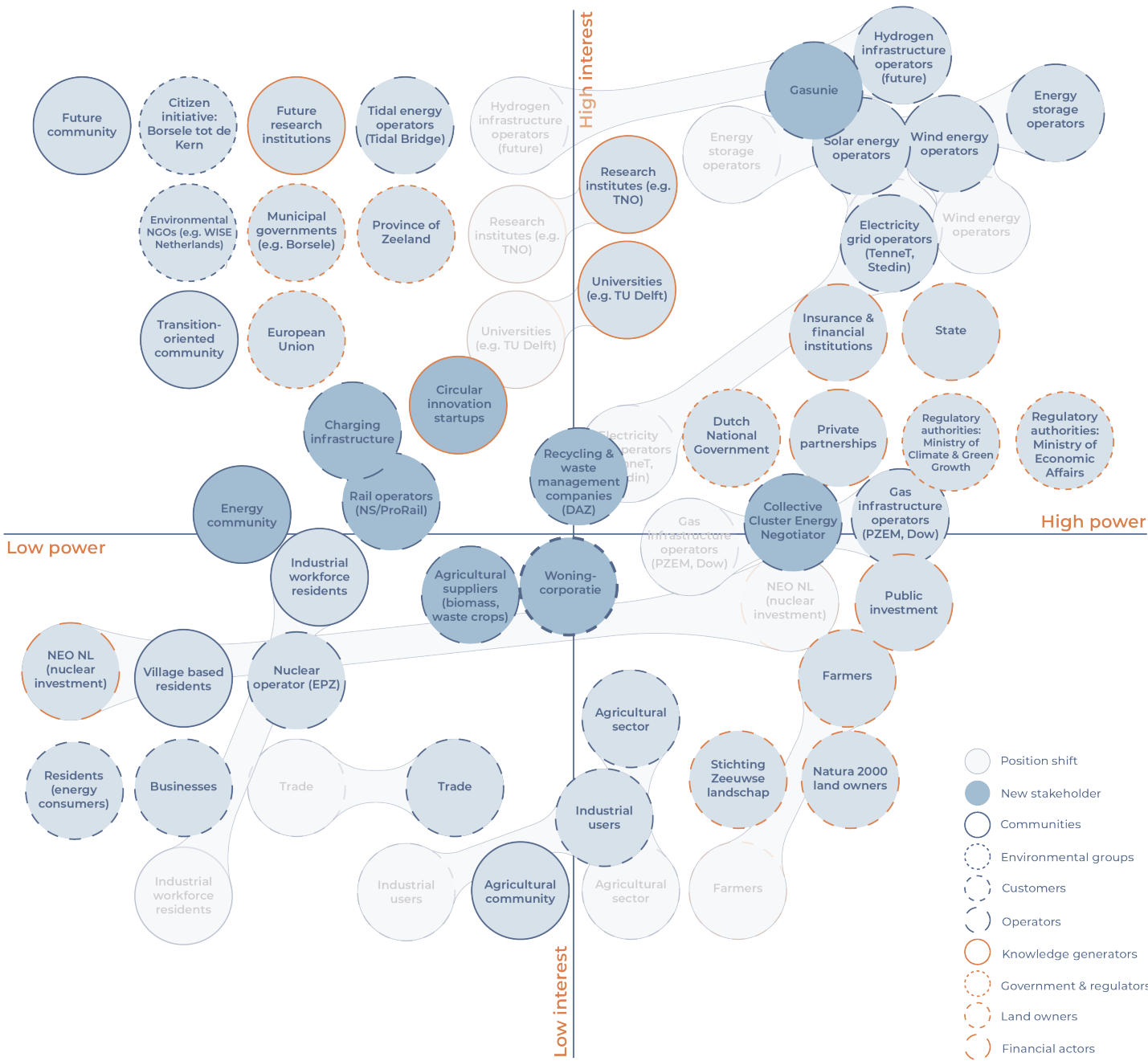
At the same time, a new layer of intermediary stakeholders is forming between the sectors. Agricultural suppliers, recycling and waste processing companies, and start-ups in the field of circular innovation act as links between industry, energy and raw material flows.

The diagram does not explicitly map out the connections, but illustrates a growing interdependence between stakeholders, with actors from different sectors moving closer together and new intermediary stakeholders appearing. This points to a shift from isolated systems towards shared infrastructure and overlapping roles.

Local actors, including residents and energy communities, are also shifting towards positions of influence, reflecting their growing involvement in energy production and local decision-making. Although their individual power remains relatively limited, their collective role is becoming increasingly important.

Meanwhile, infrastructure players such as network operators, hydrogen infrastructure managers and Gasunie are strengthening their position at the core of the system, remaining in or moving towards positions of high power and interest. Governance actors are still powerful, but operate within a more collaborative and multi-layered framework.

Overall, the diagram illustrates a transition towards a spatially integrated and territorially based system, in which the roles of stakeholders continue to overlap and multiple sectors become mutually dependent due to shared infrastructure and spatial conditions.



6.4 Theme A - Mobility of the future

6.4.1 Strategy regional scale

The goal | Create an integrated regional mobility system that connects communities, supports sustainable energy and logistics flows, and improve spatial quality across Zeeland.

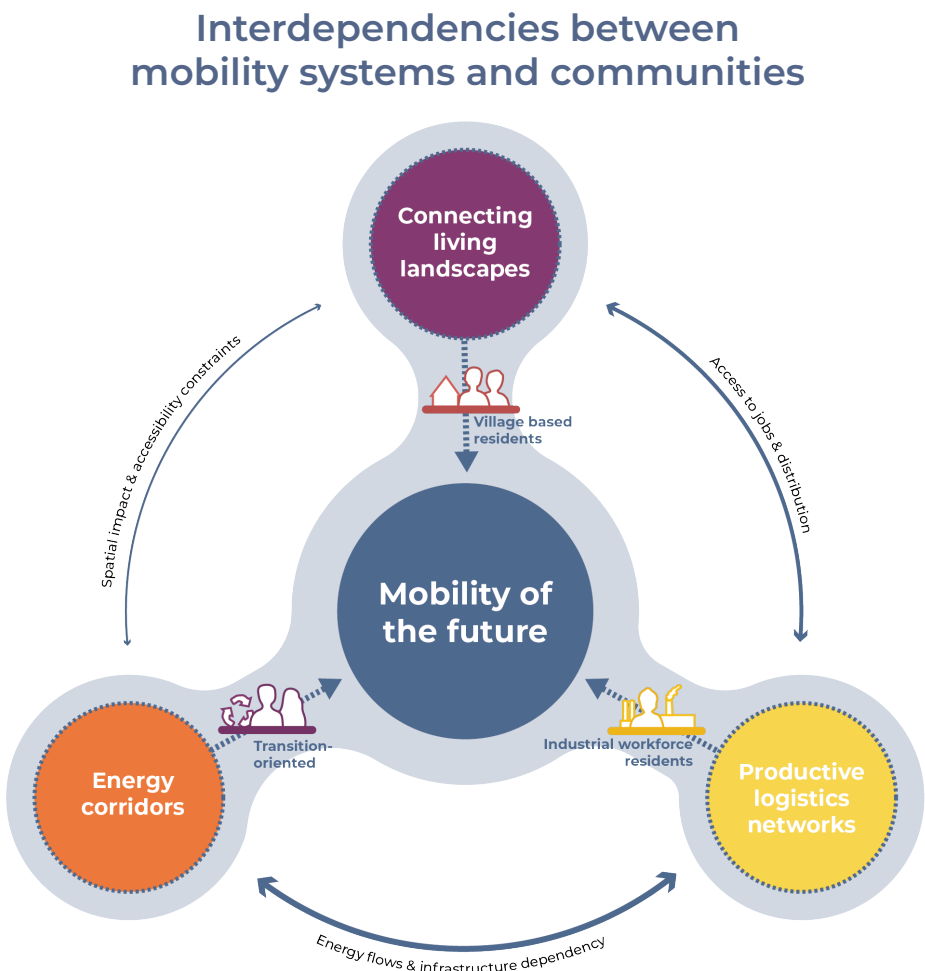
The mobility of the future is built around three interconnected systems: connecting living landscapes, energy corridors and productive logistics networks. Together, these systems form an integrated regional mobility framework that supports both energy flows and economic activity, and accessibility across Zeeland.

Communities play a central role within this system. Rather than being separated from the infrastructure, they are directly connected to mobility networks, improving accessibility to jobs, services, and regional connections. At the same time, allowing them to influence and

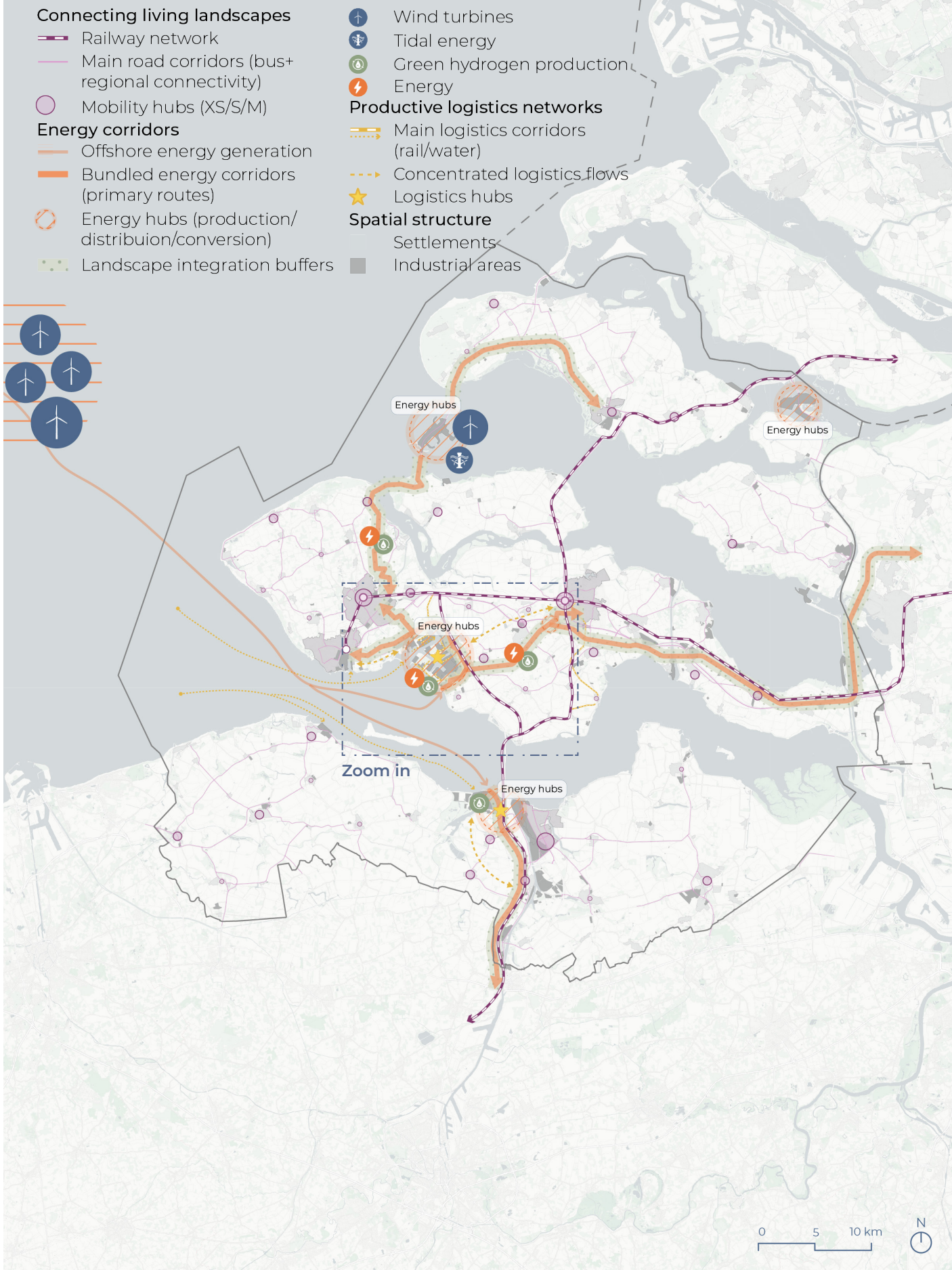
be influenced by energy production, logistics flows and spatial transformations. This creates a constant interaction between mobility systems and the everyday living environment.

The strategic map translates this framework into spatial interventions across Zeeland. It shows how energy corridors are aligned with existing infrastructure, how logistics networks are concentrated and strengthened, and how landscape structures improve both spatial quality and accessibility. Key nodes such as energy hubs and logistics hubs act as connectors between these systems.

Together, these interventions support the overall goal of creating an integrated regional mobility system that connects communities, supports sustainable energy and logistics flows, and improves spatial quality across Zeeland.



Mobility of the future (2100)



6.4.2 Timeline

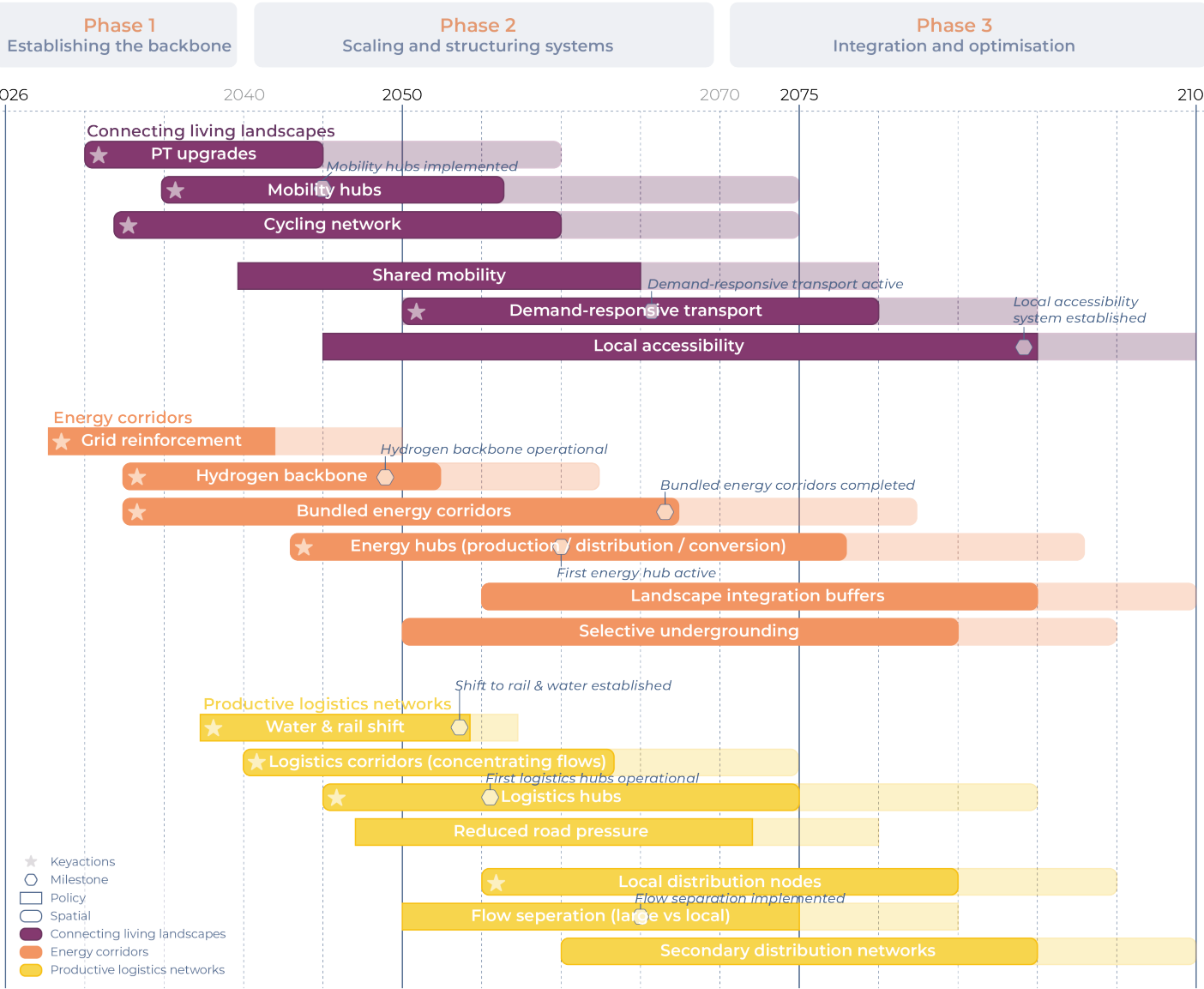
The timeline shows how the mobility system develops towards 2100 through three interconnected systems: connecting living landscapes, energy corridors, and productive logistics networks.

In the first phase, the backbone is established. Key infrastructure, such as the hydrogen network, the main logistics corridors and the first mobility hubs, are built.

In the second phase, the system expands and becomes more structured. Energy hubs are developed, logistics flows are concentrated, and accessibility improves as networks are connected to each other.

In the final phase, the focus shifts to integration and optimisation. Flows are organised more efficiently, landscape integration becomes visible, and the system functions as a whole.

Key actions highlight the most important interventions, with milestones indicating when these begin to function and shape the system.



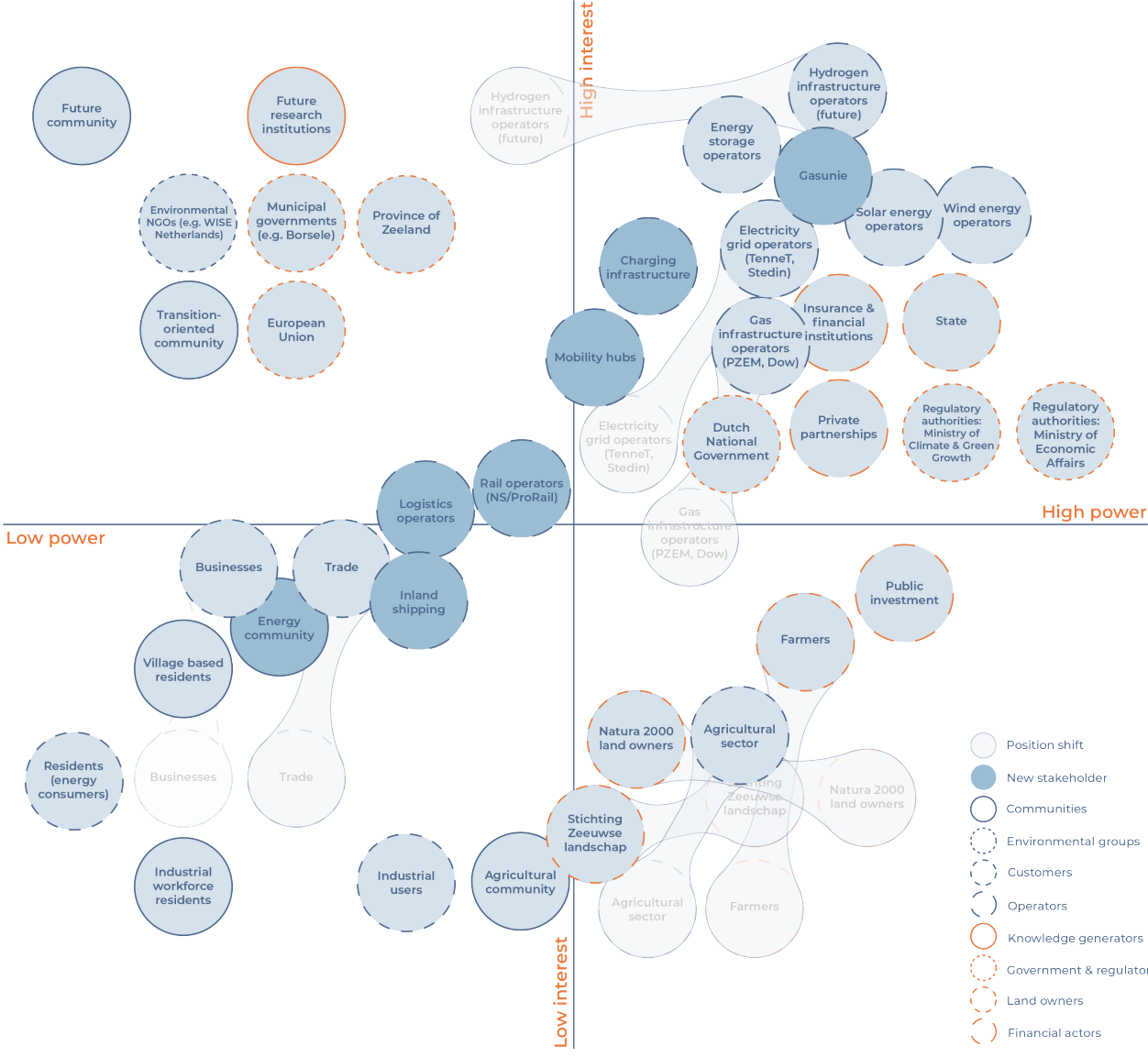
6.4.3 Stakeholder arena

The stakeholder arena focuses on the actors that are most relevant for the mobility system. It is based on the overall stakeholder map, but filtered to show only those directly involved in energy corridors, logistics and landscape/spatial integration. In addition, new stakeholders have been added to represent mobility and transport actors that were missing before.

The diagram also shows how the position of stakeholders changes over time. Actors related to infrastructure and logistics move towards higher power and higher interest, as they become central to the system. At the same

time, stakeholders in the landscape, such as farmers and landowners, are becoming more important because they are directly affected by the spatial implications of the corridors.

This highlights a shift in the system. Mobility is no longer only about transport, but becomes a crucial factor linking energy, economy and landscape. As a result, the balance between stakeholders changes and new connections are forming between actors.



6.4.4 System breakdown

 Connecting living landscapes

The (sub)goal | Ensuring accessible and inclusive mobility between villages, transport hubs and urban areas.

The theme *Connecting living landscapes* focuses on improving accessibility between villages, transport hubs and urban areas, while strengthening the relationship between mobility and the landscape. This is reflected in the subgoal of creating an inclusive and well-connected mobility system.

Two main strategies guide this approach. The first strategy focuses on strengthening rural-urban connectivity through improved public transport, the development of mobility hubs at different scales and a connected cycling network that links villages to mobility hubs. The second strategy focuses on inclusive and accessible mobility systems, introducing shared mobility, demand-responsive transport and improving local accessibility along existing landscape structures such as dikes and historical routes.

Over time, these strategies are implemented in phases. The first phase focuses on reconnecting settlements and establishing basic networks. In the second phase, the system expands and becomes more accessible through the introduction of hubs and shared mobility. In the final phase, the system becomes adaptive and demand-driven, ensuring long-term accessibility and integration within the landscape.



A1



Strengthening rural-urban connectivity

This strategy focuses on improving connections between villages, hubs and urban areas. It strengthens regional accessibility by linking different modes of transport into one integrated network.

Key interventions



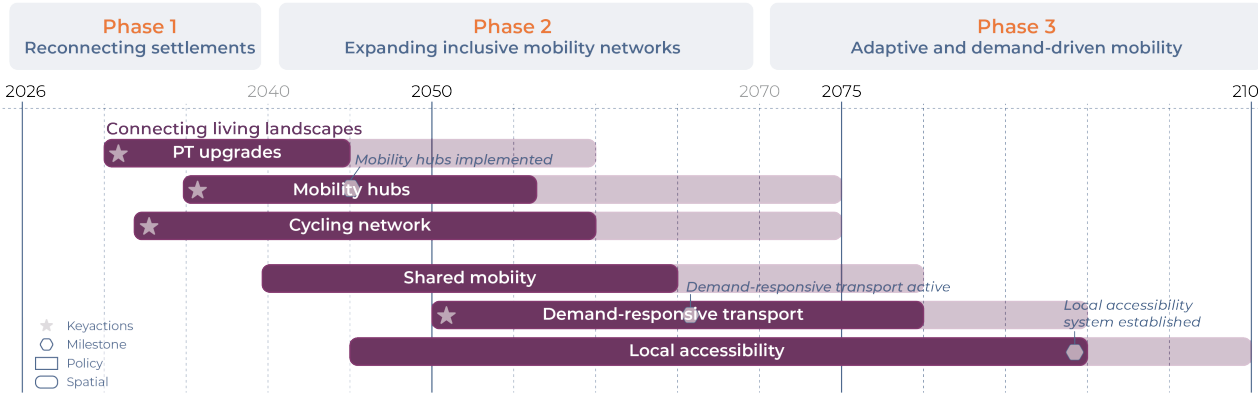
A2



Inclusive and accessible mobility systems

This strategy improves accessibility in low-density areas by combining shared mobility, demand-responsive transport and locally embedded routes. It creates a more inclusive system connecting dispersed communities to services and regional networks.

Key interventions





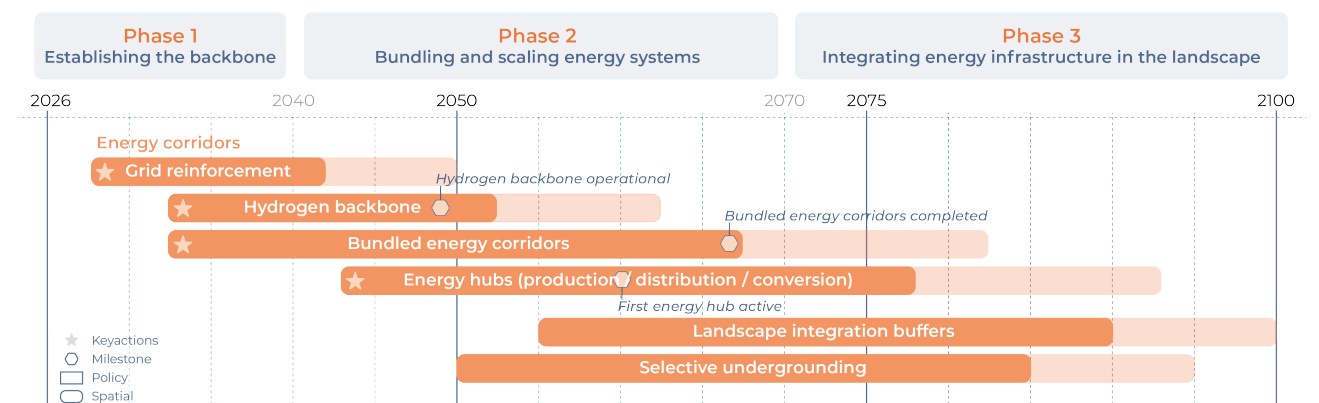
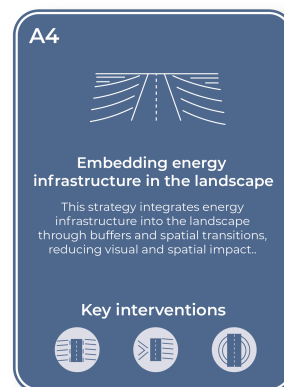
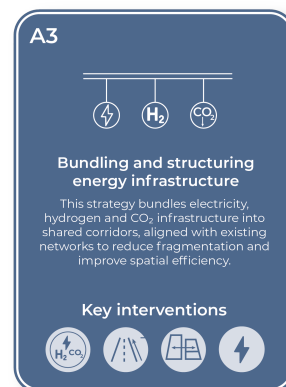
Energy corridors

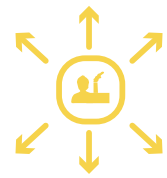
The (sub)goal | Designing energy infrastructure efficiently whilst limiting its spatial and visual impact to a minimum.

The theme *Energy corridors* focuses on organising energy infrastructure in a more efficient and spatially integrated way. The subgoal is to support the energy transition while limiting spatial and visual impact.

Two strategies guide this approach. The first focuses on bundling and structuring energy infrastructure. Electricity, hydrogen and CO₂ are combined in shared corridors and aligned with existing infrastructure. Energy hubs are developed for production, distribution and conversion. The second strategy focuses on embedding energy infrastructure in the landscape. This is done through landscape integration buffers, corridors as spatial transitions, and reducing visual impact.

Over time, these strategies are implemented in phases. The first phase establishes the backbone of the system. The second phase bundles and scales the corridors and develops energy hubs. In the final phase, the system is integrated into the landscape and spatial fragmentation is reduced.





Productive logistics networks

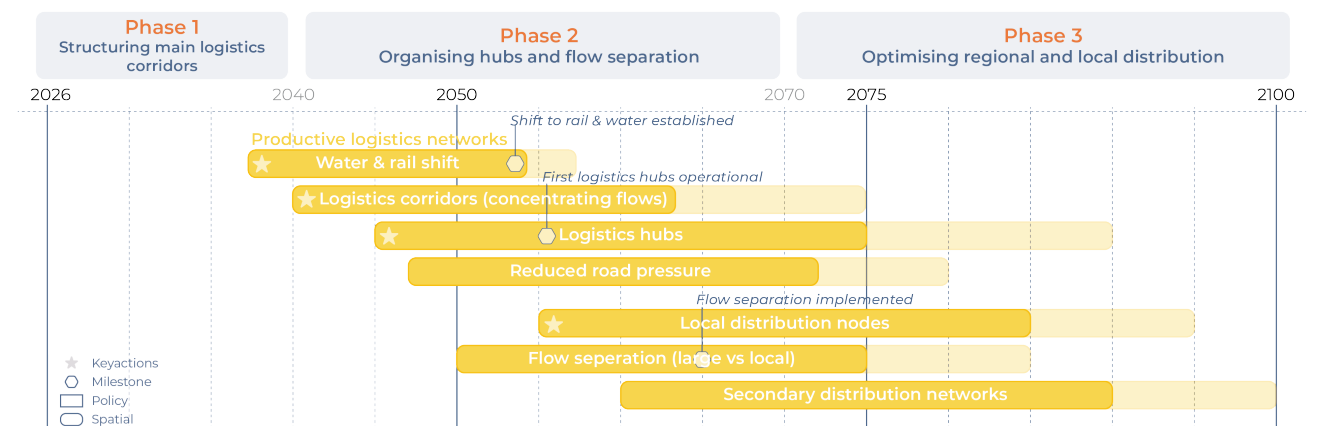
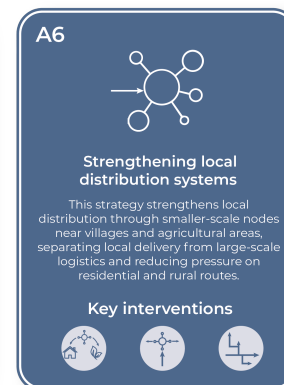
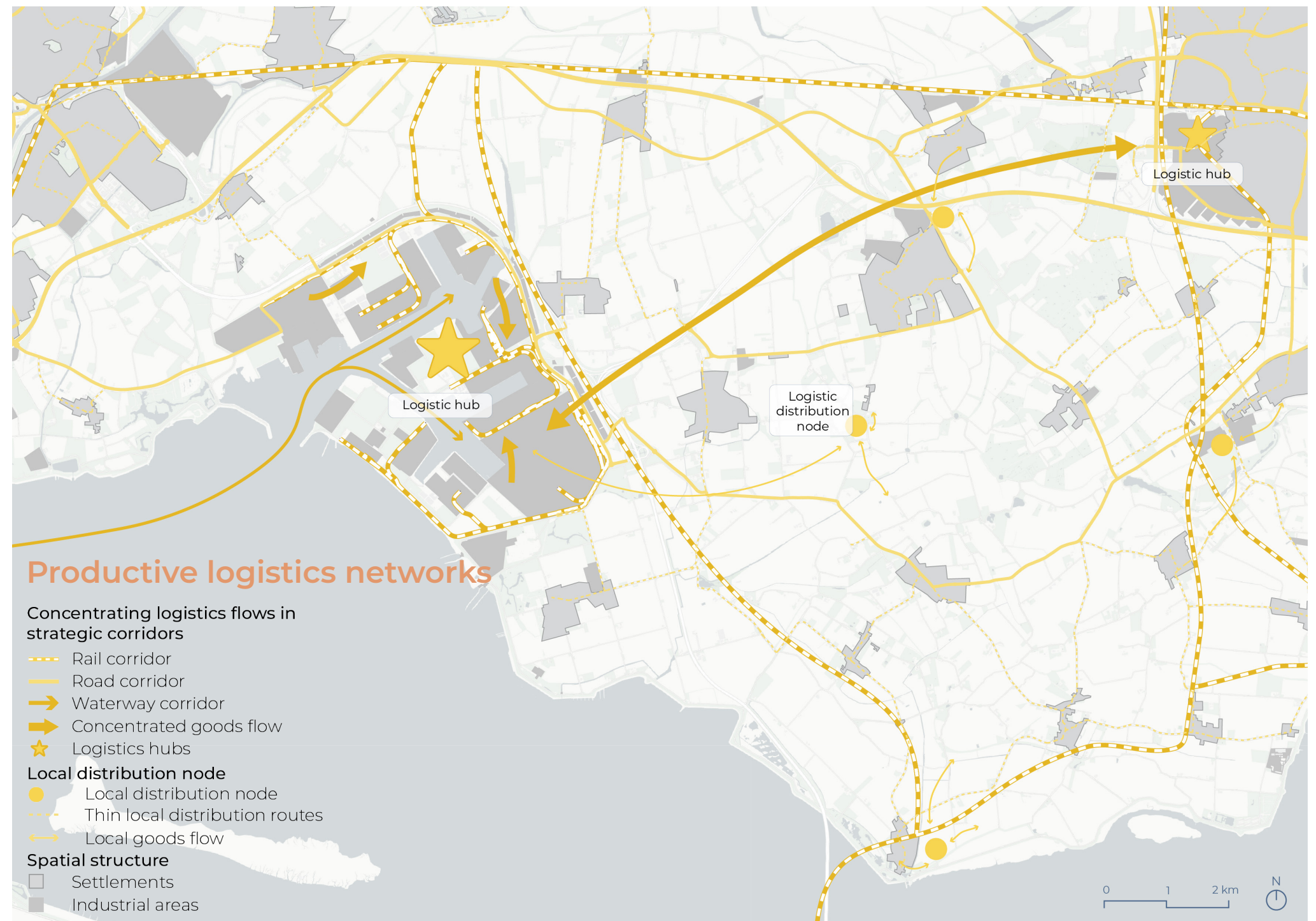
The (sub)goal | Organising efficient and sustainable goods flows in a structure that reduces its impact on the local area.

The theme *Productive logistics networks* focuses on organising goods flows in a more efficient and structured way. The subgoal is to support economic activity while reducing the impact of logistics on local and rural areas.

Two strategies guide this approach. The first focuses on concentrating logistics flows in strategic corridors. Large-scale transport shifts to water and rail. Goods move between the port, industrial areas and main infrastructure. Logistics hubs are developed at key nodes such as ports and intersections. This reduces heavy traffic on local roads. For example, goods from the port can move directly by rail or water instead of passing through villages.

The second strategy focuses on strengthening local distribution systems. Local distribution nodes are placed near villages and agricultural areas. Large-scale flows are separated from local transport. Secondary roads are used for smaller deliveries. This reduces pressure on residential and rural roads and improves safety and liveability.

Over time, these strategies are implemented in phases. The first phase structures the main corridors and shifts transport to rail and water. The second phase develops hubs and separates flows. The final phase optimises the system and creates a clear distinction between regional and local distribution.

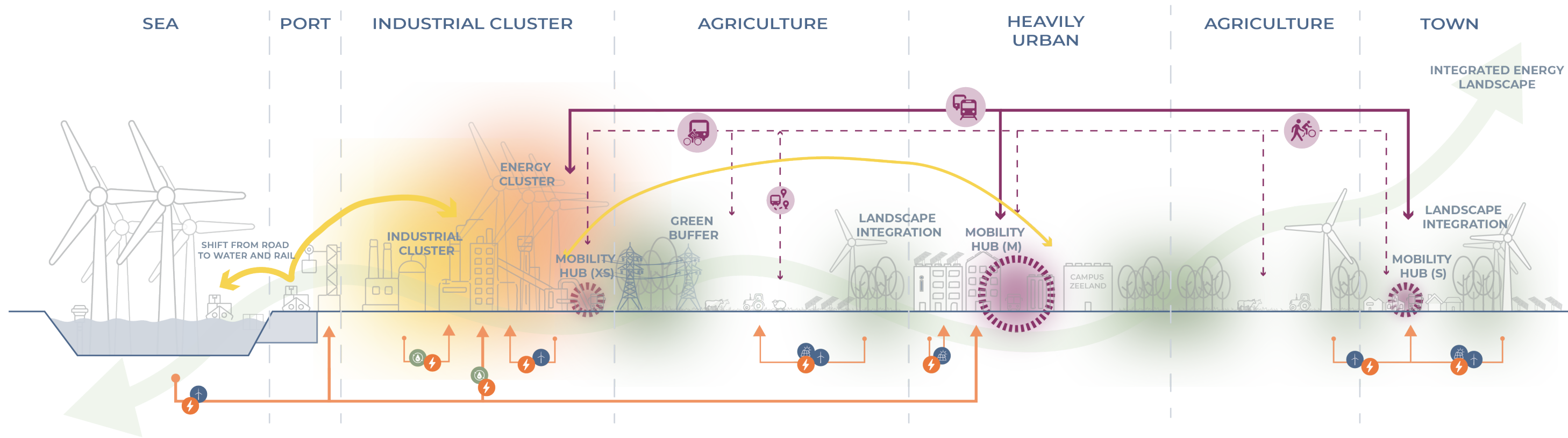


6.5.5 Systemic section

The mobility of the future is structured as an integrated system of three components that work together: connecting living landscapes, energy corridors and productive logistics networks. Instead of operating as separate systems, they strengthen each other spatially and functionally.

The focus of connecting living landscapes is on everyday accessibility, with the goal of linking villages, hubs, and urban areas through inclusive and multimodal mobility networks. Energy corridors organise the transport and distribution of energy by bundling infrastructure and aligning it with existing spatial frameworks, resulting in reduced fragmentation and spatial impact. Productive logistics networks organise the flow of goods more efficiently by shifting transport to rail and waterways, concentrating flows in strategic corridors and strengthening local distribution systems.

Together, these systems create a framework for mobility at different scales, aligning local accessibility, regional connectivity, and national and international flows. This ensures that mobility strengthens spatial quality, reduces pressure on local environments and connects communities to energy and economic systems, as well as supporting movement.



6.5.6 Principles

Six design principles have been developed to translate this integrated system into spatial interventions. These principles bring the strategy to life by showing how mobility, energy and logistics systems should be organised and embedded in the landscape.

They range from strengthening rural-urban connectivity and ensuring inclusive mobility systems to bundling and structuring energy infrastructure and embedding it within the landscape, concentrating logistics flows in strategic corridors and improving local distribution networks. Together, these principles form a framework that links spatial design decisions to the overarching goals of accessibility, efficiency, and spatial quality.

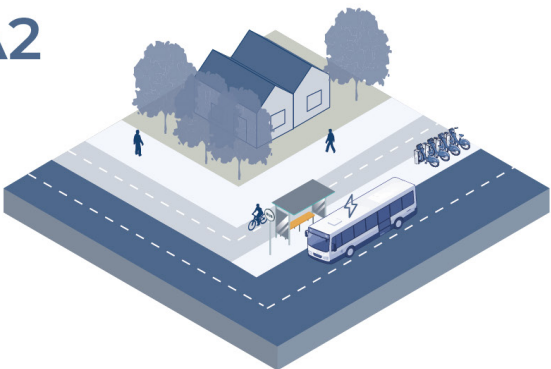
By applying these principles at different scales and in different phases, the strategy shifts from a conceptual system to concrete spatial interventions, ensuring consistency between vision, system functionality, and implementation.

A1



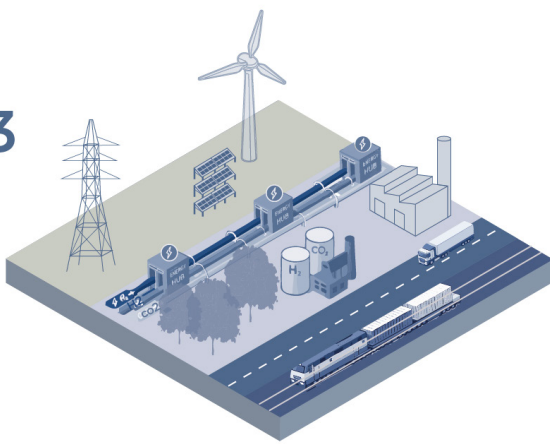
Strengthening rural-urban connectivity

A2



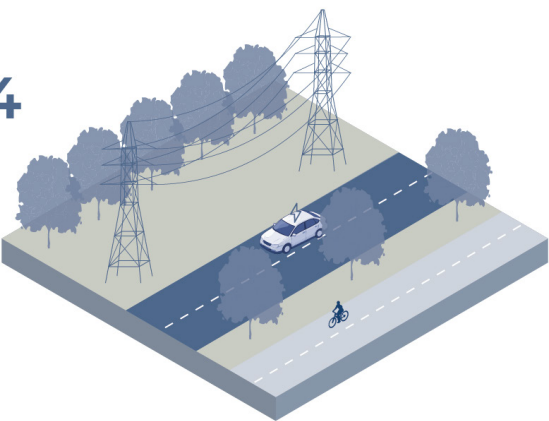
Inclusive and accessible mobility systems

A3



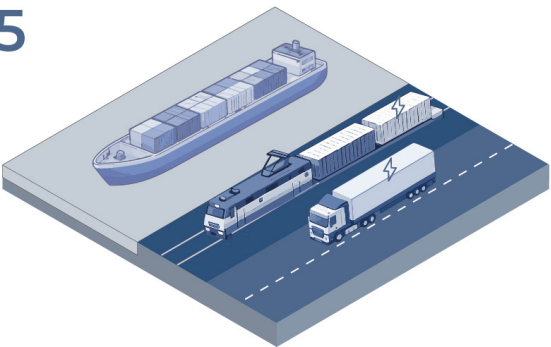
Bundling and structuring energy infrastructure

A4



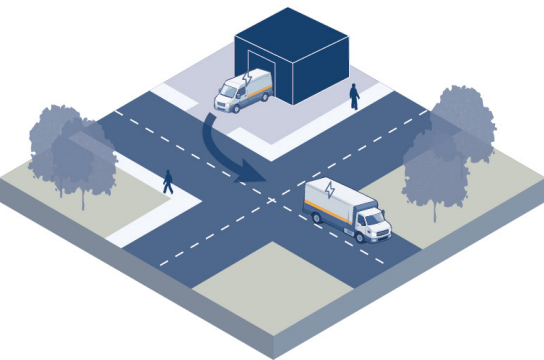
Embedding energy infrastructure in the landscape

A5



Concentrating logistics flows in strategic corridors

A6



Strengthening local distribution systems

6.5 Theme B - Industrial transformation

6.5.1 Strategy regional scale

The goal | The goal of the strategy of industry is to establish industrial symbiosis, where energy, materials and resources continuously circulate between industry and between industry agriculture and communities. Industrial symbiosis will transform isolated industrial zones into interconnected clusters, that support sustainability, economic resilience and spatial justice.

Zeeland's industry is highly dependent on fossil-based chemical production, making it energy-intensive and environmentally impactful. In order to achieve the European Union's Goals and the Smart Delta Resources goals, it is necessary to go into a transformation. This transformation includes the revision of chemical industry, into circular industry clusters that interact with other components of Zeeland in order to achieve CO2 neutrality.

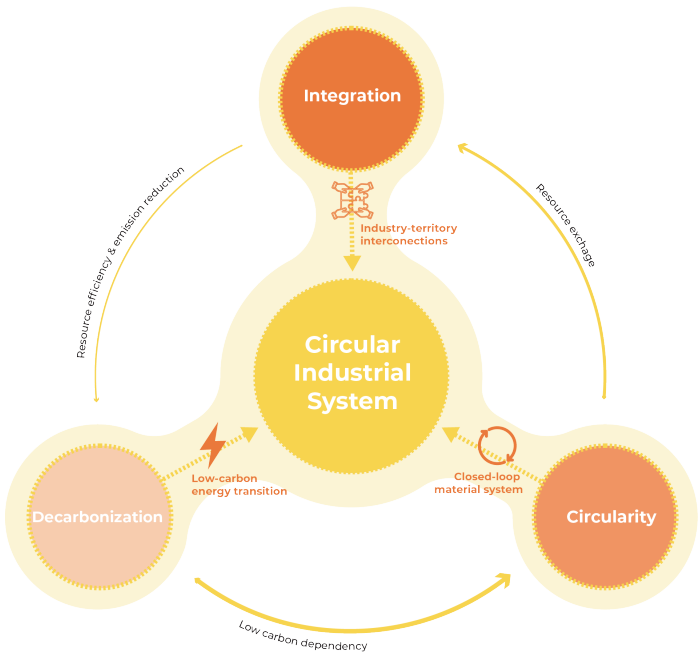
At the regional scale, the strategy restructures the industry of Zeeland into two circular and interconnected clusters. It involves the transformation of two industrial ports of

Vlissingen and Terneuzen, in which are the concentrated chemical industries. The ports will recreate their industrial identity as they will be gradually transformed into multifunctional industries, where their energy will come mostly from renewable energy, green hydrogen production and biobased processes. This transformation follows a shift from linear production towards closed-loop systems, where resources are continuously reused and emissions are minimized (Konon, n.d.).

The strategy builds on Zeeland's existing industrial spatial framework, reconfiguring it into systems of exchange between industry, agriculture and energy communities. Agricultural landscapes and settlements become active suppliers to industrial production, by their waste, while industrial clusters return residual heat back to cities and villages.

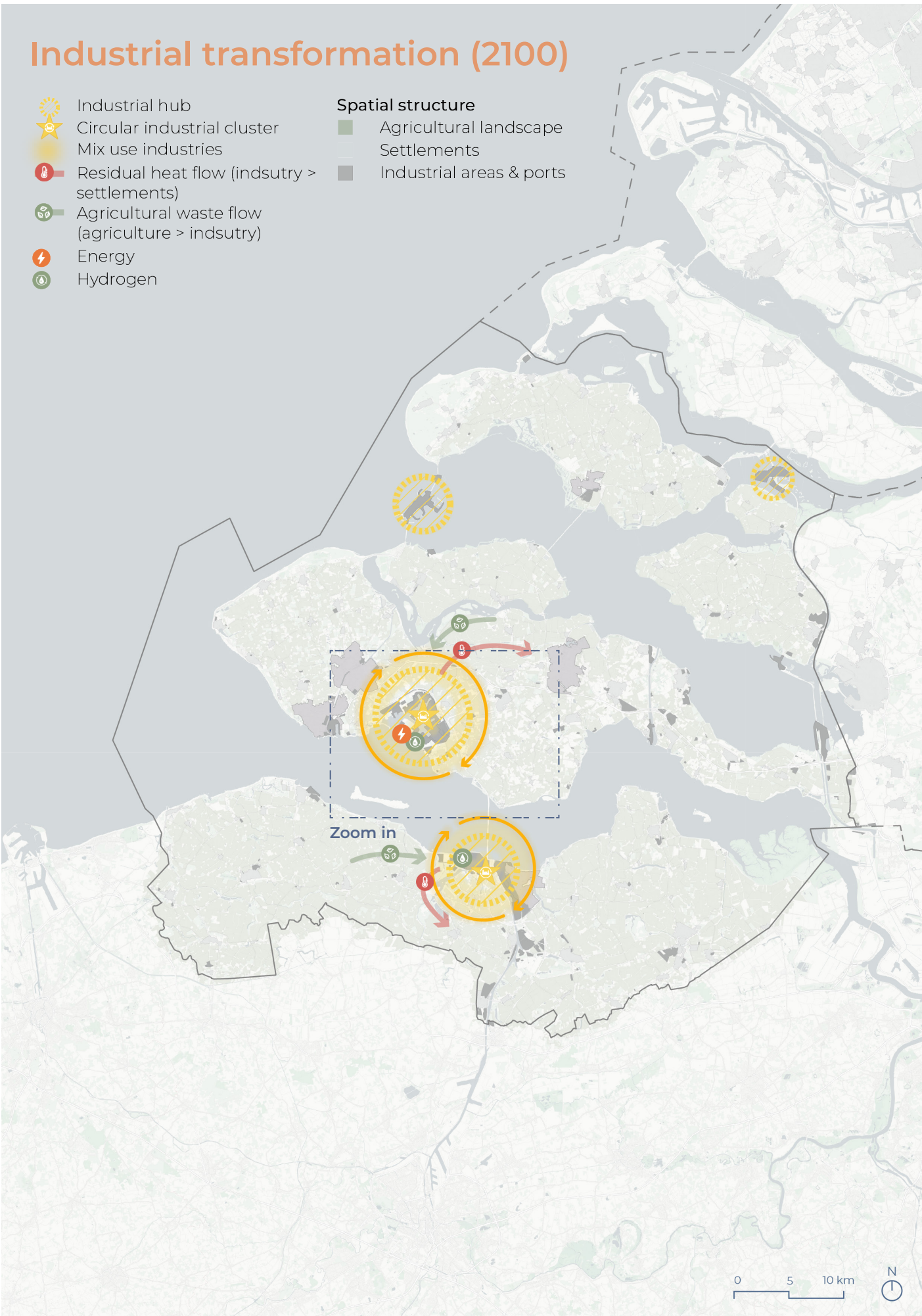
Ultimately, the regional strategy establishes a framework for territorial circularity, where Zeeland operates as an integrated system in which production, consumption, and reuse are spatially and socially connected.

Interdependencies between circular industrial system



Industrial transformation (2100)

- Industrial hub
 - Circular industrial cluster
 - Mix use industries
 - Residual heat flow (industry > settlements)
 - Agricultural waste flow (agriculture > industry)
 - Energy
 - Hydrogen
- Spatial structure**
- Agricultural landscape
 - Settlements
 - Industrial areas & ports

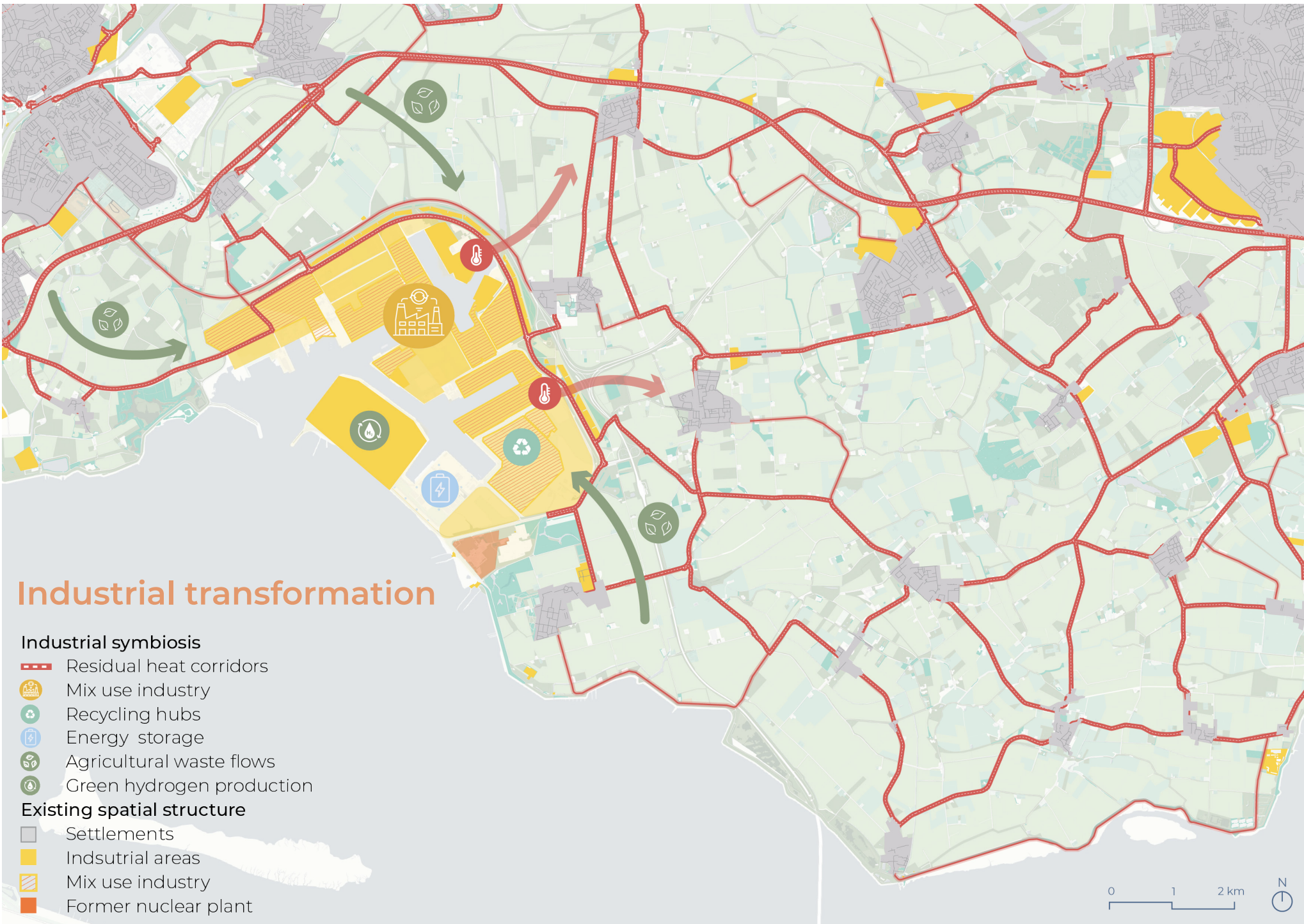


6.5.2 Strategy local scale

At the local scale, industry operated as a system of symbiotic relationship between industry, agriculture and communities. The industrial zones introduce new functions such as green hydrogen production, energy storage and the chemical industry is transformed into biobased manufacturing, while the existing infrastructure is maintained and reused.

Different flows interact within the cluster. Agricultural inputs such as biomass and biobased crop waste are used as fuel and materials for industry. Moreover, settlements give out their organic waste, while receiving residual heat, supporting district heating systems. This creates a closed loop system, in which waste from one sector becomes a valuable resource for another, reducing waste and strengthening interdependencies.

This spatial reconfiguration transforms industry into more than a production site, it evolves them to multifunctional landscapes that support social benefits and enhance the local economy.



B1

Decarbonization

This strategy focuses on reducing industrial CO₂ emissions by transitioning from fossil fuels to renewable energy sources. Through electrification, offshore wind integration, and the development of hydrogen systems, industrial processes are restructured to operate within a low-carbon energy framework.

Key interventions

Icons: Factory with lightning bolt, Wind turbine, Hydrogen tank

B2

Circularity

This strategy transforms linear industrial production into circular systems by replacing fossil-based inputs with renewable and secondary resources. Biomass from agriculture and recovered materials are reintegrated into production, enabling biobased industry and reducing waste across the system.

Key interventions

Icons: Factory with circular arrows, Leaf, Recycle symbol

B3

Integration

This strategy connects industry with surrounding systems to create mutually beneficial exchanges of energy and materials. Residual heat, waste, and resources are redistributed between industry, settlements, and agriculture, forming an integrated territorial system.

Key interventions

Icons: Factory with house, Leaf, Recycle symbol

6.5.3 Timeline

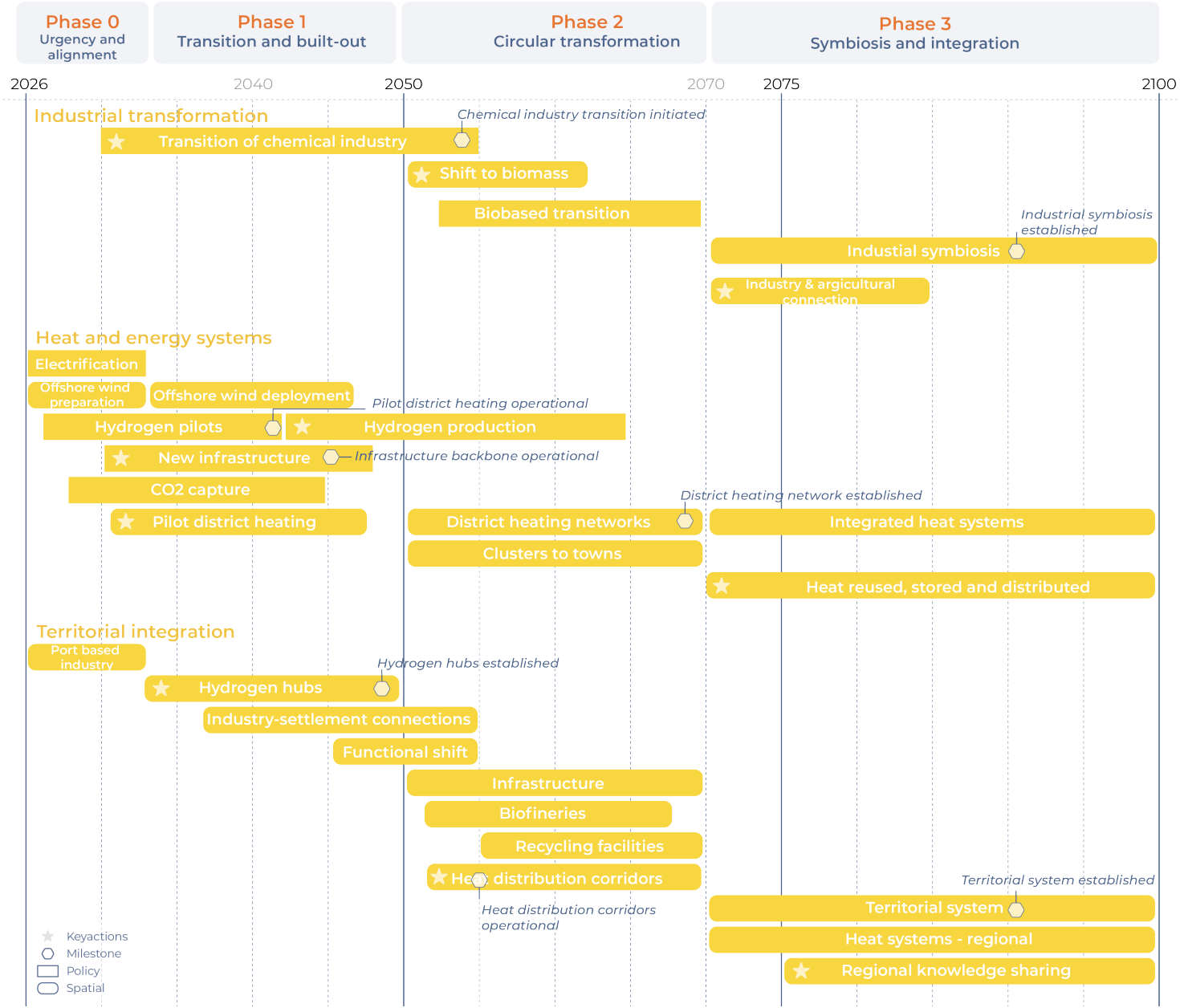
The timeline illustrates the transition of the industrial system from a linear, fossil-based approach to a circular and interconnected network.

Phase 1 focuses on starting the transition with electrification, hydrogen pilots and the first infrastructure developments. The foundation for change is laid by early heat systems and CO₂ storage.

Phase 2 shifts the system towards circular production. Biomass and bio-based processes

are introduced, and district heating networks and connections between industry and settlements are expanded. Material and energy flows become increasingly integrated.

In Phase 3, industrial symbiosis is established. Residual heat is reused and distributed, and industry becomes part of a broader territorial system that contributes to regional resilience and circularity.



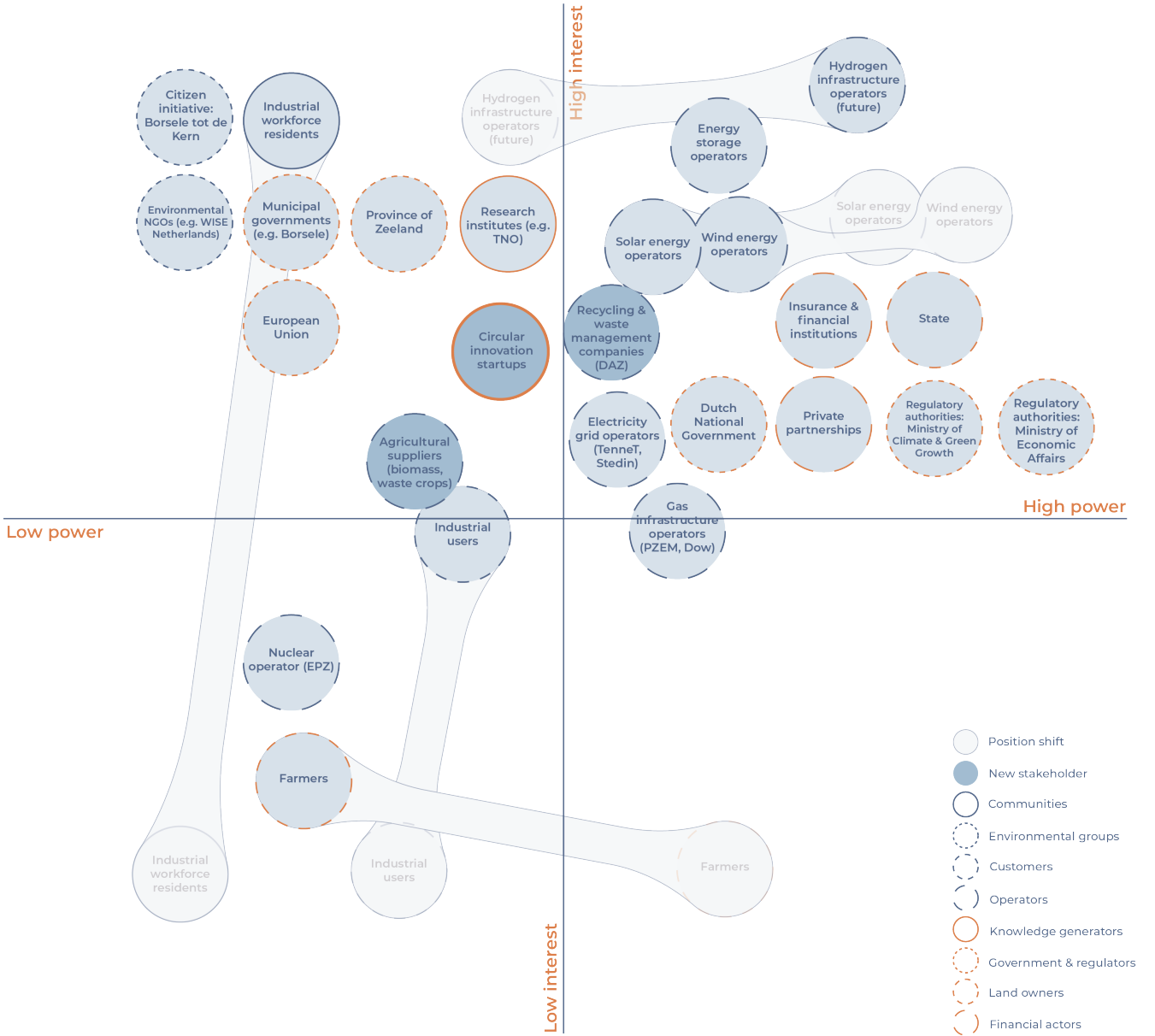
6.5.4 Stakeholder arena

The stakeholder arena focuses on the actors that are most relevant for the mobility system. It is based on the overall stakeholder map, but filtered to show only those directly involved in energy corridors, logistics and landscape/spatial integration. In addition, new stakeholders have been added to represent mobility and transport actors that were missing before.

The diagram also shows how the position of stakeholders changes over time. Actors related to infrastructure and logistics move towards

higher power and higher interest, as they become central to the system. At the same time, stakeholders in the landscape, such as farmers and landowners, are becoming more important because they are directly affected by the spatial implications of the corridors.

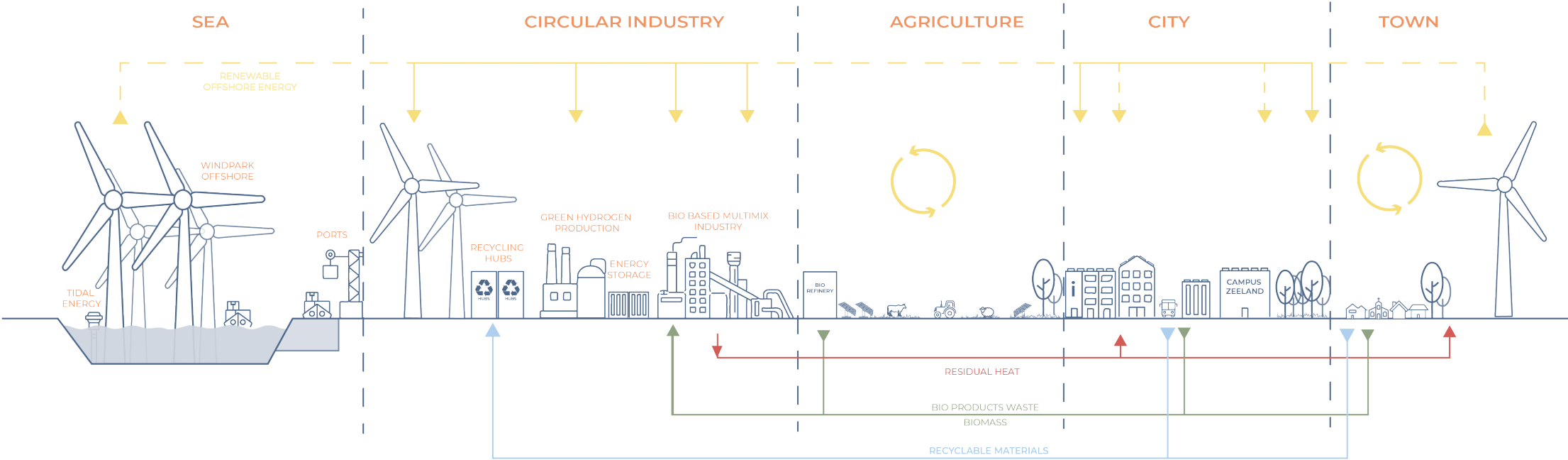
This highlights a shift in the system. Mobility is no longer only about transport, but becomes a crucial factor linking energy, economy and landscape. As a result, the balance between stakeholders changes and new connections are forming between actors.



6.5.5 Systemic section

The systemic section shows how the circular economy operates as a spatial system connecting energy production, industrial processes, agriculture and settlements. Rather than focusing on individual flows, the diagram illustrates the integration of these elements into a continuous exchange system that operates across different landscapes.

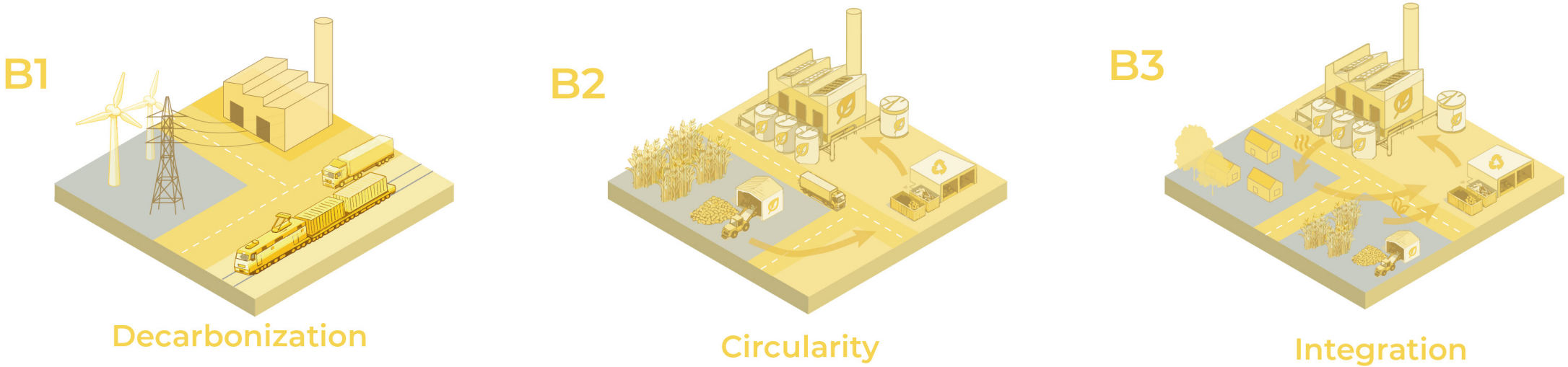
By linking offshore energy, industrial clusters, agricultural areas and urban environments, the system enables resources, energy and materials to circulate at different scales. This transforms the industrial landscape into an interconnected network where production, reuse and consumption are spatially aligned. This results in a shift from a linear, isolated system to a territorially embedded, multifunctional system that supports environmental performance and local value creation.



6.5.6 Principles

Three principles guide the transition towards a circular industry. Decarbonisation involves reducing emissions by integrating renewable energy and shifting towards hydrogen-based production. Circularity ensures that material and energy flows are reused within the system, turning waste streams into valuable resources. Integration emphasises the spatial embedding of industrial processes within surrounding landscapes, strengthening connections with agriculture and settlements.

Together, these principles translate the circular system into spatial strategies, meaning that industrial transformation is technological, spatial and socially beneficial.



6.6 Theme C - Energy communities

6.6.1 Energy community clustering

The goal | To understand the viability for decentralised energy production in different areas and the possibility for the creation of energy communities.

A spatial clustering approach was used to create different energy community typologies in Zeeland, with the goal of generating a strategy where local communities can become a part of the energy transition. The typologies were created using K-Medians clustering, with the following data points to understand the spatial characteristics of the areas: Residential Energy Demand, Commercial Energy Demand, Median Parcel size, Average Windspeed, PV mean, and Population sum.

Residential energy demand is the driving factor in this typology creation with this being the key factor in determining whether there is sufficient capacity in creating an energy community. Commercial energy demand creates the opportunity to create an energy cooperative, with a key ‘prosumer’ anchor tenant who creates continuous energy demand. Parcel size can act both as a proxy for urban density, with small median parcels indicating higher levels of urbanization, but it can also differentiate between different types of rural land-uses with very large parcels indicating the presence of public or non-cultivated land. Renewable energy potentials, in the form of average windspeed and PV mean are also guiding in Zeeland, with large differences being observed between coastal and inland areas.

The table below represents the cluster centers for 9 different typologies generated through K-medians clustering. The typologies have distinct demands and potentials which are worked out individually through phased interventions, in order to reach energy neutrality by 2100.

- **C1 | Dispersed rural residential:** fully decentralised self-consumption
- **C3 | Sparse rural residential:** conditional local energy production and export by 2040
- **C5 | Semi-rural residential:** local energy independence by 2050
- **C6 | Uninhabited coastal zone:** conditional energy export from 2035
- **C7 | Urban fringe mixed-use:** anchor-led independence by 2050
- **C8 | Semi-rural, recreational zone:** seasonally driven independence
- **C9 | Urban core:** connected to decentralised periphery by 2100

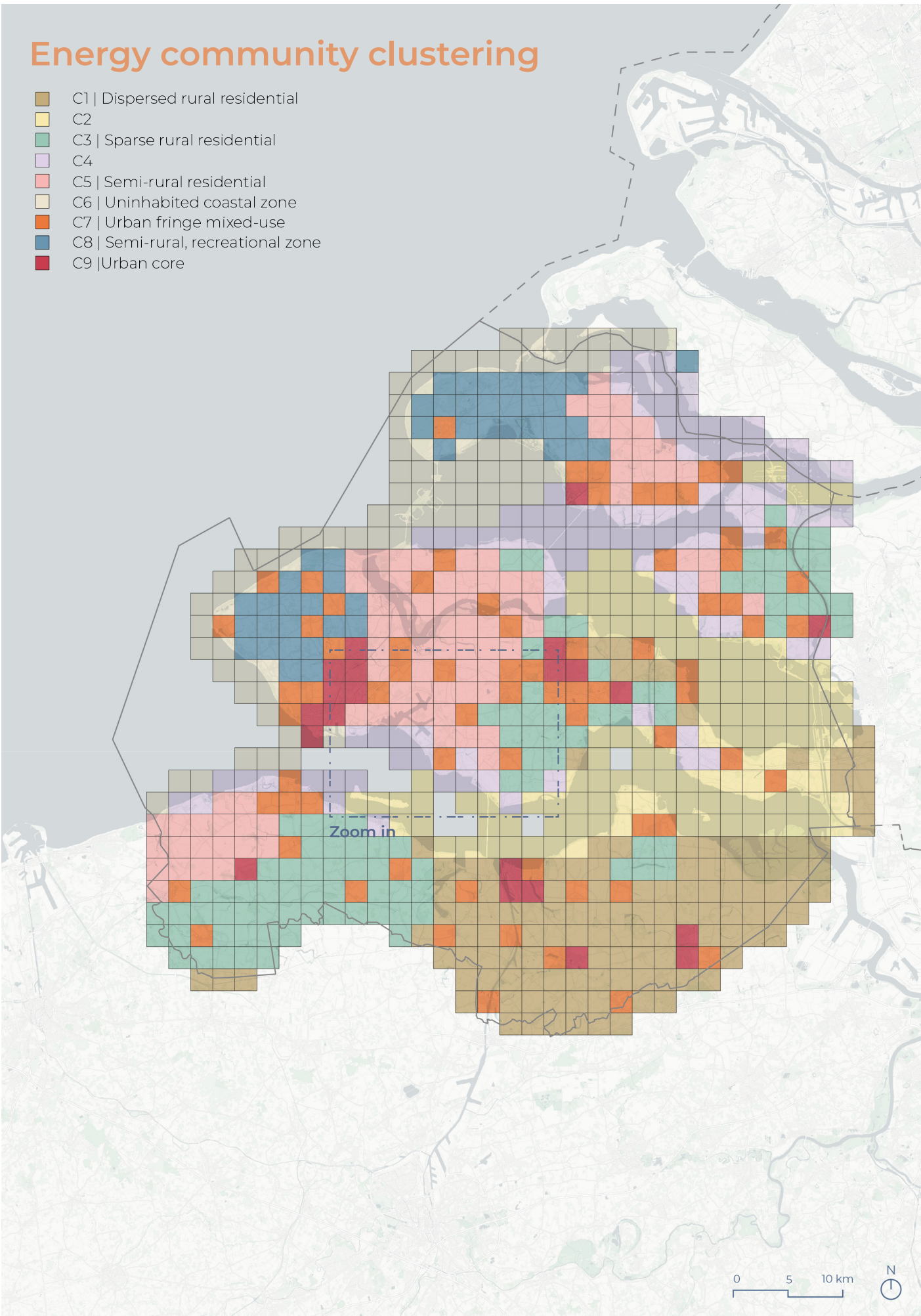
The approach to subdivide the region into 2x2km tiles does not intend to create isolated energy island, but tries to create a systematic approach for communicating with relevant actors, in order to achieve a connected landscape of energy producers making the best use of local potentials.

The focus is placed on the clusters C5, C7 and C9, as these represent the most relevant community types for the proposed strategy.

	r demand kWh	c demand kWh	median parcel m2	windspeed m/s	PV mean kWh/m2/yr	pop sum
C1	129798	0	2135	6.397	1069.63	45
C2	0	0	1970	7.429	1067.63	0
C3	130212	0	2711	6.472	1089.48	55
C4	12809.4	0	5000	7.363	1089.92	0
C5	149259	7751.73	2160	6.709	1104.46	55
C6	0	0	425.75	7.953	1108.08	0
C7	3313600	703831	288	6.677	1092.49	1730
C8	191440	12932.8	3435	6.9665	1120.84	90
C9	13042500	4483510	183	6.334	1090.45	7350

Energy community clustering

- C1 | Dispersed rural residential
- C2
- C3 | Sparse rural residential
- C4
- C5 | Semi-rural residential
- C6 | Uninhabited coastal zone
- C7 | Urban fringe mixed-use
- C8 | Semi-rural, recreational zone
- C9 | Urban core



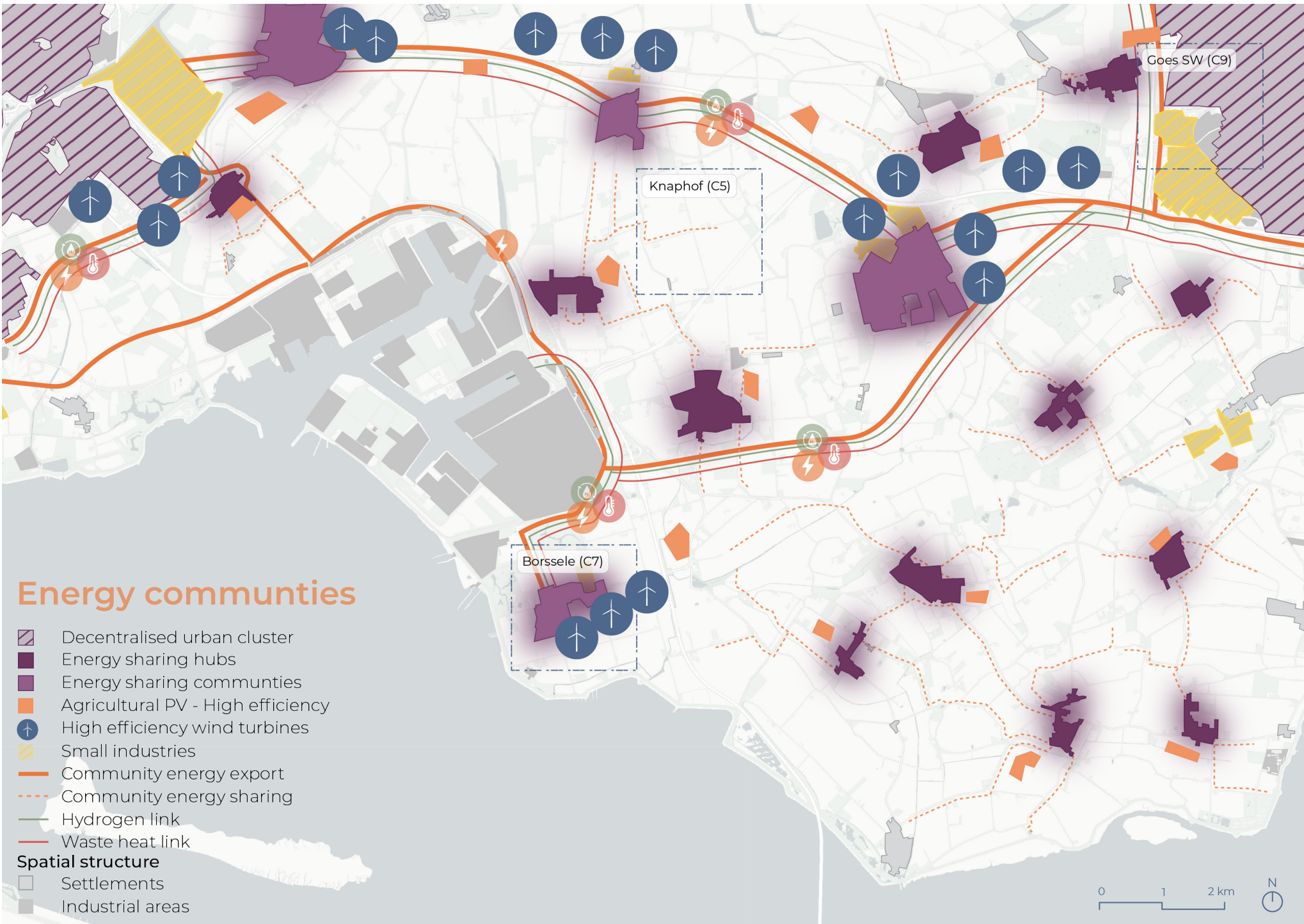
6.6.2 Strategy local scale

The goal | To create a strategy that connects energy consumers to decentralised energy production in a systematic approach, with local communities as the steering actor.

The energy communities individual contributions build upon the overarching strategies for Mobility and Industry, and benefit from the energy infrastructure, hydrogen production, and waste heat transfer planned at a higher, centralised level. Therefore, the strategy for 2100 at the local level aims to connect the typologies in a robust manner, where the success of the wider energy community goal is not contingent on the total accomplishment of milestones at each individual location.

The benefit of this approach is to bridges the gap between large infrastructure projects and targetable goals for individual residents in the energy transition. The energy sharing and export networks further act as a factor to reduce pressure on the individual by creating a strongly connected cooperative community with a strong safety net.

The strategies for typologies C5, C7 and C9, are further developed in this document, on specific locations shown in the accompanying map, as these are most representative for the chosen communities in the scope of this project. Other typologies must also be wholly developed in order to create a fully functional energy community scape for a Just Zeeland.



C5

Semi-rural residential
Local energy independence by 2050

Semi-adjacency to higher density areas creating potential for future development and increasing demand, which requires infrastructure to be introduced earlier.

Key interventions

- Icons: House, Wind turbine, Solar panel

C7

Urban fringe mixed-use
Anchor-led independence by 2050

The presence of several large commercial energy users creates potential for a resident-driven bilateral PPP. Fringe spatial configurations maintain capacity for multiple forms of energy generation.

Key interventions

- Icons: Warehouse, Wind turbine, Solar panel

C9

Urban core
Connected to decentralised periphery by 2100

Exponentially larger demand and low energy generation potential results in a need for reducing demand first, and connecting to decentralised producing regions in a phased manner once these are operational.

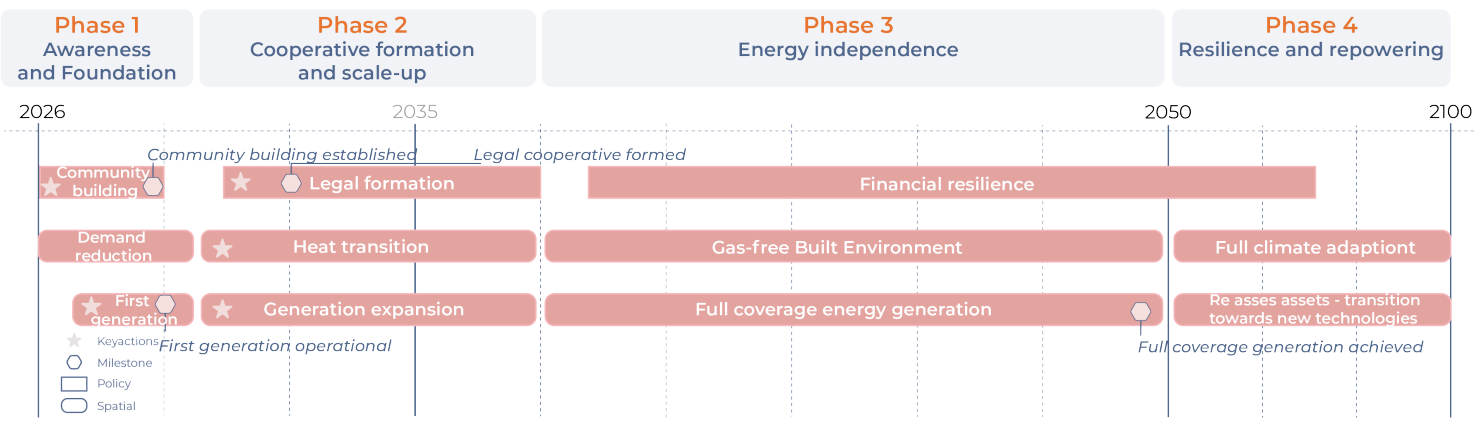
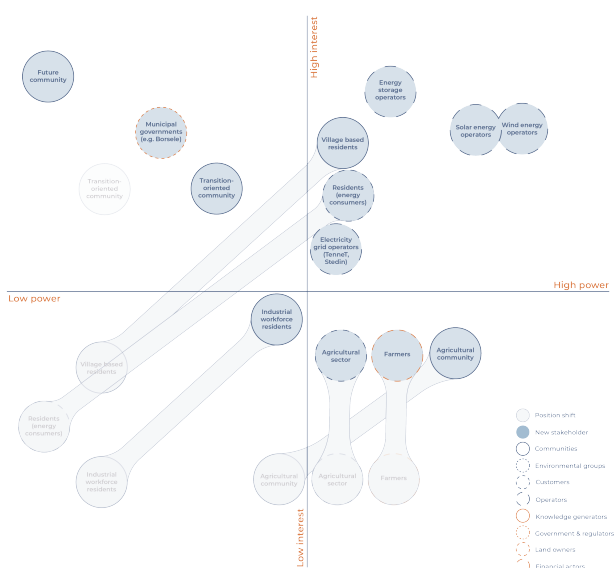
Key interventions

- Icons: Office building, Wind turbine, Solar panel

6.6.3 Cluster timeline and stakeholder arenas

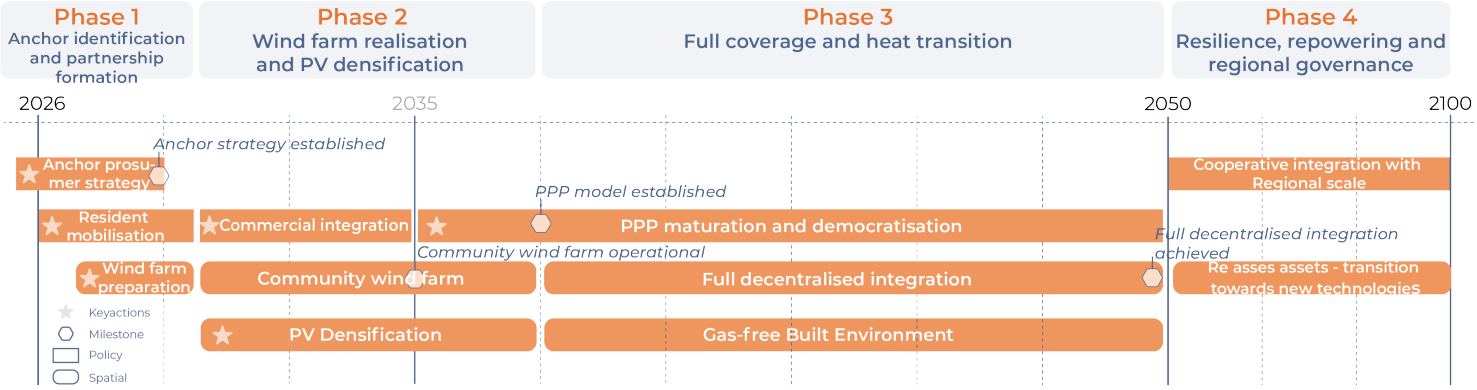
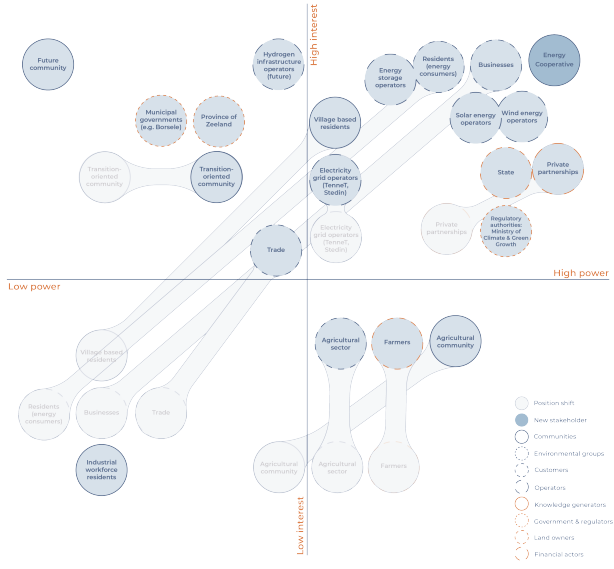
C5 | Communities present in this typology gain increased Power, due to their independence from a centralised grid, as well as increased interest as a result of recognitional justice. Through local governance and a better understanding of how to make the best use of their own resources and apply for financial subsidies, the communities can become a part of the energy transition. Local land owners gain interest in the energy transition, however, maintain an equal amount of power, since their relationship itself does not change. The biggest difference here can be seen in Residential customers becoming energy generators themselves, completely reversing their role.

Semi-rural residential: local energy independence by 2050 (C5)



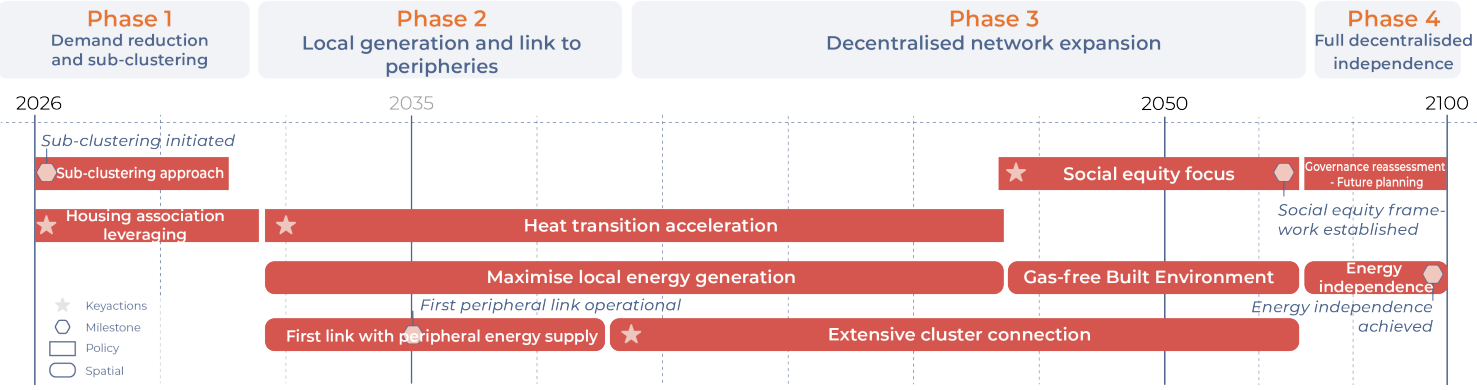
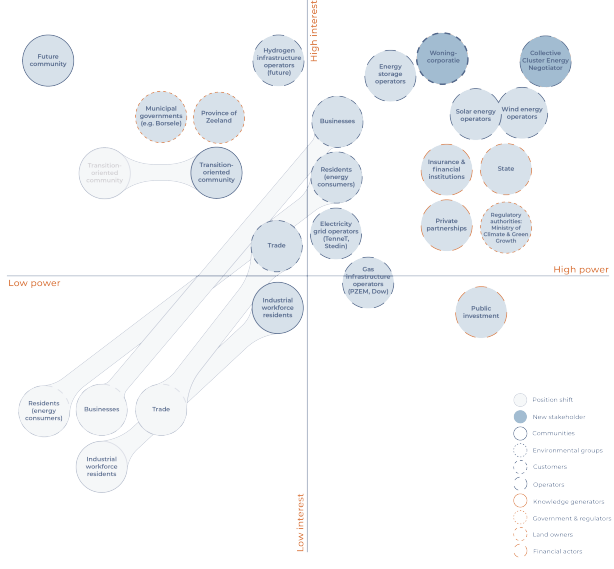
C7 | One of the defining aspects of this typology is the Pubic Private Partnership, which creates the new Energy Cooperative stakeholder. This is both a powerful and interested actor which acts as a voice for both businesses, residents, and private financial partnerships. Agricultural communities and land owners maintain their improved position as their interest is still required for energy production. More stakeholders are invested in this typology through directly benefiting from cheaper/cleaner energy, as well as from an increased organisational/governance role present for municipalities, regulators, and the energy grid.

Urban fringe mixed-use: anchor-led independence by 2050 (C7)



C9 | The massive energy demand in this typology necessitates a broader stakeholder approach, with more negotiation and agreements needing to be made. The Collective Cluster Energy Negotiator is a new stakeholder here, which would be responsible for coordinating with nearby energy producers in order to establish fair and just partnerships for energy distribution. The Woningcorporatie (Housing corporation) is also an actor which appears here, which would take on the initial effort towards reducing local demand. Customers and Businesses have a relatively lower power position in this arena due to them not being as active in the energy producing landscape.

Urban core: connected to decentralised periphery by 2100 (C9)



6.6.4 Semi-rural residential (C5)

The (sub)goal | Energy demand reduction by 2032, and virtual cross-cluster linkage from 2040.

This tile in the Borsele municipality around the Knaphof hamlet is representative of the Semi-rural residential typology. The strategy for achieving the local goals is developed along the following phases:

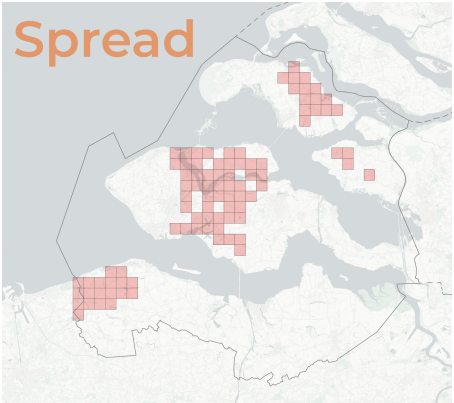
Awareness and Foundation 2025-30: Due to the small population and low energy demand, the initial step is to build a local community with 2-3 involved residents that can drive adoption of policies. These residents can register with HIER opgewekt in order to gain further support. Demand reduction can be initiated by applying for IDSE insulation subsidies up until 2030, and shared rooftop PV installation can be supported by SCE subsidies.

Cooperative formation and scale-up 2030-38: For successful further development, legal formation is necessary in the form of an Coöperatie U.A. in order to protect individual

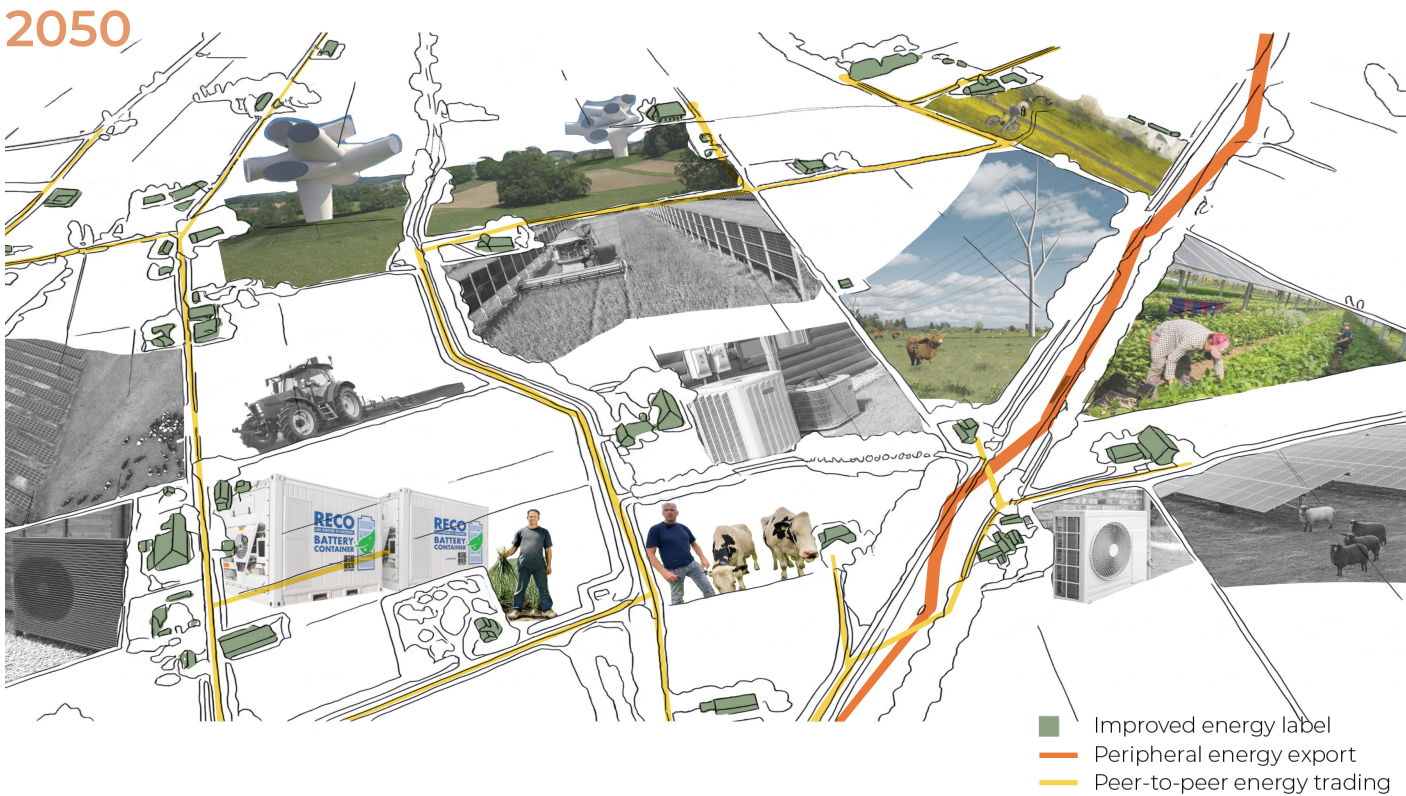
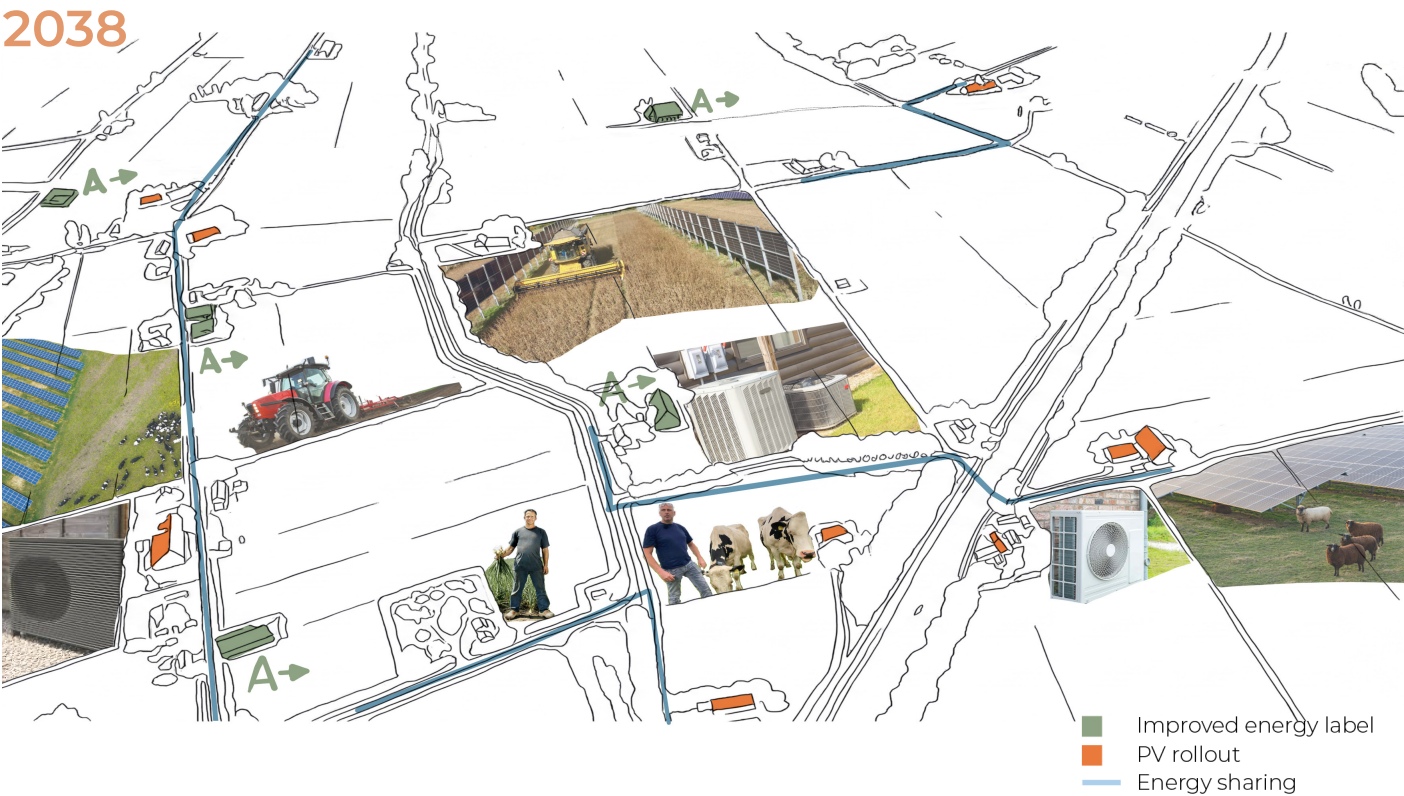
members of the community. At this stage it is important to begin sharing agreements with local grid operators in order to offload peak energy, with current Salderings Regeling policy set to run out by 2027. Larger renewable energy production projects can be funded through SDE++ subsidy applications.

Energy independence 2038-50: Successful adoption of previous phases results in 100% energy independence through rooftop PV and agri-PV with the potential for deploying battery storage for daily balancing. Peer-to-peer energy trading can support energy demand of new residents, or residents that were not previously able to begin decentralised production.

Resilience and repowering 2050+: First PV generation reaches end of life and allows for reassessment of assets, changing to more efficient community owned technologies. Community governance further evolves allowing to merge with other rural communities and empower late adopters.



Knaphof
Population 125, Residential demand 223 MWh, Commercial demand 0, Parcel size 3,370m2, Wind speed 6.49m/s, PV 1,103 kWh/m2/yr



6.6.5 Urban fringe mixed-use (C7)

The (sub)goal | Establish Public Private Partnership with anchor consumer by 2030, build out renewable energy production with energy democratisation and full independence by 2050.

This tile has the town of Borssele at its centre, and is representative of the Urban fringe-mixed use typology. The strategy for achieving the local goals is developed along the following phases:

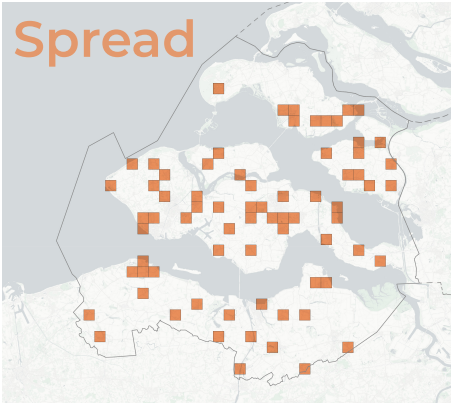
Anchor identification and partnership formation 2025-30: The key initial goal for this typology is the identification of a partner 'prosumer' to initiate the Public Private Partnership (PPP) process, offer stable daytime offtake, and financial credibility for initial SCE/ SDE++ subsidy applications. With an initial demand prognosis, plans can be made for wind turbine viability, and engagement of grid operators for grid capacity, offloading, and net congestion.

Wind farm realisation and PV densification 2030-38: Wind turbine generation is operational with a minimum 50% community-owned stake. The revenue model can offer residents

dividends, and anchor prosumer fixed costless offtake. Façade and Agri-PV can further be developed, and plans for potential batteries can be started. District heating from local producers or nearby industrial actors can be explored.

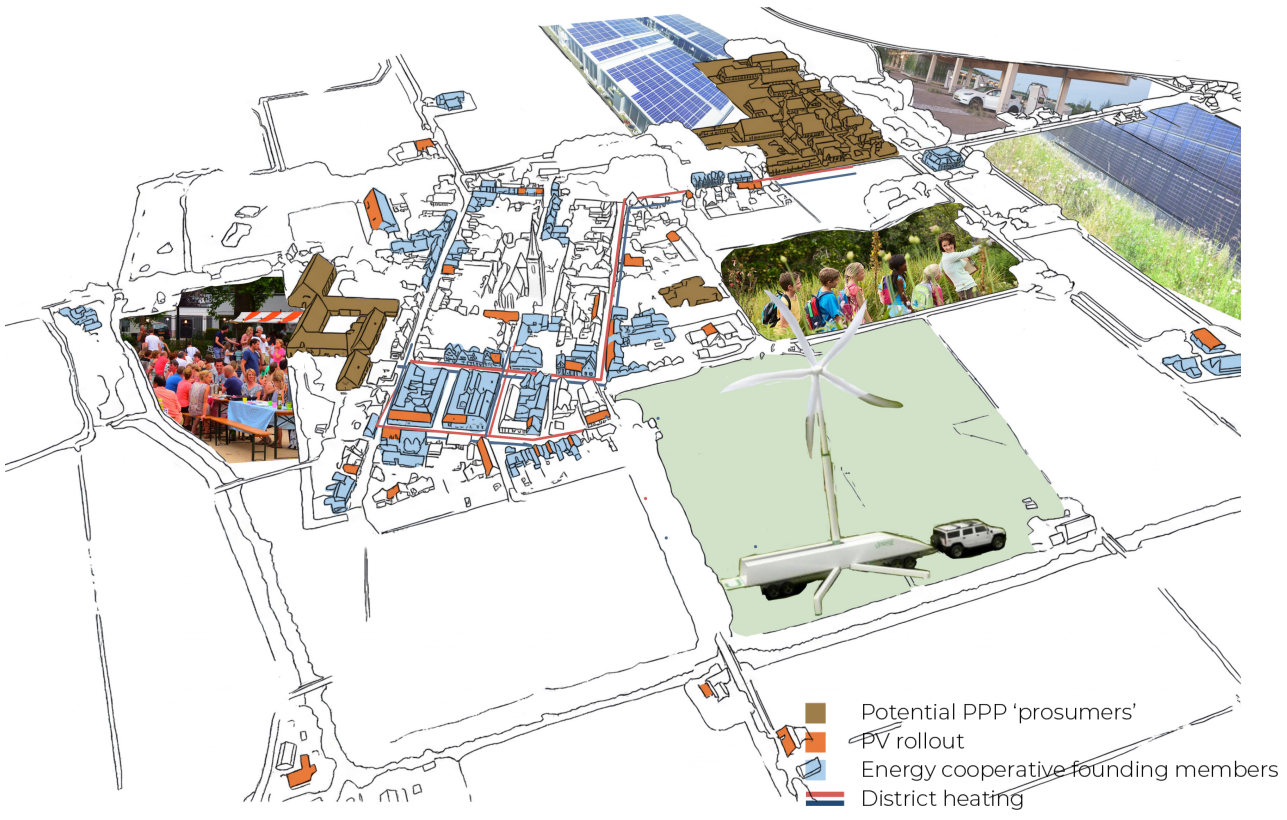
Full coverage and heat transition 2038-50: Smart energy grid connections, with ev charging, heat pump scheduling, and battery dispatch cover 100% of annual local energy demand through the Wind – PV – Agri-PV energy mix. Existing grid connections shift towards an energy export role, with the PPP shifting to equal status ensuring democratic ownership.

Resilience, repowering, and regional governance 2050+: New generation wind turbines can begin to replace aging assets generating more energy with the same spatial footprint. Potential for hydrogen connections for transport and heating can be explored with the prevalence of electrolysis. Local experiences can be shared with other typologies, in the case of changing demands, as well as strengthening physical connections with surrounding regions.

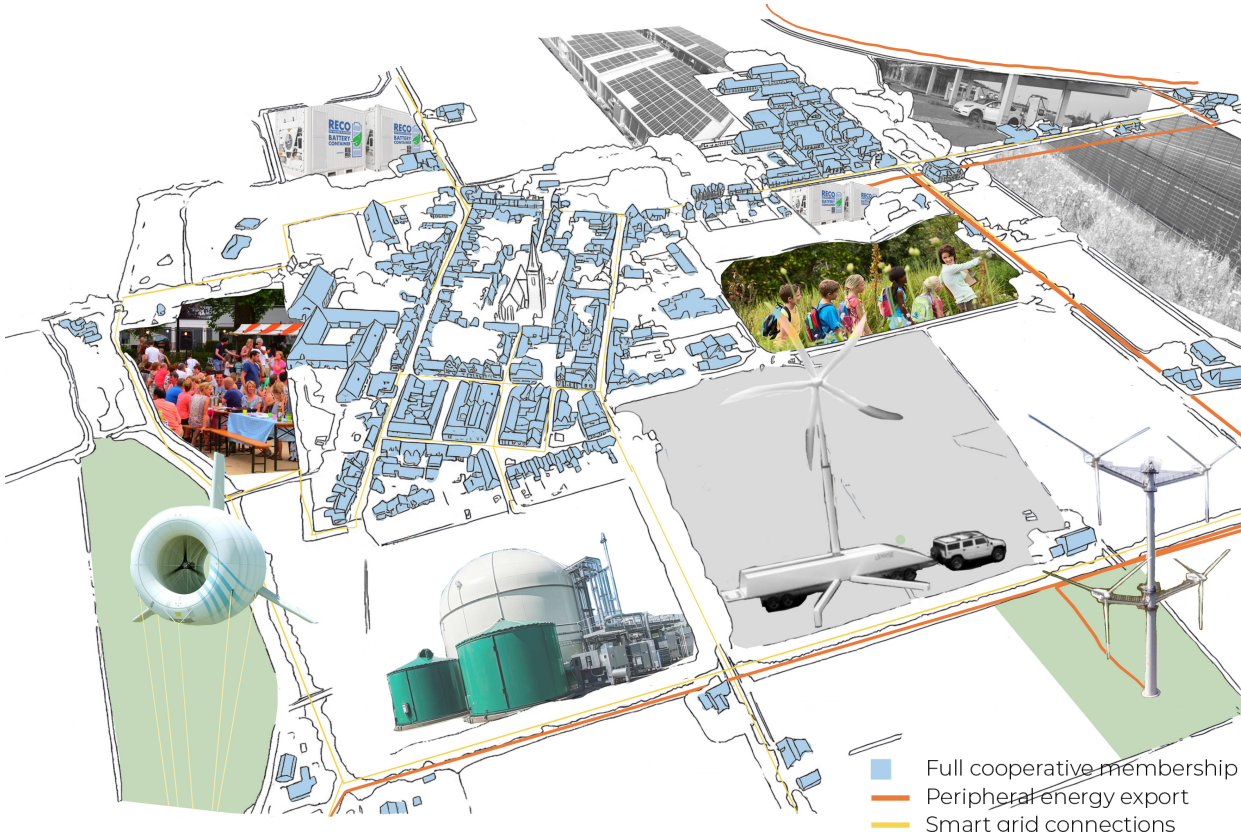


Borssele
Population 1,360, Residential demand 2,2 GWh, Commercial demand 435 MWh, Parcel size 367m2, Wind speed 7.33m/s, PV 1,091 kWh/m2/yr

2038



2050



6.6.6 Urban core (C9)

The (sub)goal | Maximal energy reduction through cash incentives and Woningcorporatie obligations, phased connection to decentralised energy producers by 2100.

This tile centered around the South-West industrial district of Goes is representative of the Urban core typology. The strategy for achieving the local goals is developed along the following phases:

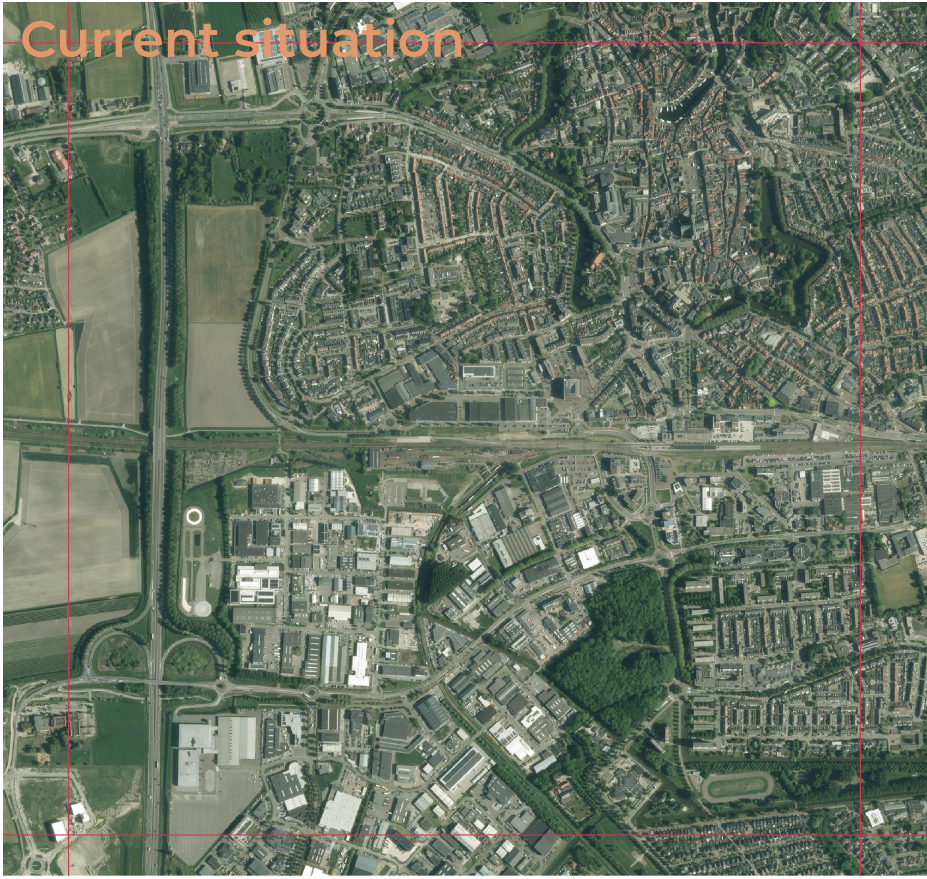
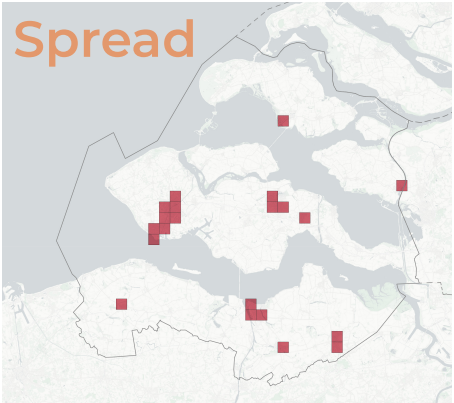
Demand reduction and sub-clustering 2025-32: Woningcorporaties (WC) can be utilised to reduce demand through centralised renovation programmes and can act as a lever for PV rollout due to larger useable roof areas on apartment buildings. Energy communities also need to be drawn up in a sub-clustering manner, balancing larger peak demand in WC ownership, small commercial users, and residential units of various typologies.

Local generation and link to peripheries 2032-45: All potential roofs and unused built surfaces host PV installations, and sub-clusters

are formed where energy can be distributed and shared. First peripheral typology link can made through an associated structure to offtake available energy. District heating feasibility study conducted between local light industries and anticipation for heavy industrial connections.

Decentralised network expansion 2045-75: This typology contains the highest concentration of renters and low-income residents, and the sub-clusters must reflect this with municipalities and WC strengthening their positions. Zeeland smart grid routes decentralized energy from all exporting clusters (C6, C7, C8) where the Collective Cluster Energy Cooperative (CCEC) holds responsibility for fair financing.

Full decentralised independence 2075+: The Urban core supplies its entire energy demand through decentralised production from its peripheries, and acts as a load-balancing hub to stabilise the grid. Policy framework remains technologically neutral and focuses on the goal: decentralised, locally owned, and carbon-free energy.



Goes South-West
Population 8,445, Residential demand 18 GWh, Commercial demand 24.6 GWh, Parcel size 172m2, Wind speed 6.0m/s, PV 1,090 kWh/m2/yr

2045

- Woningcorporaties as levers
- PV rollout
- Centralised renovations
- Energy sub-clusters
- District heating pilot
- Peripheral energy export
- Energy sharing



2075

- District heating expansion
- Peripheral energy expansion
- Smart grid

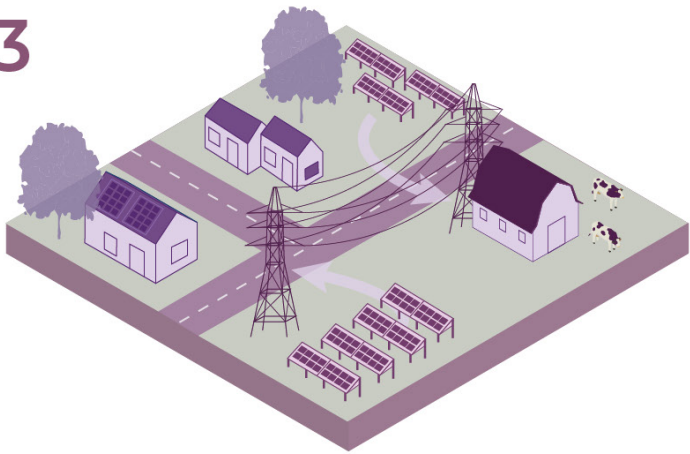


6.6.7 Principles

These four principles for the spatial arrangement of renewable energy infrastructure provide an initial framework for designing across typologies with varying population densities. A key insight, which challenges conventional infrastructure thinking, is that sparsely populated areas do not necessarily need to accommodate the largest energy-generating installations, such as wind turbines, particularly when the energy produced is not intended for local use.

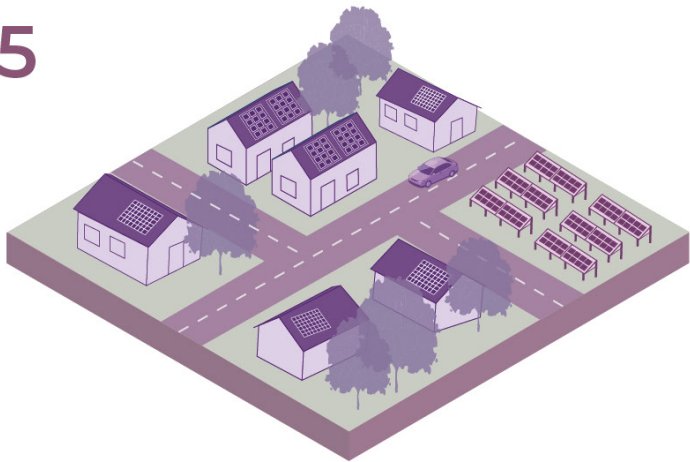
Instead, the guiding principle is to align the spatial footprint of energy production with the scale and location of demand. In this approach, energy generation is reflective of local needs, while allowing for expansion in cases where energy export is considered beneficial or strategically desirable.

C3



Sparse rural residential

C5



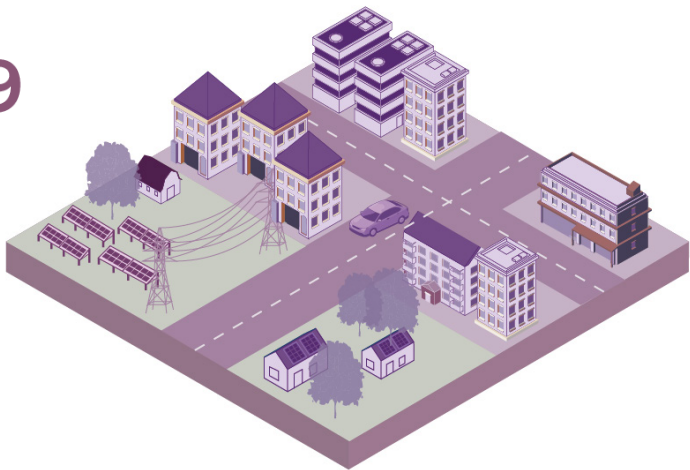
Semi-rural residential

C7



Urban fringe mixed-use

C9

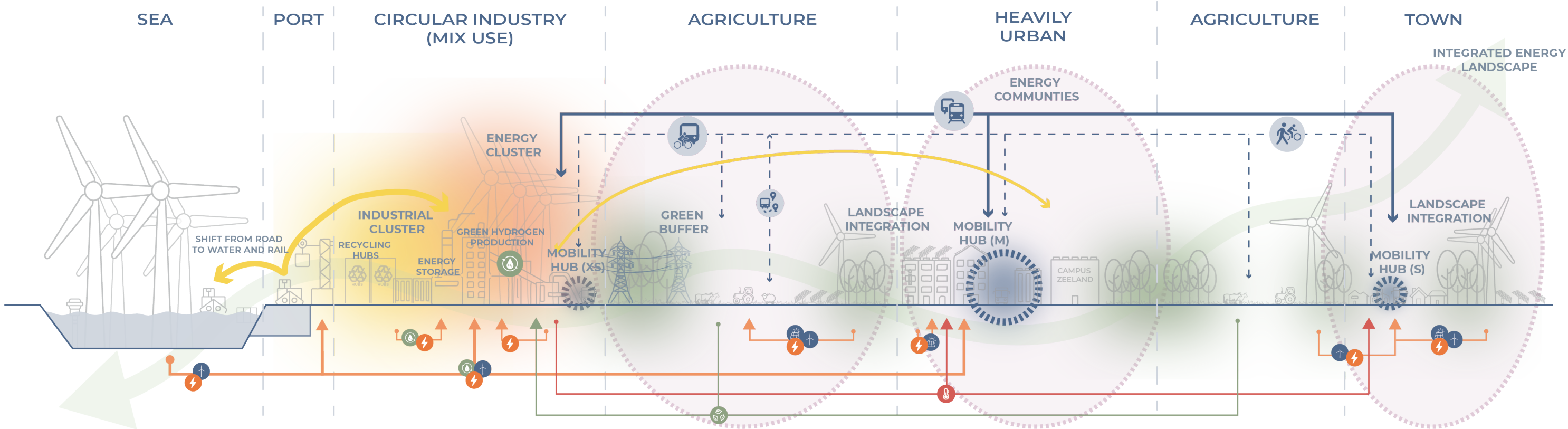


Urban core

6.7 Total strategy visuals

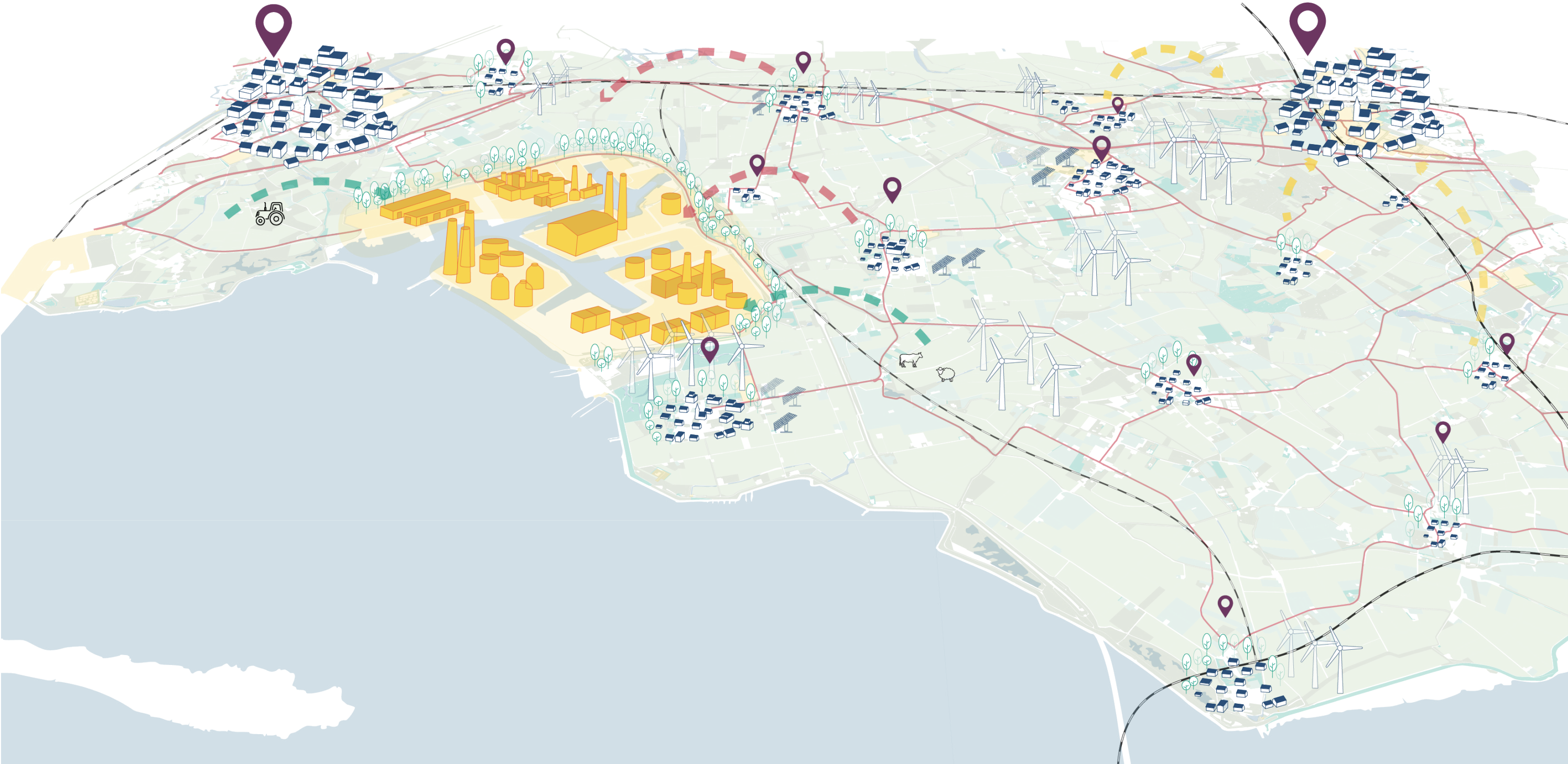
6.7.1 Systemic section

The section illustrates how energy, industry, mobility and landscape are integrated into one interconnected system. Energy is generated offshore and processed in industrial clusters, while local energy communities produce and manage their own energy at smaller scales. Together, these systems support circular production processes and redistribute energy through heat, hydrogen and material flows. Mobility networks connect clusters, communities and urban areas, enabling the movement of both people and goods through a system of hubs and corridors. Through exchanges between industry, agriculture and settlements, infrastructure becomes embedded in the landscape, forming a circular and spatially integrated territorial system.



6.7.2 Bird eye view

The bird's-eye view illustrates the spatial outcomes of the strategy, showing how the different systems form a coherent territorial structure. It demonstrates how energy, mobility, industry and landscape are organised at various scales to create an integrated and interconnected future for Zeeland.



07.

Conclusion & Discussion

Conclusion & discussion

7.1 Conclusion

7.2 Discussion

7.1 Conclusion & discussion

Assessment of research questions

How can the demands and visions of communities in Zeeland that bear the burdens of the energy system while experiencing limited local benefits inform energy futures in which the phase-out of nuclear energy supports a socially and spatially just transition towards renewable energy?:

In order to support a socially and spatially just energy transition, the project is grounded in the coexistence of three key communities directly affected by the energy transition. Each group embodies unique values and perspectives, ranging from economic stability, to environmental responsibility and proper governance. By addressing these perspectives in a territorial context, the research aims to enhance participation, accessibility and shared benefits. The development of energy communities in a decentralised scenario enables people to take action and contribute in energy transition. In this way, the phase out of nuclear energy, becomes more than a technical replacement into an opportunity to empower citizens and strengthen local agency into future energy systems.

Which spatial renewable energy alternatives could replace nuclear energy in Zeeland while addressing the burdens experienced by local communities?:

Throughout our research we have found that a mix of central and decentralised energy production is necessary in order to successfully phase out nuclear energy production in Zeeland. Nuclear energy's key benefit within the Zeeland energy landscape is the base load generation that it provides to support the Energy Intensive Industries (EII). By analysing energy future scenarios, and developing spatial strategies, we have found that the key to replacing it is, therefore, creating sufficient energy storage capacity which can be achieved through either green hydrogen production, or battery storage.

While peri-urban communities can locally generate their own energy requirements

through targeted strategy, the EII demands must also be met in order to maintain the local economy and competitiveness.

How can the demands and visions of affected communities be translated into spatial strategies?:

Our approach for spatialising the community demands for a Just Zeeland came in the broad understanding of different communities, translation of their interests and concerns into core values, and separate visioning in order to understand contrasting perspectives to create a combined community vision.

How can these strategies support a socially and spatially just energy transition in Zeeland?:

Through understanding community desires as a result of visioning, we could split the most important demands into pillars of development. Working backwards, we first envisioned the result of the targeted strategies, and then developed a phased approach to achieving this, focusing on decentralization, circularity, and symbiosis across industry, mobility systems and energy communities, driven by the the different energy demands of each component.

By integrating phases in the transition of the province, the strategy enables a gradual shift from centralized and energy intensive systems, towards localized energy production, The development of energy communities, the circular industry and the connection across urban and rural areas, ensure that benefits and burdens are distributed equitably. In that way, socially and spatially just energy transition in Zeeland can be achieved.

Relevance

Given the current geopolitical situation, energy systems are in a very vulnerable state. The project is particularly relevant within the current context, where energy systems are increasingly influenced by global instability and resource dependencies. The reliance on fossil fuels exposes regions to external risks, price escalation, and supply disruptions.

In this context, the project is particularly relevant as it proposes a shift towards renewable energy systems and a decentralized approach which enhance the province's self-sufficiency and resilience. By linking industry, agriculture and communities the strategy creates an adaptive system where energy, materials and benefits come from a circular model that operates locally. This approach, strengthens local energy systems and enhance the local economic stability.

Recommendations for implementation

While the visions and strategies generated in this report form a coherent whole, where the partial conclusions at each step inform the implementation of the project, the reality is that the proposed plans may not conform wholly to the development visions of governing actors and therefore have to be subjected to change. We view the proposed approach to the project, reviewing the desires of different communities, and the separate implementation of these visions in strategies, as a meaningful manner for implementation. In this way, relevant actors can begin the process of change independently, and to come together once meaningful milestones are reached, and a change to the governance approach can be justified.

For a direct implementation of the strategy, a combined approach, including all components needs to be held. First, the transition should begin with a pilot project at a cluster level, where settlements, circular industry and the mobility of the future can be tested together in a symbiotic scenario. In that way it would be possible to see whether the plan responds to the real conditions of the area. Moreover, the collaboration between the different stakeholders is important. From national government actors to local communities, coordination and cooperation is important in order to align into a symbiotic scenario that would be best for the province. Finally, policy support and financial mechanisms are required to enable the implementation. This includes subsidies for renewable energy

production and storage, funding into mobility infrastructures and industrial stakeholders shift towards circular practices.

Limitations

A key limitations lies in the divergence of the proposed plan and strategy with the current regional frameworks for the province. Existing policies, plan for the energy intensive industries, in a centralized scenario where nuclear energy not only exists but thrives. In comparison, the project promotes a decentralized future, based on community needs, environmental protection, that begun as an anti-nuclear initiative.

In addition, the project is limited by its conceptual nature and limited time, as technical and economic feasibility are not fully assessed. The implementation of the strategy would require complex coordination between multiple stakeholders and governance levels. Moreover, the long-term horizon of 2100 introduces uncertainty regarding future technological and societal developments. Finally, the success of the strategy depends on active participation from communities, which cannot be fully ensured.

Further research

In order to deepen the feasibility of the proposed strategy, further research needs to be conducted. First of all, energy concepts like green hydrogen production, energy storage and district heating, require technical evaluation and research to assess their applicability and spatial footprint. Moreover, the transitioning circular and biobased industry needs to be economically assessed. Furthermore, the project discusses bottom-up solutions. Solutions like this need proper governance models for multi-actor collaboration. Finally, social research needs to be conducted, focusing on communities' behaviour, their different goals and values, and on how participatory processes can be effectively implemented.

Review of Ethics, Values, and Public goods

How does our strategy address social, environmental and economic sustainability (in an integrated manner)?

In our strategy, sustainability is not addressed in only the environmental dimension but is treated as a multidimensional framework. It integrates social, environmental and economic aspects.

Our strategy integrates sustainability by recognizing diverse knowledges and needs of three different communities. It distributes spatial benefits fairly in Zeeland, ensuring that the region is not treated only as an energy hub. Moreover, our strategy empowers communities through participation in energy systems. Environmental sustainability is addressed with the reduction of the province's environmental impact, through renewable energy systems and territorial circularity practices.

Does our strategy address intra- and inter-generational justice?

Our strategy addresses intra generational justice through a symbiotic scenario between communities, industry and mobility. It seeks to equitable balance different different stakeholder groups needs and values and ensure a fair distribution of benefits and burdens across them.

Inter-generational justice is addressed by the integration of social, economic and environmental sustainability. The future scenario for 2100, aims for a long term resilience of the region, ensuring that future generations will be benefited by it and aims to a just energy transition.

What public goods are being created? Are they fairly distributed? Who has access?

A major public good that is being created is the rural mobility system. By the creation of new mobility hubs, which are strategically placed, the mobility systems ensures that all places are accessible by public transport.

What commons are being created or sustained? Who are the communities managing those commons? Who has access?

Our strategy establishes commons in the form of community energy production hubs, for local production, storage and exchange. These commons are managed by local residents participating in energy communities and cooperatives. Moreover, access is open to all residents, ensuring inclusivity in participation and benefits.

What capabilities are being created or sustained? To whom are those capabilities accessible?

The strategy creates capabilities related to participation in energy production, enabling communities to be active actors into energy transition. These capabilities are accessible to residents of the province, strengthening their roles as energy consumers and producers and empowering them through collective initiatives.

Key question: Does our strategy produce the greatest good for the greatest number of people?

Our strategy aims to maximize the collective benefits by reducing the environmental impact, ensuring clear energy for everyone and empowering communities.

What are the likely outcomes of this strategy for different stakeholders—especially the most vulnerable?

We aspire that the outcomes of our strategy would be beneficial for everyone, especially for the most vulnerable. The most vulnerable groups are expected to become more empowered through improved access to affordable energy, participation in energy systems, and reduced dependency on centralized infrastructures. At the same time, large industrial actors and energy providers also benefit from the transition, as the shift towards renewable energy and circular systems increases long-term stability, reduces exposure to fossil fuel price volatility, and aligns with emerging regulatory frameworks and climate targets.

Are harms being minimised and benefits maximised in both the short and long term?

As harms we define the environmental impact, landscape degradation, and energy inequalities that could be the outcome from a centralized energy system. We aim to environmental protection while maximizing long-term social, and economic benefits.

Who gains and who loses from the spatial, economic, and environmental changes proposed?

Communities and energy cooperatives gain increased access and benefit from the re-introduction of energy systems, while traditional fossil-based energy models are gradually reduced.

Connection to SDGs

The project aligns with several United Nations Sustainable Development Goals, particularly it addressed the followings:

No poverty: Energy poverty, as an aspect of poverty has been addresses in this project, by enabling households to become energy producers in a decentralized system and thus, reducing the dependency in external energy markets.

Reduced inequalities: Communities are empowered to increase their agency in energy production and governance and increase their power as active actors.

Affordable and clean energy: Affordable and clean energy is the main goal of this project, as it aspires to move away from fossil fuels, by deploying renewable energy systems and green hydrogen production, all in a mainly decentralized system for the province. By combining renewable sources, energy sharing and district heating, the energy cost for residents becomes less.

Industry, innovation and infrastructure: Chemical industry is changing into circular industrial clusters, that aspire to achieve symbiosis between other components of Zeeland, achieving territorial circularity.

Sustainable cities and communities: Cities produce part of their own energy and become active nodes of the energy system. This strengthens resilience and improves living conditions through energy accessibility and better infrastructure.

Responsible consumption and production: Responsible consumption and production becomes a reality for the province with the transformation of industry into circular hubs, which are based on reuse and recycle. Waste is redefined as a valuable resource for industry and cities.

Climate action: Climate action is achieved by reducing CO2 emissions through the transformation of industry and the phasing out of fossil fuels.



(Neshovski 2026)

08.

Reflection

Reflection

- 8.1 Group reflection
- 8.2 Individual reflection

8.1 Group reflection

8.1.1 Key learnings

This quarter taught us how regional design can connect community perspectives to strategic spatial thinking. In Zeeland, it quickly became clear that the energy transition directly affects the wishes, concerns, and everyday living environment of local communities. By consciously approaching the project from the perspective of residents, rather than from national energy interests, we came to understand the region not only as an energy landscape, but also as an area in which livability, landscape quality, and local identity are central.

Community perspectives were therefore not seen as an addition, but as the starting point of the project. This approach made us more aware of the tension between national energy ambitions and their local spatial consequences and helped us reflect on how design can respond to unequal distributions of burdens and benefits.

In addition, we learned how important it is to work across different scales at the same time. Our project continuously moved between the regional scale of strategy and infrastructure and the local scale of villages, landscape, and everyday use. This made clear that a regional vision is only convincing when it remains connected to concrete places, landscapes, and communities. At the same time, it taught us how abstract concepts such as justice, burden, and benefit can be translated into concrete spatial choices.

8.1.2 Reflection on Values, Ethics and Responsibilities as Urbanists

Throughout the project, justice, livability, and spatial quality were central to our approach to Zeeland. The region was not only seen as a place where national energy goals could be realised, but as a lived landscape in which local communities are rooted. Early on, we realised that these communities are directly affected by the spatial consequences of the energy transition, and this changed the way we worked. It meant that questions of landscape quality and long-term livability had to be integrated with questions of infrastructure, policy, and energy production.

Spatial design is rarely neutral, because every design decision gives priority to certain interests, values, and ideas of the future. In our project, this became clearly visible in the tension between national energy interests and their local consequences for communities in Zeeland. Although the transition is often presented as a national necessity, its burdens are not always equally distributed. Communities living close to these developments often experience the spatial impact directly, while the benefits are not always equally visible. This raised an important ethical question for us: how can design deal with this unequal distribution of burdens and benefits in a just way?

For us, this meant that the project could not focus only on facilitating new energy systems. It also had to show how the energy transition can contribute to spatial quality, the public interest, and the interests of local communities. Our project therefore was not only about the energy transition itself, but also about how this transition can unfold in a more just way for the region. As urbanists, this gave us a role that went beyond making spatial proposals alone. It pushed us to think critically about power relations, to weigh different interests, and to reflect on what kind of future we are trying to support through our work.

8.1.3 Our Approach to the Studio and Process of Working

This studio was particularly insightful but challenging at the same time due to the complexity of the topic and the minimal background knowledge that we had in it. We spent a lot of time researching different components and try to put them together. One approach that definitively helped us was the sketching of maps and sections and then putting it together to see our alignments and conflicts. This made it easier to come up with a symbiotic scenario. Moreover, working across different scales, moving between local initiatives to regional scale strategies, helped us to better understand the relationships between the different components.

8.1.4 Narrative Building

Building a clear narrative is an important part of our design process, because the project addresses several themes at the same time. Within this narrative, different layers came together, such as community perspectives, landscape quality, spatial justice, and the energy transition. This helped us not only to structure the project itself, but also to explain our vision more clearly.

Our narrative developed around the idea of the transition from risk zone to benefit zone. This helped us see Zeeland not only as a region where national energy ambitions can be realised, but also as a region where spatial quality, public value, and benefits for local communities can be developed. In this way, the narrative helped us connect analysis, vision, and strategy, while also making the project clearer and more coherent.

8.1.5 Group dynamics

Throughout the project, justice, livability, and spatial quality were central to our approach to Zeeland. The region was not only seen as a place where national energy goals could be realised, but as a lived landscape in which local communities are rooted. Early on, we realised that these communities are directly affected by the spatial consequences of the energy transition, and this changed the way we worked. It meant that questions of landscape quality and long-term livability had to be integrated with questions of infrastructure, policy, and energy production.

Spatial design is rarely neutral, because every design decision gives priority to certain interests, values, and ideas of the future. In our project, this became clearly visible in the tension between national energy interests and their local consequences for communities in Zeeland. Although the transition is often presented as a national necessity, its burdens are not always equally distributed. Communities living close to these developments often experience the spatial impact directly, while the benefits are not always equally visible. This raised an important ethical question for us: how can design deal with this unequal distribution of burdens and benefits in a just way?

For us, this meant that the project could not focus only on facilitating new energy systems. It also had to show how the energy transition can contribute to spatial quality, the public interest, and the interests of local communities. Our project therefore was not only about the energy transition itself, but also about how this transition can unfold in a more just way for the region. As urbanists, this gave us a role that went beyond making spatial proposals alone. It pushed us to think critically about power relations, to weigh different interests, and to reflect on what kind of future we are trying to support through our work.

8.2 Individual reflection

8.2.1 Elerina Karolou

Learning from regional design and methodology

From the beginning of the project, I was motivated to understand the complex relationships underlying a just energy transition. Throughout the process, I developed a deeper understanding of spatial justice and the connections between different communities and large-scale infrastructural systems. This shifted my perspective from focusing primarily on spatial and technical solutions towards recognizing the importance of integrating social dimensions into design. I became more aware of how different voices and concerns can be represented within a project, although this was mainly based on literature review and media analysis, as time constraints did not allow us to delve deeper into participatory processes engagement. This limitation made me reflect on the importance of incorporating real stakeholder input in future work.

A key challenge throughout the project was the amount of data and information required to develop meaningful and critical proposals, much of which was not readily available. I realized that complex territorial problems demand deeper investigation, and due to time limitations, I was not always able to explore these layers as thoroughly as I would have preferred. This highlighted for me the tension between depth and feasibility within design processes.

One approach that I found particularly valuable was the development of two contrasting energy futures: a centralized scenario based on existing policy frameworks, and a decentralized scenario reflecting our group's values. This comparison allowed me to critically engage with current planning trajectories while exploring alternative possibilities. It also helped me understand that meaningful design does not only propose solutions, but also questions dominant systems and offers new perspectives.

The visioning process, which included three different community based perspectives, was especially insightful. Although each vision responded to specific needs, together they revealed how a more symbiotic and integrated scenario could emerge. This reinforced for me the importance of acknowledging a diversity of perspectives and translating them into spatial strategies.

Another key learning was the concept of industrial symbiosis and its potential application within a peri-urban region such as Zeeland. I found this particularly inspiring and would be interested in exploring how similar approaches can be implemented in other contexts. Additionally, the development of systemic sections proved to be a valuable tool, helping me understand relationships between different spatial, social, and infrastructural components that I might not have considered otherwise.

Work process and collaboration

At the beginning of the project, the team faced challenges in establishing a clear starting point, as none of us had previously worked within such a complex and multi-scalar context. However, once we developed a shared direction, the workflow became more structured and efficient. The collaborative nature of the group allowed us to divide tasks and maintain momentum, while building trust to each other throughout the process.

The diversity of approaches within the team was particularly valuable, as it allowed me to learn from my teammates and engage with different ways of thinking and working. This exposure broadened my perspective and helped me become more flexible and open in collaborative design processes. Studio discussions further strengthened my critical thinking, especially in articulating and supporting arguments from different viewpoints, while also improving my verbal and visual communication skills.

At the same time, the decision to divide tasks for efficiency and deep diving into each component, also introduced challenges, particularly towards the end of the project when we needed to bring all components together into a coherent whole. Integrating the different parts required additional coordination and alignment, highlighting the importance of maintaining a shared overview throughout the process. This made me realize that while task division can increase efficiency, continuous integration and communication are essential to ensure consistency in the final outcome.

Overall, the team worked well together, adopting a collaborative mindset where ideas were openly shared and discussed. This created a strong collective understanding of the project and allowed us to combine our individual contributions into a unified and well-developed vision.

8.2.2 Kiki van der Veen

During this quarter, I became more aware of the influence of my own way of thinking on my design process. I like to approach spatial challenges by focusing strongly on creating coherence in both content and representation. It is important to me that different elements connect well and come together as one clear story. At the same time, however, I realised I have a possible blind spot. My focus on consistency can make it difficult to allow for alternative approaches or interpretations.

This became clearer during the project on the energy transition in Zeeland. At first, I tried to create integrated solutions, but I realised that different communities have very different values and interests. This made me realise that spatial decisions are never neutral. They always involve trade-offs between justice, liveability, and economic interests.

During the group process, I realised that I often took on the role of maintaining consistency. While this helped to create a clear overall result, I also recognise the importance of trusting the process and allowing others to work in their own way.

Overall, I am happy with how the project came together. I can see that I worked on the visualisations and the way everything is connected with a lot of thought and effort.

I also found it difficult during supervision to express my ideas clearly. As many of these sessions were done in a group setting, I sometimes found myself staying within existing ideas. In reflection, I recognise that I did have my own insights, but I did not always express them with enough certainty.

A key turning point was working with core values. This helped me stop trying to solve tensions and use them as a starting point instead.

In the future, I want to be more aware of these tensions, collaborate more and express my own views more clearly during lessons.

8.2.3 Mila Veenboer

This quarter was a steep learning curve for me. Because this was my first Master's course after joining via the pre-master, I experienced the project as intensive and challenging from the start. I had not worked on the theme of energy transition before, which made it difficult at times to determine a clear direction within the project. Consequently, I also found it challenging to create visual and spatial work that connected the various themes in a coherent way. At the same time, this process helped me develop quickly, both in my understanding of the subject and in my way of working within a design project.

Throughout the quarter, I primarily contributed by connecting the different parts of the project into one clear whole. While other group members often focused more on specific visions or strategic interventions, I worked extensively on the overarching structure. I contributed to analyses, the problem statement, community cards, values, icons, tiles, timelines, and strategy maps. In this way, I helped to connect analysis, vision, and strategy and create a more coherent narrative throughout the entire project. This made me realize that one of my strengths is creating structure and cohesion within a complex group project.

Looking back, I also see clear areas for improvement. Because the subject was new to me and the pace of the project was high, I sometimes found it difficult to make decisions with confidence. At the beginning of the quarter, I was also somewhat more reserved in group discussions and feedback sessions, especially because the course was in English and I did not always feel confident enough to express what I already understood. Towards the end of the block, I felt increasingly comfortable giving my opinion and contributing ideas, which I consider an important personal development. In the future, I want to continue improving my spoken English so that I can share my findings and ideas more clearly in discussions and presentations. I also want to challenge myself to elaborate on a specific part of a project. At the same time, I appreciate that this quarter has given me broad insight into many themes, from energy systems to their spatial and social impact on communities and landscapes.

All in all, this project has not only helped me acquire new knowledge, but also gain more confidence in my role within a demanding design environment.

8.2.4 Stepan Prikazchikov

I approached this project with a keen interest in energy production and systems thinking. Having grown up primarily in the Randstad, the scale of energy infrastructure and production often remains abstract, as these systems are largely situated outside one's immediate lived environment. Working on an energy transition project in Zeeland, however, forced a confrontation with the physical and spatial reality of energy systems, and how landscapes can become dominated by a range of actors whose interests do not necessarily align or result in mutually beneficial outcomes.

One uncertainty I encountered during the project was the translation of broad conceptual theories into the specific context of Zeeland. While it was relatively straightforward to map and quantify energy demand and spatial conditions, it proved more challenging to interpret how these spatial relationships relate to concepts such as spatial justice. What helped bridge this gap was the continuous work between analysis and design and using spatial mapping to inform conceptual understanding. Engaging with stakeholder perspectives and situating abstract ideas within physical landscapes made these concepts more concrete and applicable.

One of the most productive processes throughout the project was designing through future visions and then working backwards to identify gaps in knowledge. This approach allowed us to work both individually and collaboratively, sketching scenarios for different communities and possible futures, while quickly identifying assumptions, uncertainties, and points of conflict. It encouraged us to step outside of our own perspectives and values, and instead design with consideration for others, particularly those directly affected by energy transitions.

Initially, I approached the project with a solution-oriented mindset, viewing the energy transition as a problem that could be resolved through technical and spatial optimisation. However, without critically questioning the underlying assumptions, power structures, and methods available, such solutions risk remaining superficial.

I came to understand that the energy transition is not a singular problem to be solved, but an ongoing process shaped by competing interests, unequal power relations, and differing values. This shift in perspective allowed me to move from seeking definitive answers toward engaging with complexity, uncertainty, and the need for more inclusive and context-sensitive approaches.

09.

Bibliography

Bibliography

- 9.1 Sources
- 9.2 Data
- 9.3 AI Statement

9.1 Sources

Actiedag tegen kernenergie op vier plekken. (2025, 13 mei). Provinciale Zeeuwse Courant.

Activisten dragen kerncentrale ten grave in Groningen. "Het zijn allemaal oude mensen." (2025, 5 oktober). *Dagblad van het Noorden*.

ArbeidsmarktInZicht - Samenvatting: cijfers Zeeuwse energietransitie toegelicht. (n.d.). <https://arbeidsmarktinzicht.nl/longread-arbeidsmarkt-energietransitie-zeeland>

Balz, V. E. (2018). *Regionaal ontwerp: discretionaire benaderingen van regionale planning in Nederland*. In Delft University of Technology, Planning Theory (pp. 332–354) [Tijdschriftartikel]. <https://doi.org/10.1177/1473095217721280>

Bedrijven op de kaart. (n.d.). <https://app.bedrijvenopdekaart.nl/?bodkdata=N4lg-ZiBcDallYBsEgLoBoQCMrWgBgDoB2A-ZgA40BWEggTgEYAmI9aW4gNkapoeda-LEytIIxoF69PB1aNiUkmlISZKAL5A>

Besançon, S. (2024, 3 september). 2030: *Wat als de toekomst van mobiliteit landelijk was?* - Mobilize. Mobilize. <https://www.mobilize.com/en/wearemobilizers/2030-what-if-the-future-of-mobility-was-rural/>

Biobased Building Lab | Joint Research Center Zeeland. (n.d.). <https://jrcz.nl/en/biobased-building-lab.html>

Blumberga, A., Gravelsins, A., & Blumberga, D. (2022). *Deliberatieplatform voor energietransitiebeleid: hoe maak je complexe zaken eenvoudig*. *Energies*, 15, 90. <https://doi.org/10.3390/en15010090>

CBS. (2023, 31 oktober). Internationale goederenhandel: samenstelling en geografie - Dutch Trade in Facts and Figures, 2023 | CBS. <https://longreads.cbs.nl/dutch-trade-in-facts-and-figures-2023/international-trade-in-goods-composition-and-geography/>

Centraal Bureau voor de Statistiek, Planbureau voor de Leefomgeving, Rijksinstituut voor Volksgezondheid en Milieu, & Wageningen University & Research. (2014, 20 mei). *Visuele verstoring en landschapsbeleving*. CLO.

Centraal Bureau voor de Statistiek, Planbureau voor de Leefomgeving, Rijksinstituut voor Volksgezondheid en Milieu, & Wageningen University & Research. (2024, 28 oktober). *Woningen in indicatieve zones hoogspanningslijnen, 2000–2023*. CLO. <https://www.clo.nl/en/indicators/en140803-visual-disturbance-and-landscape-perception>

Centraal Bureau voor de Statistiek, Planbureau voor de Leefomgeving, Rijksinstituut voor Volksgezondheid en Milieu, & Wageningen University & Research. (2025, 21 juli). *Zichtbaarheid van windturbines en impact op visuele kwaliteit, 2022*. CLO. <https://www.clo.nl/en/indicators/en140805-wind-turbine-visibility-and-impact-on-visual-amenity-2022>

Centraal Bureau voor de Statistiek. (2026, 12 januari). Centraal Bureau voor de Statistiek. Centraal Bureau voor de Statistiek. <https://www.cbs.nl/>

Central Office, NucNet a.s.b.l., Brussels, Belgium. (n.d.). *NUCNET-uitleg: Finlands Olkiluoto-3 start commerciële exploitatie. The Independent Global Nuclear News Agency*. <https://www.nucnet.org/infographics/nucnet-explainer-finland-s-olkiluoto-3-begins-commercial-operation-5-2-2023>

Daar die kleine kerncentrale aan de haven... in Veghel? (2025, 6 december). Brabants Dagblad.

Datasets - PDOK. (n.d.). <https://www.pdok.nl/datasets>

De Blois Anne-Peter Alberda En Harm Jan Boonstra, C. (2024c, 10 april). *De goederenstromen van de provincies in 2015-2022*. Centraal Bureau voor de Statistiek. <https://www.cbs.nl/nl-nl/longread/diversen/2024/de-goederenstromen-van-de-provincies-in-2015-2022?>

De Greef, A. (2026, 14 februari). *De kerncentrale is terug*. Leeuwarder Courant.

De komst van kerncentrales: splijtzwam of superplan? (2025, 26 september). Reformatorisch Dagblad.

DIRK SIJMONS, Dirk Sijmons, & H+N+S Landscape Architects. (n.d.). *LANDSCHAP EN ENERGIE: de transitie ontwerpen*. In kWh/M2 [Boek]. nai010 uitgevers.

DuCoop cvba. (2024). *Territoriale analyse van gedecentraliseerde energiemarkten*. In ESPON. <https://espon.eu>

Dumoulein, V. (2026, 21 januari). *Aantal nucleaire transporten in West-Vlaanderen in 2025 flink gestegen*. HLN.

Eén ramp of koeltoren en de steun verdampst. (2025, 18 december). BN DeStem.

Endona. (n.d.). *Endona - Zonne-energie uit Salland*. <https://endona.nl/>

Energieprojecten in Zeeland. (n.d.). RVO.nl. <https://www.rvo.nl/onderwerpen/energieprojecten-nederland/energieprojecten-zeeland>

Energy Port Zeeland. (n.d.). Energiecoöperatie Zeeuwind: kracht voor een duurzame toekomst.

Energy.nl - TNO. (2024, 6 november). *De rol van vraagsturing in het Nederlandse elektriciteitssysteem 2030-2050 - Energy.nl*. Energy.nl. <https://energy.nl/publications/vraagsturing-elektriciteitssysteem-2030-2050/>

Er is maar één oplossing: kernenergie. (2025, 6 november). De Telegraaf.

ESPON. (2025). *Territoriale analyse van gedecentraliseerde energiemarkten*. In ENERKOM OPAVSKO (pp. 1–3). <https://espon.eu>

Falcones, R., Brinkmann, M., Bidenharn, L., Feller, E., United Nations Environment Programme Finance Initiative, Avermaete, D., Priekulis, J., European Banking Federation, & Gwen Yu. (2025). *Transitie van de chemische sector in de EU*. Genève. <https://www.ebf.eu/wp-content/uploads/2025/12/The-EU-Chemical-Industry.pdf>

Flameling, I. (2021, 11 november). *Waarom Zeeland niet voor kernenergie moet kiezen*. Provinciale Zeeuwse Courant.

Gatto, A. (2022). *De energietoekomst die we willen: een onderzoeks- en beleidsagenda voor energietransities*. Energy Research & So-

cial Science, 89, 102639. <https://doi.org/10.1016/j.erss.2022.102639>

Geen duidelijk antwoord op de vraag of kernenergie alles oplost. (2025, 11 oktober). De Gelderlander.

Giele, T. (2023, 27 november). *Steun voor meer kernenergie iets groter in Zeeland*. BN DeStem.

Gladwin, D., & Ellis, N. (2023). *Energiegeletterdheid: naar een conceptueel kader voor de energietransitie*. *Environmental Education Research*, 29(10), 1515–1529. <https://doi.org/10.1080/013504622.2023.2175794>

Green City Times. (2023, 9 november). *De groenste stad van Europa | Green City Times*. <https://www.greencitytimes.com/europe-s-most-sustainable-city/>

Heffron, R. J. & University of West Indies. (n.d.). *Het toepassen van energie-rechtvaardigheid in de energietransitie*. In *Renewable and Sustainable Energy Reviews* (Vol. 156, p. 111936).

Heller, A., & Kers, B. (2025, 14 februari). *Zaltbommel in beeld voor kerncentrale*. Brabants Dagblad.

Het RESCoop-model - RESCoop. (n.d.). <https://www.rescoop.eu/the-rescoop-model>

Hydrogen Delta | Smart Delta Resources. (n.d.). <https://www.smartdeltaresources.com/en/hydrogen-delta>

Ivanova, I. (n.d.). *Roze waterstof: kernenergie ontmoet elektrolyse*. <https://hydrogenera.eu/tpost/aid7379j91-pink-hydrogen-nuclear-power-meets-electr>

Jetten, R. (2023). *Nationaal plan energiesysteem*. In *Nationaal Plan Energiesysteem*.

Kalundborg Symbiosis. (2026, 18 maart). *Startpagina - Kalundborg Symbiosis*. <https://www.symbiosis.dk/en/>

KEA. (2025, 16 januari). *Nucleaire energie zal pieken in 2025 volgens Internationaal Energieagentschap*. HLN.

Kerncentrale even duur als turbines; TNO-conclusie na uitgebreid onderzoek. (2025, 18 oktober). De Telegraaf.

Kerncentrale in Theodorushaven is een 'proefballon'. (2025, 10 december). BN DeStem.

Kerncentrale of niet, Meierijstad houdt vast aan plannen voor energie uit wind en zon. (2025, 24 december). BN DeStem.

Kerncentrale-angst wordt misbruikt. (2025, 20 juni). De Telegraaf.

Kerncentrales kunnen bijna overal. (2025, 9 december). Eindhovens Dagblad.

Kerncentrales, Westerscheldetunnel en PFAS: dit willen de politieke partijen voor Zeeland. (2025, 27 oktober). HLN.

Kernenergie is geen vies woord meer. (2025, 7 oktober). Amersfoortse Courant.

"Kernenergie kan een nuttige aanvulling zijn." (2025, 18 oktober). Leeuwarder Courant.

Kernenergie veel te belangrijk om aan een paar gemeenten over te laten. (2026, 20 januari). De Telegraaf.

Kernenergie. (2025, 7 november). De Telegraaf.

Kernenergie. (2026, 20 januari). De Telegraaf.

Killemaes, D. (2026, 15 januari). *"Nucleaire energie creëert maatschappelijke meerwaarde"; Magali Vercammen over de toekomst van kernenergie.* Trends.

Kleine kerncentrales, SMR's - WISE. (2025, 21 juli). WISE. <https://wisenederland.nl/artikel/kleine-kerncentrales-smrs/>

Klimaatakkoord (door Den Haag). (2019). <https://english.rvo.nl/sites/default/files/2020/07/National%20Climate%20Agreement%20The%20Netherlands%20-%20English.pdf>

Konon, A. (n.d.). *Futurium | REGIO Peer2Peer Communities - De kringloop sluiten: de circulaire economie bevorderen met eco-industriële parken.* <https://futurium.ec.europa.eu/en/regio-peer-2-peer-communities/news/closing-loop-advancing-circular-economy-eco-industrial-parks>

Lelieveldt, H., & Schram, W. (2022). *Waar zijn de burgers? Het ontrafelen van de scheve aard van stakeholderparticipatie in de Nederlandse regionale energietransitie.* Energy Research & Social Science, 96, 102925. <https://doi.org/10.1016/j.erss.2022.102925>

Ministerie van Economische Zaken en Klimaat. (2025, 7 augustus). *Kernenergie in Nederland. Ministerie van Economische Zaken en Klimaat.* <https://www.overkernenergie.nl/english>

Ministerie van Economische Zaken en Klimaat. (2026, 18 februari). *Overzichtskaart Nationale Energieprojecten Zeeland februari 2026. Ministerie van Economische Zaken en Klimaat.* <https://www.overkernenergie.nl/documenten/2026/02/18/overzichtskaart-nationale-energieprojecten-zeeland-februari-2026>

Ministerie van Infrastructuur en Waterstaat. (2023, 11 augustus). *Kamerbrief over voornemen overname aandelen Gemeenschappelijke Kernenergiecentrale Nederland door de Staat.* Kamerstuk | Rijksoverheid.nl. <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/05/16/voornemen-overname-aandelen-gemeenschappelijke-kernenergiecentrale-nederland-door-de-staat>

Net een shotje 'nucleaire energie'. (2025, 24 januari). Het Parool.

Netherlands, S. (2023, 3 oktober). *Akkerbouwgewassen; productie, naar regio 1994-2023.* Centraal Bureau voor de Statistiek. <https://www.cbs.nl/en-gb/figures/detail/7100eng?>

Nijmeijer, A. (2025, 12 mei). *Actiedag tegen kernenergie in Zeeland: "Voor 20 miljard kun je zoveel andere dingen doen."* BN DeStem.

Nijmeijer, A. (2025, 16 december). *Steun in Zeeland voor kerncentrales kan ook verdampen: "Bij een ramp is de groep tegenstanders snel 90 procent."* BN DeStem.

Nijmeijer, A. (2025, 19 december). *Laat Zeeland niet het Groningen worden.* Provinciale Zeeuwse Courant.

North Sea Port | North Sea Port. (2026, 1 april). <https://www.northseaport.com/en>

Omroep Zeeland. (n.d.). *Hoogspanning-slijn net in bedrijf, maar binnenkort al te klein?* <https://www.omroepzeeland.nl/nieuws/17551734/hoogspanningslijn-net-in-bedrijf-maar-binnenkort-al-te-klein>

Onderwerpen: Energie. (n.d.). <https://vauban.de/en/topics/energy>

OpenStreetMap contributors. (2026). OpenStreetMap-data-extract voor Zeeland, Nederland. Geraadpleegd via Geofabrik. <https://download.geofabrik.de/europe/netherlands.html>

Opmeer op weg naar kerncentrale. (2026, 17 februari). De Telegraaf.

Over het EU ETS. (n.d.). *Klimaatactie.* https://climate.ec.europa.eu/eu-action/carbon-markets/about-eu-ets_en

Over SDR | Smart Delta Resources. (n.d.). <https://www.smartdeltaresources.com/en/about-sdr>

PDvZ ziet een kleine kerncentrale in Zoetermeer, maar de gemeenteraad niet. (2026, 13 februari). Algemeen Dagblad.

Pedersen, E., & Persson Waye, K. (2007). *Geluid van windturbines, hinder en zelfgerapporteerde gezondheid en welzijn in verschillende leefomgevingen.* Occupational and Environmental Medicine, 64(7), 480–486. <https://oem.bmj.com/content/64/7/480.short>

Provinciale Zeeuwse Courant. (n.d.). *Alleen als men rommel kwijt wil, zijn we het geschikte deel van Nederland*

Publicatie Operationeel Plan Transitie Industrie Cluster Zeeland/West-Brabant (OPTICZ) | Smart Delta Resources. (n.d.). <https://www.smartdeltaresources.com/publicatie-operationeel-plan-transitie-industrie-cluster-zeelandwest-brabant-opticz>

Redactie. (2022, 16 juli). *Van het Duitse anti-atoomsucces kunnen de Nederlandse activisten alleen maar dromen.* Tubantia.

Rijksinstituut voor Volksgezondheid en Milieu. (2020). *Gezondheidseffecten gerelateerd aan geluid van windturbines: een update (RIVM-rapport 2020-0150).* <https://www.rivm.nl/>

bibliotheek/rapporten/2020-0150.pdf

Rijksinstituut voor Volksgezondheid en Milieu. (2023, 24 april). *RIVM-handreiking berekening magneetveldzone, versie 5.0.* <https://www.clo.nl/indicatoren/nl213507-woningen-in-indicatieve-zones-hoogspanningslijnen-2000-2023>

Rijksinstituut voor Volksgezondheid en Milieu. (2024, 18 maart). *Herijkt voorzorgbeleid.* https://www.rivm.nl/documenten/rivm-handreiking-berekening-magneetveldzone-versie-5_0-21-april-2023

Rösler, H., Beurskens, L., Londo, M., & ECN. (2016). *Zeeuwse energietransitie kansenkaart (ECN-E--16-024).*

Schoonhoven, S., & Van der Schoot, E. (2021, 18 december). *Na decennia van protest nu plan voor kernenergie.* De Limburger.

Schoors, K. (2025, 17 februari). *Vijf redenen waarom we beter niet voor nucleaire energie kiezen.* De Morgen.

smartdeltaresources.nl, Dekker, M., & Beek, A. V. (2024). *Cluster Energie Strategie (CES) 3.0.* <https://www.smartdeltaresources.com/sites/default/files/media-files/SDR%20CES%203.0%20rapport.pdf>

Startpagina - Windpark Midden Betuwe. (2026, 27 maart). *Windpark Midden Betuwe.* <https://windparkmiddenbetuwe.nl/>

Nucleair risico. (n.d.). <https://nucleairrisico.be/nl>

Startpagina. (n.d.). Planbureau voor de Leefomgeving. <https://www.pbl.nl/>

Stegenga. (2025, 5 april). *Meerderheid in Flevoland voor kerncentrale.* De Stentor.

Straver, F. (2024, 20 mei). *Woede, gejubel en twijfel: geen energievorm maakt zoveel emotie los als kernenergie.* Trouw.

Straver, F. (2024, 9 maart). *Yvonne protesteerde eerst tegen kernenergie, maar is nu vóór.* Trouw.

Tielens, T., & De Waard, P. (2025). *SMR Zeeland 2050. In Provincie Zeeland, Impuls Zeeland, & Smart Delta Resources, Eindrapport.*

TNO. (2025, 7 juli). *Impact van de import van hernieuwbare energie en grondstoffen op de Nederlandse industrie*. tno.nl/en. <https://www.tno.nl/en/newsroom/insights/2025/06/future-energy-intensive-industry/>

Uslu, A., & Oliveira, C. (2024). *Verkenning van transitiestrategieën in Nederlandse raffinaderijen en de organische chemische industrie voor klimaatbeleid*. In TNO Public, TNO Public (pp. 3–78) [Rapport]. TNO. <https://publications.tno.nl/publication/34643179/Mdrh6ZRw/TNO-2024-R11075.pdf>

Valkenberg, S. (2026, 17 februari). *Vergeet de moskee, organiseer een schoolreisje naar Borssele*. De Telegraaf.

Van Der Niet, S., Rooijers, F., Van Der Veen, R., Meijer, M., Vendrik, J., Scholten, T., CE Delft, Van Lieshout, M., Croezen, H., & Royal HaskoningDHV. (2020). *Systeemstudie energie-infrastructuur Zeeland* (Rapport 20.190283.0035). CE Delft. <https://www.ce.nl>

Van Gelder, L., & Van Gelder, L. (2025, 29 januari). *LISA: een digitale schatkamer voor ruimtelijk-economisch onderzoek*. Convergence. <https://convergence.nl/nl/lisa-een-digitale-schatkamer-voor-ruimtelijk-economisch-onderzoek/>

Verduurzamen industrie | Provincie Zeeland. (n.d.). <https://www.zeeland.nl/onderwerpen/energie-en-klimaat/verduurzamen-industrie>

Vóór 2040 een kerncentrale in Opmeer? “Niet realistisch”; discussieorganisatie die zich inzet tegen kernenergie maakt zich zorgen. (2026, 30 januari). Noordhollands Dagblad.

WarmtelinQ. (n.d.). WarmtelinQ.

We zouden best een kleine kerncentrale willen hebben. (2025, 18 november). De Gooi- en Eemlander.

Wetenswaardigheden over kernenergie - WISE. (2021, 6 mei). WISE. <https://wisenederland.nl/artikel/wetenswaardigheden-over-kernenergie/>

Windparkzone Borssele. (n.d.). *Noordzeeloket UK*. <https://noordzeeloket.nl/en/functions-use/offshore-energy-transition/off->

[shore-wind-energy/free-passage-shared-use/borssele-wind-farm-zone/](https://noordzeeloket.nl/en/functions-use/offshore-energy-transition/offshore-wind-energy/free-passage-shared-use/borssele-wind-farm-zone/)

9.2 Data

TNO. (2025, 7 juli). *Impact van de import van hernieuwbare energie en grondstoffen op de Nederlandse industrie*. tno.nl/en. <https://www.tno.nl/en/newsroom/insights/2025/06/future-energy-intensive-industry/>

Uslu, A., & Oliveira, C. (2024). *Verkenning van transitiestrategieën in Nederlandse raffinaderijen en de organische chemische industrie voor klimaatbeleid*. In TNO Public, TNO Public (pp. 3–78) [Rapport]. TNO. <https://publications.tno.nl/publication/34643179/Mdrh6ZRw/TNO-2024-R11075.pdf>

Valkenberg, S. (2026, 17 februari). *Vergeet de moskee, organiseer een schoolreisje naar Borssele*. De Telegraaf.

Van Der Niet, S., Rooijers, F., Van Der Veen, R., Meijer, M., Vendrik, J., Scholten, T., CE Delft, Van Lieshout, M., Croezen, H., & Royal HaskoningDHV. (2020). *Systeemstudie energie-infrastructuur Zeeland* (Rapport 20.190283.0035). CE Delft. <https://www.ce.nl>

Van Gelder, L., & Van Gelder, L. (2025, 29 januari). *LISA: een digitale schatkamer voor ruimtelijk-economisch onderzoek*. Convergence. <https://convergence.nl/nl/lisa-een-digitale-schatkamer-voor-ruimtelijk-economisch-onderzoek/>

Verduurzamen industrie | Provincie Zeeland. (n.d.). <https://www.zeeland.nl/onderwerpen/energie-en-klimaat/verduurzamen-industrie>

Vóór 2040 een kerncentrale in Opmeer? “Niet realistisch”; discussieorganisatie die zich inzet tegen kernenergie maakt zich zorgen. (2026, 30 januari). Noordhollands Dagblad.

WarmtelinQ. (n.d.). WarmtelinQ.

We zouden best een kleine kerncentrale willen hebben. (2025, 18 november). De Gooi- en Eemlander.

Wetenswaardigheden over kernenergie - WISE. (2021, 6 mei). WISE. <https://wisenederland.nl/artikel/wetenswaardigheden-over-kernenergie/>

Windparkzone Borssele. (n.d.). *Noordzeeloket UK*. <https://noordzeeloket.nl/en/functions-use/offshore-energy-transition/offshore-wind-energy/free-passage-shared-use/borssele-wind-farm-zone/>

9.3 AI Statement

AI Use Statement

This report may include the use of artificial intelligence (AI) tools (such as large language models and generative image tools) to support specific tasks, including language editing, structuring of text, and preliminary idea exploration.

The authors understand that all TU Delft produced publications are subject to AI scanning and that all use of AI must be transparently disclosed in this report.

All substantive content, including research design, analysis, interpretation, and project development, was produced by the authors. AI tools were used as assistive instruments and not as a substitute for critical thinking, academic judgement, or original work.

All sources have been independently verified by the authors. Any content generated with the assistance of AI has been reviewed, edited, and validated to ensure accuracy, relevance, and compliance with academic standards.

The authors remain fully responsible for the content, integrity, and originality of this report



10.

Appendix

Position papers

- 10.1 WISE | Elerina Karlou
- 10.2 NEO NL | Kiki van der Veen
- 10.3 Agricultural landowners | Mila Veenboer
- 10.4 Ministerie van Economische Zaken |
Stepan Prikazchikov

Just Zeeland?

A promising energy future of the province

What is just Zeeland?
Just Zeeland is an energy vision for the province in 2100. It promises a resilient and equitable energy landscape built on decentralized systems that empower local communities and economies, while collaborating with shared infrastructures in order to align and benefit from the Netherlands’ national energy transition and the constant rise of energy demand.

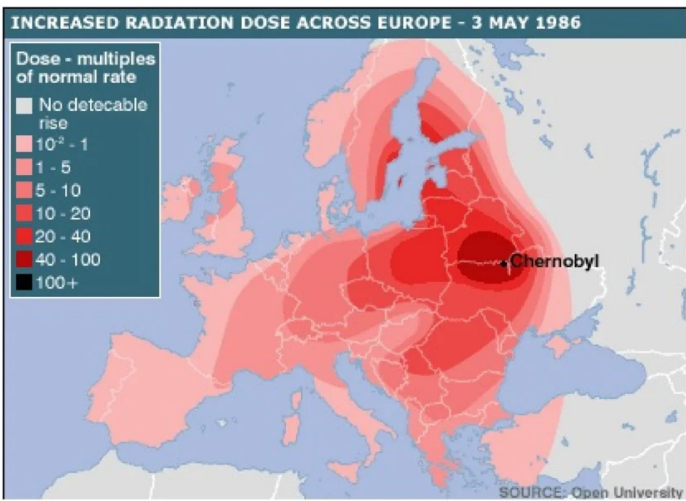
How did just Zeeland start?
Just Zeeland started as an energy alternative project that suggests moving away from fossil fuels to renewable energy systems, while phasing out nuclear energy! We as WISE support this movement as our main focus is to give alternative solutions in order to change the energy system and develop

democratic and sustainable tools for energy transition (Over WISE - WISE, 2025). Moreover, Just Zeeland prioritizes communities that can become vulnerable during an energy transition, like village residents and industry workers, while incorporating their vision in their proposal in a symbiotic scenario. We support this idea as major goal of the organization is empowering citizens and groups critically engage with the policies and plans of the government in power and supporting participatory processes and bottom-up solutions. Finally, Just Zeeland advocates for the settlements and landscape protection and gives priority to sustainable transformation and development of the industrial areas.

Shared Position: A Nuclear-Free Energy Future
We, as WISE, share a strong alignment with Just Zeeland in rejecting nuclear energy as part of the future energy system. We support a transition towards a nuclear-free energy future due to the significant environmental, social, and economic risks associated with nuclear power.

WISE, supports the anti-nuclear perspective of Just Zeeland in the future energy system, as we strongly advocate against nuclear energy. We share the opinion that nuclear energy is neither sustainable nor clean and it is a safety hazard. Nuclear power is fueled with uranium and the production generates radioactive waste, which cannot be safely stored (WISE, 2023). Moreover, historical disasters like Harrisburg (USA), Chernobyl (Ukraine) and Fukushima (Japan), make it even harder to trust this energy type due to severe and long-lasting risks associated with this technology.

This shared anti-nuclear position creates a strong foundation for a renewable-based transition and reflects a common commitment to environmental protection and intergenerational responsibility.

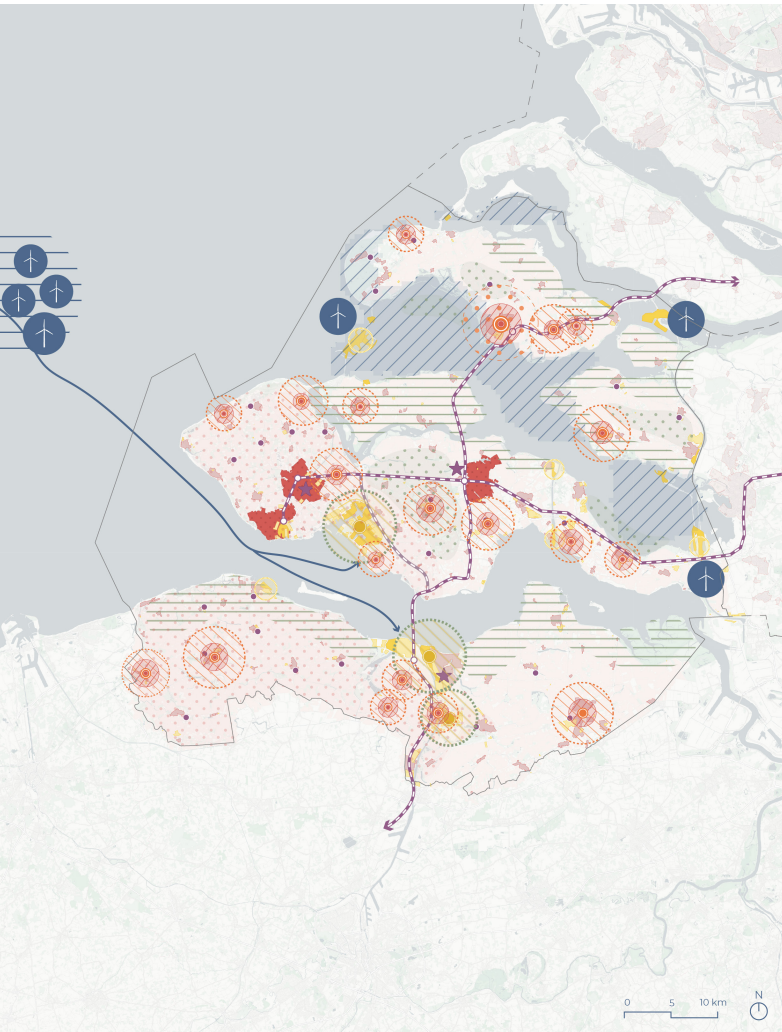


Reconstructed deposition map of Caesium (Cs-137) in Europe after the Chernobyl accident

How about energy poverty?
Energy poverty is becoming a very important issue, as people who cannot economically handle sustainable energy tools for their home are segregated from the energy transition. People living in energy poverty cannot often escape this situation and they have to pay a substantial part of their income on fossil fuel driven power (Energiearmoede - WISE, 2026).

While Just Zeeland makes a legitimate effort to address spatial justice, it tends to overlook these critical social dimensions. A just energy transition must ensure that all individuals have access to affordable and sustainable energy, rather than reproducing or deepening existing inequalities.

Addressing energy poverty should therefore be a central component of the vision, ensuring that vulnerable groups are not excluded from the benefits of the transition.



Fukushima: Abandoned Urban Landscape

Combined vision

- Settlements & landscape protection**
 - Village protection zones with decentralised energy clusters
 - Cultural landscape protection areas
 - Expanded biodiversity areas
 - Expanded wetlands/floodplains
 - Landscape buffers for industry
- Economic & urban development**
 - Sustainable urban development
 - Sustainable redevelopment of inland ports
 - Innovation & knowledge hubs
- Agriculture**
 - Regenerative agricultural systems
- Existing spatial structure**
 - Settlements
 - Industrial areas
 - Ports
 - Agricultural land
- Energy system**
 - Wind turbine clusters
 - Potential wind turbines
 - Offshore wind

Alignment and Conflicts

WISE’s position largely aligns with Just Zeelands vision of a community oriented energy transition and renewable energy based on spatial justice, while strengthening local autonomy. However, an implication between these visions would be that WISE supports energy conservation while Just Zeeland takes for granted that energy demand will remain constant if not higher.

Moreover, we are not a fan of the role of industry. While Just Zeeland develops a plan for industrial activity as part of the provinces economy, we question the long term sustainability of energy- intensive industries in the region. We suggest of reconsidering the scale and necessity of such industries.

While Just Zeeland seeks to balance renewable energy with landscape preservation, we advocate for a stronger prioritization of renewable infrastructure, as we believe the spatial conflicts can be overcome.

Spatial Vision - WISE edition

From a spatial perspective, we reinterpret the Just Zeeland vision by prioritizing renewable energy production and reducing the area of influence of industrial systems. This includes expanding offshore and onshore wind energy and reducing energy-intensive industrial zones.

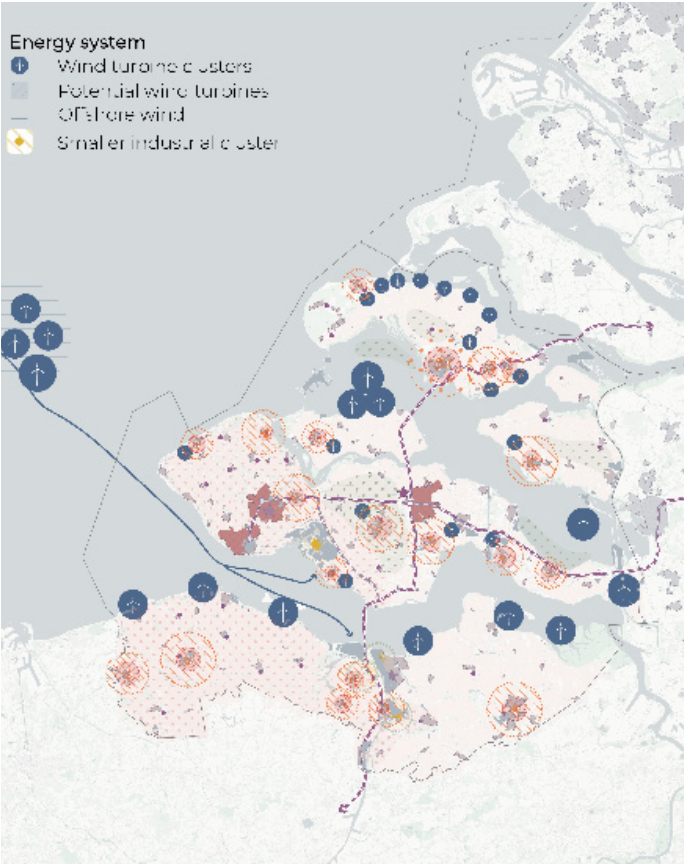
Conclusion

We support the Just Zeeland’s honest effort to diversify from the energy intensive future with nuclear infrastructures that is planned for the province and we appreciate their community oriented approach to the matter. Its vision represents an important step towards a more sustainable and equitable future.

However, we argue that the transition could be strengthened by placing greater emphasis on renewable energy expansion and the reconsideration of energy-intensive industrial activities. Addressing energy poverty and prioritizing environmental justice are

also essential for achieving a truly inclusive transition.

A just energy future for Zeeland requires not only technological change, but also a transformation of spatial priorities and societal values.



Bibliography

- Hegger, D. L. T., Mees, H. L. P., & Wamsler, C. (2022). The role of citizens in sustainability and climate change governance: Taking stock and looking ahead. *Environmental Policy and Governance*, 32(3), 161–166. <https://doi.org/10.1002/eet.1990>
- Hegger, D. L., Mees, H. L., Driessen, P. P., & Runhaar, H. A. (2017). The Roles of Residents in Climate Adaptation: A systematic review in the case of the Netherlands. *Environmental Policy and Governance*, 27(4), 336–350. <https://doi.org/10.1002/eet.1766>
- Wamsler, C., & Brink, E. (2013). Interfacing citizens’ and institutions’ practice and responsibilities for climate change adaptation. *Urban Climate*, 7, 64–91. <https://doi.org/10.1016/j.uclim.2013.10.009>
- Wamsler, C., & Raggars, S. (2018). Principles for supporting city–citizen commoning for climate adaptation: From adaptation governance to sustainable transformation. *Environmental Science & Policy*, 85, 81–89. <https://doi.org/10.1016/j.envsci.2018.03.021>
- Over WISE - WISE. (2025, September 9). WISE. <https://wisenederland.nl/over-wise/>
- TNO. (2022, September 7). Ambitieuze scenario's voor klimaatneutraal energiesysteem. [tno.nl/nl. https://www.tno.nl/nl/newsroom/2022/04/ambitieuze-scenario-klimaatneutraal/](https://www.tno.nl/nl/newsroom/2022/04/ambitieuze-scenario-klimaatneutraal/)
- Locaties voor nieuwe kerncentrales - WISE. (2025, July 22). WISE. <https://wisenederland.nl/artikel/factsheet-lokatie-kerncentrales/>
- Greenpeace Nederland. (2025, March 4). Nederland klimaatneutraal in 2040: een haalbaarheidanalyse | Greenpeace Nederland | Voor een groene,. Greenpeace Nederland. https://www.greenpeace.org/nl/klimaat-categorie/67513/klimaatneutraal-2040-analyse/?fbclid=PAZXh0bgNhZW0CMTEAAaZ_xgKPCugNLysopncjmvdpYHGr6nxx5YhK5jTiDiW2XQWf3acx_mavAaL_aem_5Q0A6tfj_9S33xfKE3pJBQ
- Kerncentrales in een Klimaatneutraal Energiesysteem, revised version WISE - WISE. (2020, September 16). WISE. <https://wisenederland.nl/rapport/kerncentrales-in-een-klimaatneutraal-energiesysteem-revised-version-wise/>
- Busink, L., & Busink, L. (2023b, April 12). Experts bevestigen: Niet kernenergie, maar energiebesparing noodzakelijk voor klimaat. WISE. <https://wisenederland.nl/experts-bevestigen-niet-kernenergie-maar-energiebesparing-noodzakelijk-voor-klimaat/>
- Is kernenergie duurzaam? - WISE. (2023, August 21). WISE. <https://wisenederland.nl/artikel/is-kernenergie-duurzaam/>
- Energiearmoede - WISE. (2026, March 4). WISE. <https://wisenederland.nl/campagne/energiearmoede/>
- Teodoriu, L., Ungureanu, M. C., Leustean, L., Preda, C., Ciobanu, D., Grierosu, I., Matei, M., Iacob, R., & Stefanescu, C. (2021). Updated Incidence of Thyroid Cancer in the North East Region of Romania after 35 Years of Chernobyl Fallout. Is There a Link between? *Diagnostics*, 11(5), 907. <https://doi.org/10.3390/diagnostics11050907>
- Staff, N. (2024, August 5). Fukushima: The ghost towns behind the gates. NPR Visuals. <https://apps.npr.org/fukushima/>
- Prikazchikov, S., Veenboer, M., Van De Veen, K., & Karolou, E. E. (n.d.). Just Zeeland?: A place based and community driven alternative to centralised energy production.

Towards a stable and efficient energy system in Zeeland

The position of NEO NL on the regional energy transition

The role of NEO NL in Zeeland

The energy transition in Zeeland lies at the intersection of local spatial quality and national energy security. We, the Nuclear Energy Organisation Netherlands (NEO NL), participate in this deliberative arena as the organisation in charge of the development, construction and operation of two new nuclear power plants (NEO NL, 2026; Ministerie van Economische Zaken en Klimaat [EZK], 2024).

We acknowledge the community vision of rural delta residents, who seek a balance between quality of life, landscape quality and energy development. This broader community consists of various sub-communities with different interests and values. While we support the ambition to protect quality of life and landscape, we explicitly reject the strong focus on decentralisation in the current community vision, as this undermines the technical feasibility and spatial cohesion of the energy transition (EZK, 2023).

The industrial cluster in Zeeland produces around 15% of the country's industrial CO₂ emissions. Making this cluster more sustainable means it needs around 200 PJ of energy, a scale that cannot be achieved using only local systems (Smart Delta Resources [SDR], 2024).

We argue that Zeeland must function as a national energy infrastructure hub, with large-scale nuclear energy in the Sloe area forming the basis of a secure and climate-neutral energy system (EZK, 2024). Our position prioritises system stability and national energy security, and therefore challenges a primarily local, decentralised approach as proposed in the current community vision.

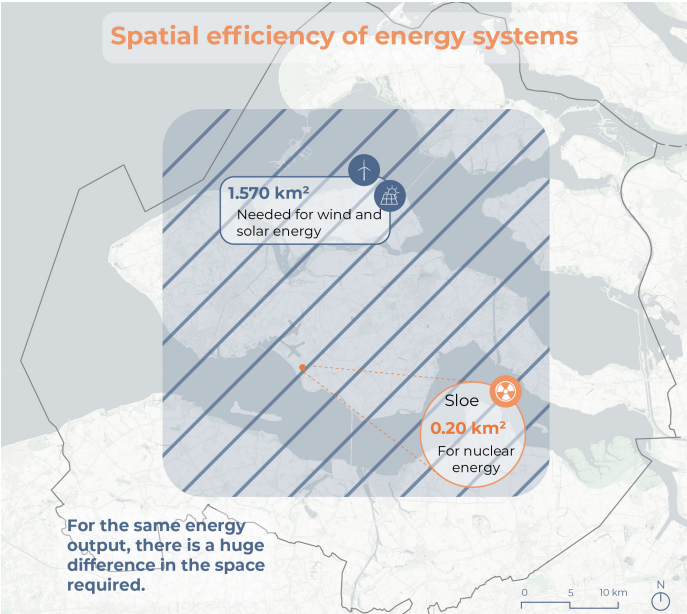


Figure 2 | Spatial efficiency of energy systems

Core beliefs: stability and space efficiency

Our position is based on core policy beliefs centred on technological innovation and large-scale infrastructure (Jenkins-Smith & Weible, 2025, as cited in Balz, 2026). Rural residents value the protection of their living environment highly, although we highlight that an energy system dependent on weather conditions is less stable (EZK, 2023). Nuclear energy is currently the only CO₂-free energy source capable of providing constant baseload capacity (90% of the time) and is essential for a stable energy system (N.V. Elektriciteits-Produktie maatschappij Zuid-Nederland [EPZ], 2020; SDR, 2024).

Regarding the unique suitability of the Zeeuwse coast for this task, director Carlo Wolters noted:

“This is an ideal place for a nuclear power plant. There is enough cooling water here, COVRA is nearby for the nuclear waste. The knowledge is here. The infrastructure is there.” (Wolters, 2020, as cited in EPZ, 2020; p. 3).

Nuclear energy is also much more efficient in terms of land use. Three nuclear power stations together take up only 0.20 km², compared to around 1,570 km² needed for a similar amount of energy production using wind power. This is almost the entire land area of Zeeland (EPZ, 2020). NEO NL believes that concentrating energy production in the Sloe area helps to prevent large-scale fragmentation of the landscape (Province of Zeeland, 2025).

At the same time, we are aware that this concentration creates tension in terms of spatial justice, particularly in how impacts, risks and benefits are unevenly distributed across different communities.

The spatial and technical trade-off

The main issue in the Zeeland delta is not so much a choice between decentralised and centralised energy systems, but rather a decision between a fragmented, weather-dependent energy system and a centred, stable system (EZK, 2023).

An energy system based on decentralised sources requires much more space than a system based on nuclear energy. This leads to a clear spatial choice: large-scale transformation of the landscape, or concentration in industrial zones such as the Sloe area (EZK, 2024).

This choice affects sub-communities differently. Where village based residents place a high value on landscape conservation and quality of life, industrial workforce residents are dependent on the stability of the energy supply and the economy.

We argue that the phase-out of nuclear energy could lead to a big impact on the landscape, as it would need extra space for storage, backup facilities and grid upgrades (EZK, 2023). This outcome is therefore in conflict with the current community vision, in which landscape conservation plays a central role.

This trade-off highlights a critical issue of spatial justice: decentralised systems tend to distribute impacts and decision-making more widely across the territory, but require extensive land use, while centralised systems reduce overall spatial pressure yet concentrate impacts in specific locations. This reveals that spatial justice is not only about distribution, but also about the concentration of national energy functions. While this creates tension, we clearly prefer concentration to protect both system stability and landscape quality at regional scale.

Rejecting nuclear energy does not prevent spatial impact; it spreads and increases it across the entire regional landscape.

System integration and infrastructure

In the arena, we position ourselves as a defender of technical feasibility. From this perspective of deliberative governance, we argue that a transition is only justified when national security of supply and industrial viability are guaranteed (Balz, 2026; EZK, 2024).

Firstly, large-scale hydrogen production requires a constant electricity supply. Electrolysers (>100 MW) only operate efficiently with a stable baseload, which wind energy cannot provide (SDR, 2024; EZK, 2024). Without nuclear energy, the transition of industry towards sustainability will be delayed.

Secondly, the expansion of the electricity grid, including the 380 kV substation in the Sloe area, needs to be prioritised over local spatial concerns (RVO, 2024; SDR, 2024). This infrastructure is essential to avoid grid congestion.

Thirdly, we support the clustering of infrastructure along existing corridors, the ‘Energy Necklace’ principle (Ministry of KGC, 2024), to limit spatial fragmentation (EZK, 2024).

Our position does not align with the community vision, which places more focus on small-scale and locally integrated energy solutions. These arguments show that rejecting nuclear energy does not prevent spatial impact, but instead spreads and increases it.

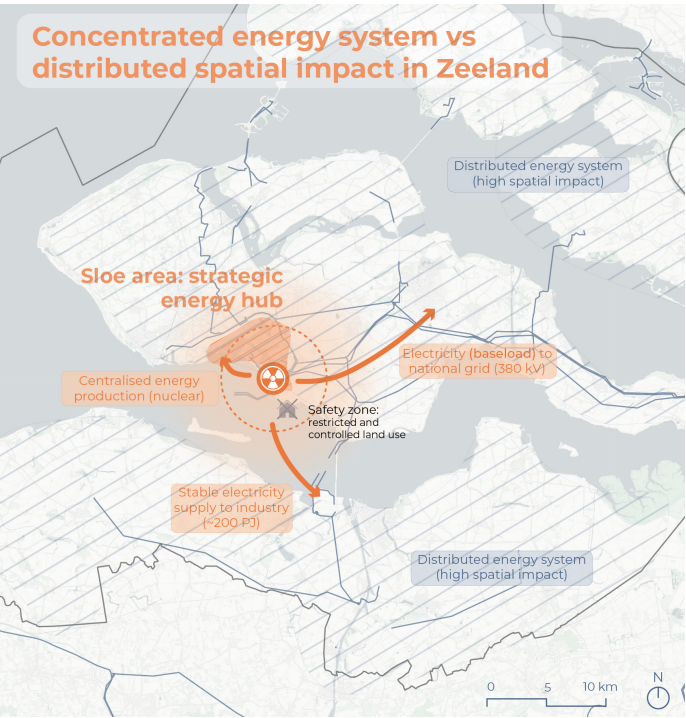


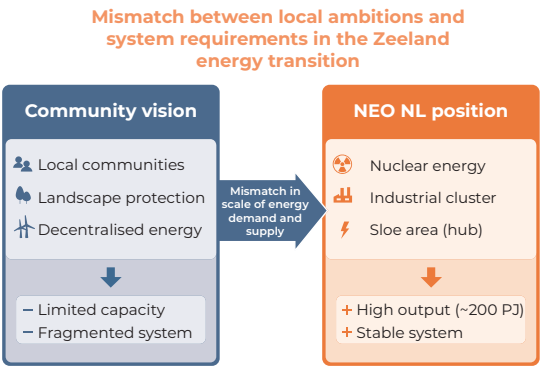
Figure 3 | Concentrated energy system

Spatial demands and governance implications

The Sloe area must remain a protected strategic location, free from conflicting land uses such as housing development or other vulnerable functions within the required safety zone (EZK, 2024). In addition, the construction phase requires temporary space for logistics and housing for employees (EPZ, 2020).

A direct link between nuclear power plants and energy storage is also needed to stabilise the power grid (EZK, 2024).

These arguments show that the energy transition is not only technical but also political. Prioritising national infrastructure over local wishes brings up questions about fairness in the process and the role of local communities. This implies that local communities may have limited influence over decision-making, as national energy priorities take precedence. We understand this tension but argue that national direction is needed to guarantee a reliable and affordable energy system.



This mismatch explains why decentralised systems cannot meet the regional energy demand.

Figure 1 | Our position

Justice and conclusion
We see system stability as a form of social justice, where future generations are not burdened with an unreliable or unaffordable energy system. At the same time, nuclear energy supports employment and economic stability in the region (EPZ, 2020; SDR, 2024).

This view of fairness is different from that of local communities, who focus more on participation and landscape protection. This highlights that the energy transition is actually a political balancing of different values and interests.

We conclude that Zeeland should position itself as a national nuclear energy hub, where concentrated energy production protects the broader landscape quality (EZK, 2024). This means the current community vision must be adapted, as its strong focus on decentralisation is incompatible with a stable and feasible energy system. Nuclear energy becomes a central element in the region's future development.

Author	Kiki van der Veen 6343651
Supervisors	Alex Wandl & Marcin Dabrowski
Course	AR2U086 R and D Studio: Spatial Strategies for the Global Metropolis
Project	Group 3.2 Just Zeeland?

Sources

Balz, V. E. (2026). *Positioning communities in the deliberative governance of sustainability transitions: Introduction to the individual assignment*. Research & Design Studio Spatial Strategies for the Global Metropolis, Delft University of Technology

N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland (EPZ). (2020). *Visie EPZ op kernenergie in Nederland na 2033. Borssele: N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland*.

Jenkins-Smith, H. C., & Weible, C. M. (2025). *The Advocacy Coalition Framework*. As cited in Balz, V. E. (2026).

Ministerie van Klimaat en Groene Groei (KGG). (2024). *Nationale energie-infrastructuurprojecten in Nederland*. Editie 2024. Den Haag: Ministerie van Klimaat en Groene Groei.

Ministerie van Economische Zaken en Klimaat (EZK). (2023). *Nationaal Plan Energiesysteem*. Den Haag.

Ministerie van Economische Zaken en Klimaat (EZK). (2024). *Programma Energiehoofdstructuur*. Ruimte voor een klimaatneutraal energiesysteem van nationaal belang. Den Haag.

NEO NL. (2026). *Onze opgave: Kernreactoren in Nederland*. Retrieved March 19, 2026, from <https://www.neonl.nl>

Provincie Zeeland. (2025). *Energievisie Zeeland: Definitief ontwerp april 2025*. Middelburg.

Rijksdienst voor Ondernemend Nederland (RVO). (2024). *Hoogspanningsstation omgeving Sloegebied: Participatieplan en Integrale Effectenanalyse*. Retrieved from <https://www.rvo.nl>

Smart Delta Resources. (2024). *Schelde-Deltaregio: Cluster Energie Strategie (CES) 3.0*. Smart Delta Resources in samenwerking met Quo Mare.

From: Agricultural Landowners
To: Provincial Council of Zeeland
Date: March 25, 2026
Subject: Response to the 2100 Vision

Dear Sir/Madam,

We hereby submit the views of local agricultural landowners regarding the draft Vision for 2100.

As farmers in Zeeland, we have taken note of the Vision 2100 (image 2), in which nuclear energy is gradually phased out and replaced by various clusters of renewable energy around the villages. We support the transition to a more sustainable energy system and recognize that, as agricultural landowners, we can play an important role in this. However, upon reviewing the vision, we also have serious concerns about the spatial implementation. As soon as multiple energy clusters are placed in the landscape, our valuable agricultural land risks being sacrificed, while there appears to be little direct local benefits, as illustrated by the pressure zones shown in Image 3. That is why we advocate for an approach that prioritizes early participation, careful spatial considerations, and the preservation of landscape qualities.

Looking at this vision, our main concern is not sustainability itself, but the way in which the agricultural landscape is once again expected to bear the spatial burden. The proposed futurerenewable energy clusters around the villages seem like a logical solution, but we want to emphasize that these are not being placed in an “empty” space. They would be located in a fertile landscape that is intensively used for food production, livestock farming, or farm operations. This is a particularly critical issue in Zeeland, as the province itself acknowledges that farmers in the Bevelanden, Borsele, and Walcheren regions are already experiencing significant disruption from existing energy developments. New clusters, together with the associated infrastructure, will place additional pressure on our sector and other stakeholders involved (Provincie Zeeland, n.d.).

This pressure and the lack of participation are causing frustration among some farmers. PZC previously reported that farmers involved in cable projects in Zeeland did

not so much object to the interventions themselves, but rather to the way they were treated throughout the process (PZC, 2022). This frustration does not appear to be an isolated incident. According to the Southern Agriculture and Horticulture Organisation (ZLTO), a survey among 97 farmers in Zeeland and North Brabant showed that grid operators, such as TenneT, received failing scores on ten out of eleven criteria. For instance, they entered farmyards without consultation, failed to deal properly with damage, and disrupted growing seasons. As a result, farmers felt pressured by them, while the consequences for their businesses were barely taken into account (ZLTO, 2025). This confirms to us that agricultural land is still too often viewed as available space, rather than the land of a farming business. For us, the energy transition is not the problem, but the lack of communication and the uncertainty surrounding what will ultimately happen to our land.

At the same time, we would like to emphasize once again that farmers are not necessarily opposed to renewable energy. Farmer Kees Steendijk from Kamperland is one of the examples showing that sustainability is indeed possible, provided it aligns with the agricultural business and is carefully integrated into the landscape. According to an interview with PZC, Steendijk has a small wind turbine approximately twenty meters high, located about sixty meters from his farm buildings. In addition, the roof of his farm building is covered with solar panels, making him self-sufficient and ensuring the installation has a minimal visual impact on the landscape (Balkenende, 2023).

His situation is relevant to our perspective, in which we are willing to participate in an energy transition. However, this is only possible if the landscape’s qualities are respected, and energy facilities are not placed separately from agricultural operations but rather contribute to agricultural business operations, as illustrated in image 1, where small windturbines are places on the land and solar panels are

mainly integrated in existing roofs. ZLTO also emphasizes that farmers’ interests must be better safeguarded from the outset in the new RES plans. In their view, existing rooftops should be utilized as much as possible first, rather than installing solar parks on fertile farmland for large new energy developments (Schel, 2021).



Image 1

If Vision 2100 proceeds and renewable energy takes up a larger place in the Zeeland landscape, this could have consequences for us. That is why we believe this can only happen under clear conditions. First and foremost, we want to be involved in the planning process at an early stage and not just be informed once the spatial decisions have already been finalized. Recent Zeeland documents on regional investments in offshore wind show that it is essential to establish clear agreements regarding governance, regional cooperation, and an area-based approach is essential for new energy developments (Province of Zeeland, 2025). For us, this means that we want genuine, meaningful say in the location, scale, and form of installations. In addition, we believe it is important to first consider logical locations such as farmyards, rooftops, infrastructure, and already disturbed sites before allocating fertile agricultural land to new energy developments. Both Zeeland’s provincial policy and LTO emphasize that these types of locations must be utilized first before open agricultural land is considered (Province of Zeeland, 2025; LTO

Netherlands, 2025). Support for the energy transition can only emerge from our sector if there is careful integration into the landscape, demonstrable clear local benefits or fair compensation, and if our business operations are protected (Province of Zeeland, 2025; ZLTO, 2025).

In summary, we wish to express our support for an energy transition toward a sustainable Zeeland, but not through an approach in which the agricultural sector is treated as readily available space without equal involvement. We therefore ask you to fully incorporate our conditions regarding participation, careful integration into the landscape, local benefits, and the prior use of alternative locations into the further development of the Vision 2100. Only by treating farmers as equal partners can a sustainable energy transition take place that is not only future-proof but also does justice to the landscape in which people live and work. We look forward to discussing this with you in the near future.

Sincerely,

On behalf of local agricultural landowners in Zeeland

Vision created for 2100

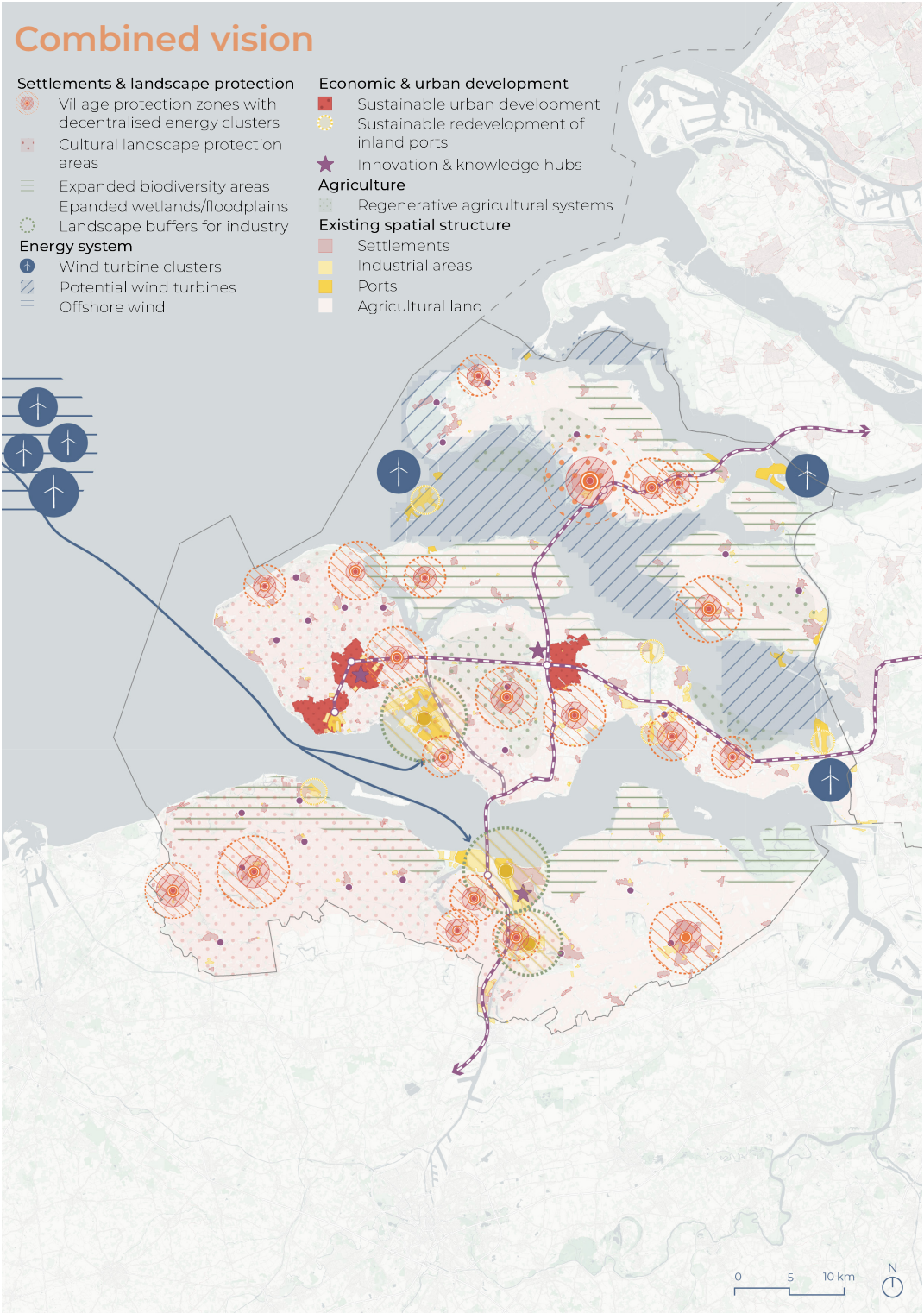


Image 2

Pressure zones for agriculture landowners

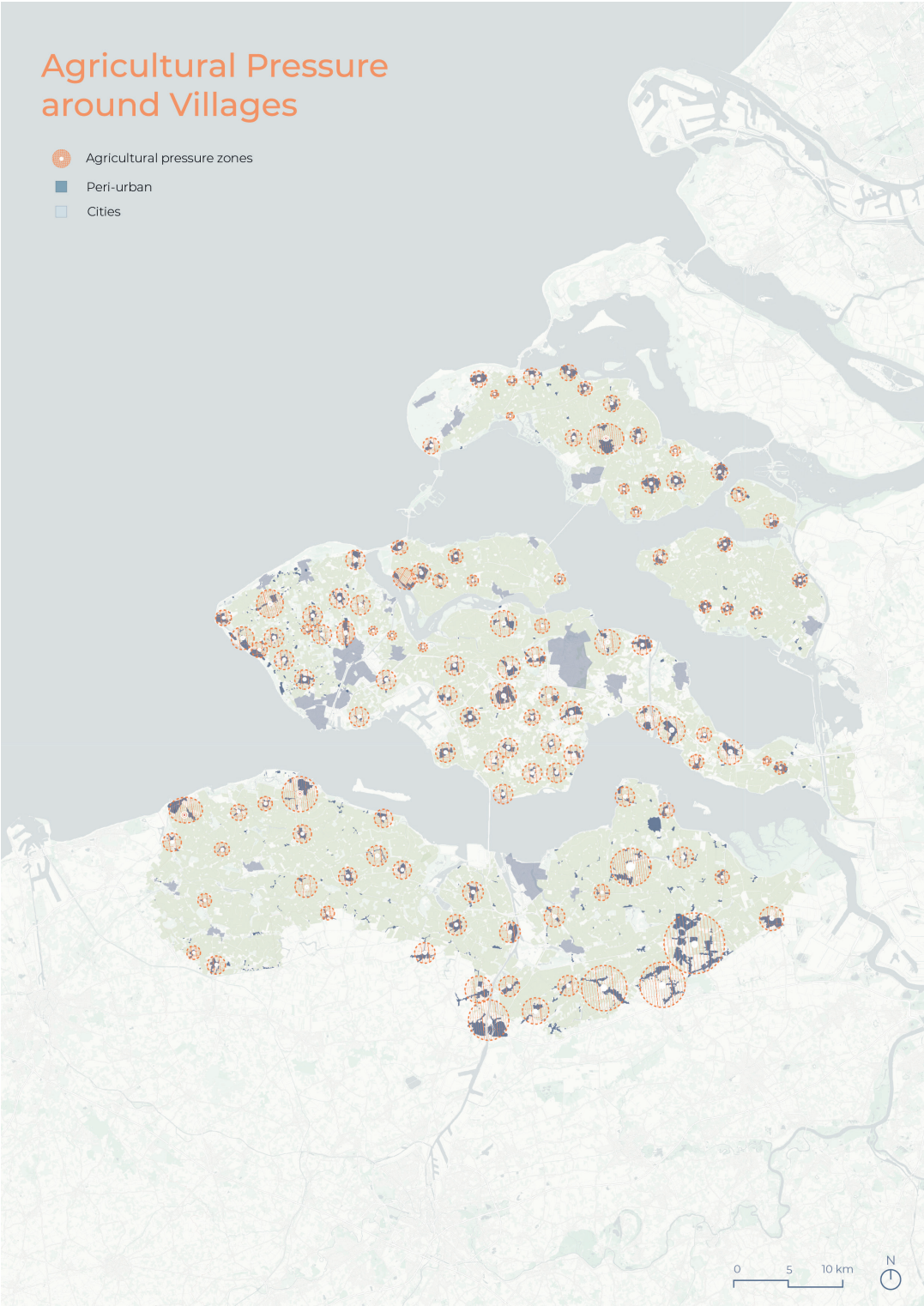


Image 3

Sources

Balkenende, F. (2023, 23 March). *Dankzij een kleine molen gaat het boer Kees uit Kamperland voor de wind, toch staat niet elke gemeente dit toe*. PZC. Retrieved 19 March 2026, from <https://www.pzc.nl/zeeuws-nieuws/dankzij-een-kleine-molen-gaat-het-boer-kees-uit-kamperland-voor-de-wind-toch-staat-niet-elke-gemeente-dit-toe~aeb1c17b>

LTO Nederland. (2025, 15 December). *Reactie LTO internetconsultatie ontwerp Nota Ruimte*. Retrieved 19 March 2026, from <https://www.lto.nl/wp-content/uploads/2025/12/2025-12-15-Reactie-LTO-internetconsultatie-ontwerp-Nota-ruimte-jho.pdf>

Provincie Zeeland. (n.d.). *Gebiedsinvesteringen wind op zee in Zeeland*. Retrieved 19 March 2026, from <https://www.zeeland.nl/onderwerpen/energie-en-klimaat/gebiedsinvesteringen-wind-op-zee-zeeland>

PZC. (2022, 22 May). *Boeren balen van kabels in de grond, maar vooral van hoe ze behandeld worden: "Eigenlijk is dit chantage"*. PZC. Retrieved 19 March 2026, from <https://www.pzc.nl/bevelanden/boeren-balen-van-kabels-in-de-grond-maar-vooral-van-hoe-ze-behandeld-worden-eigenlijk-is-dit-chantage~a29a3c525>

Schel, J. (2021, 1 November). *ZLTO wil boerenbelangen borgen in RES-plannen*. Nieuwe Oogst. Retrieved 19 March 2026, from <https://www.nieuweoogst.nl/nieuws/2021/11/01/zlto-wil-boerenbelangen-borgen-in-res-plannen>

Zuidelijke Land- en Tuinbouworganisatie. (2025, 23 May). *ZLTO in de lobby: TenneT 'geschrokken' van ervaringen boeren*. Retrieved 19 March 2026 from <https://www.zlto.nl/actueel/zlto-in-de-lobby-tennet-geschrokken-van-ervaringen-boeren>

Date 25 March 2026
Subject Combined community future energy vision: Zeeland 2100

Dear Chair,

The ministry has been instructed to review the Combined Community Future Energy Vision for Zeeland 2100 (CCFEV) (reference appendix 1), and to comment on the potential benefits and drawbacks of its implementation. The CCFEV calls to:

- Expand the use of renewable energy, especially offshore wind and decentralised energy production;
- Develop new energy clusters;
- Protect village identities and cultural landscapes;
- Combine economic development, agriculture, and energy systems;
- Improve mobility and infrastructure connections.

The CCFEV marks a lowered importance upon stimulating the Energy Intensive Industries (EII) as opposed to previous proposals¹, a different strategy and approach in developing energy production in the future, and a lack of a structured solution for net congestion for either EII or residential users. This letter therefore elaborates upon these points and provides feedback on, and improvements to, the CCFEV in order to achieve broader economic prosperity.

1. Energy Intensive Industries (EII)

The Netherlands has five EII clusters with the Zeeland – West-Brabant port zone being an important actor on the National scale, contributing to the Netherlands’ earning capacity, and resilience (including strategic autonomy)². The desire for the EII to transition towards a strong and sustainable industry in line with the Climate Accords (2019), and Energy Accords (2013) has been expressed³, and the manner to achieve this has been defined along four lines: Market Creation, Financing, Policy, and Physical space. These positions require several strategic choices that are, however, not elaborated upon within the CCFEV.

The CCFEV proposal indicates a move towards Multimix industrial energy clusters situated in industrial areas around port structures with landscape buffers surrounding them. While there remains a desire from local communities to form landscape buffers surrounding industrial areas and to reign in expansion, the need for local industries to move toward circular practices, and to attract new businesses focusing on renewable production cycles, comes with a large spatial

requirement expressed by the stec group in appendix 2. The report further expresses that of the 735ha needed for a medium growth prognosis, only 340ha are available within existing boundaries, necessitating expansion, especially along water adjacent parcels for improved mobility potentials⁴.

Besides spatial requirements, a substitute for the existing nuclear and natural gas energy generation that produces constant and reliable power for the EII is not proposed. In line with the growing prognosis for energy demand⁵, a stronger policy approach and strategic collaboration with relevant energy producers has to be made.

2. Potential for decentralised energy production

While the EII forms the largest net energy demand in Zeeland, residential and middle sector demand shows signs of growth especially with electrification of natural gas heating which currently sits above National levels in Zeeland. The CCFEV proposal for the decentralised energy clusters near rural residential areas falls inline with existing market conditions and the growth of residential PV rollout, currently surpassing large solar installations in terms of total energy output. The spatial preference for integrating solar-PV is further expressed in appendix 3, implying strong potential for residential and middle sector commercial decentralised energy generation.

The CCFEV locations for decentralised energy production can further be expanded past

the direct peripheries of rural residential areas in order to supply a wider section of the market. To this extent, the Energy Generation at Government-Owned Properties (OER)⁶ can be included in the provincial energy production vision to increase decentralised energy production near, for example, logistics hubs and agricultural demands. The potential for local ownership of large PV installations can also be expanded if project developers, municipalities, and local initiatives can be better informed and approached in a timely and appropriate manner⁷.

3. Net congestion

Next to developing energy production, an important question left unanswered by the CCFEV is the persistent issue of net congestion. Net congestion affects the ability of new businesses and houses to be connected to the energy grid, and electrification will further put pressure on existing connections. The connection of decentralised energy production to this grid can further cause issues by increasing peak loads on the system. The approach to solving the net congestion besides investments in key projects such as found in the pMIEK⁸ can be defined in three ‘better use’ approaches: better possibilities, approaches for businesses and organisations, and for small users⁹. Policy has to shift in order for it to be easier to make smarter use of the grid, through price incentives and flexible contracts to shift consumption away from peak times, the use of flexibility measures (such as batteries and smart charging), prioritising essential consumption, and improved cooperation, knowledge and planning among businesses and households.

In conclusion

Zeeland’s ambition to increase its energy dependence can contribute positively to the national energy policy and mix. More investment has to be made in ensuring the longevity of EII, with more physical space being needed in development zones where green/circular industry can be developed next to existing logistical hubs. Further research

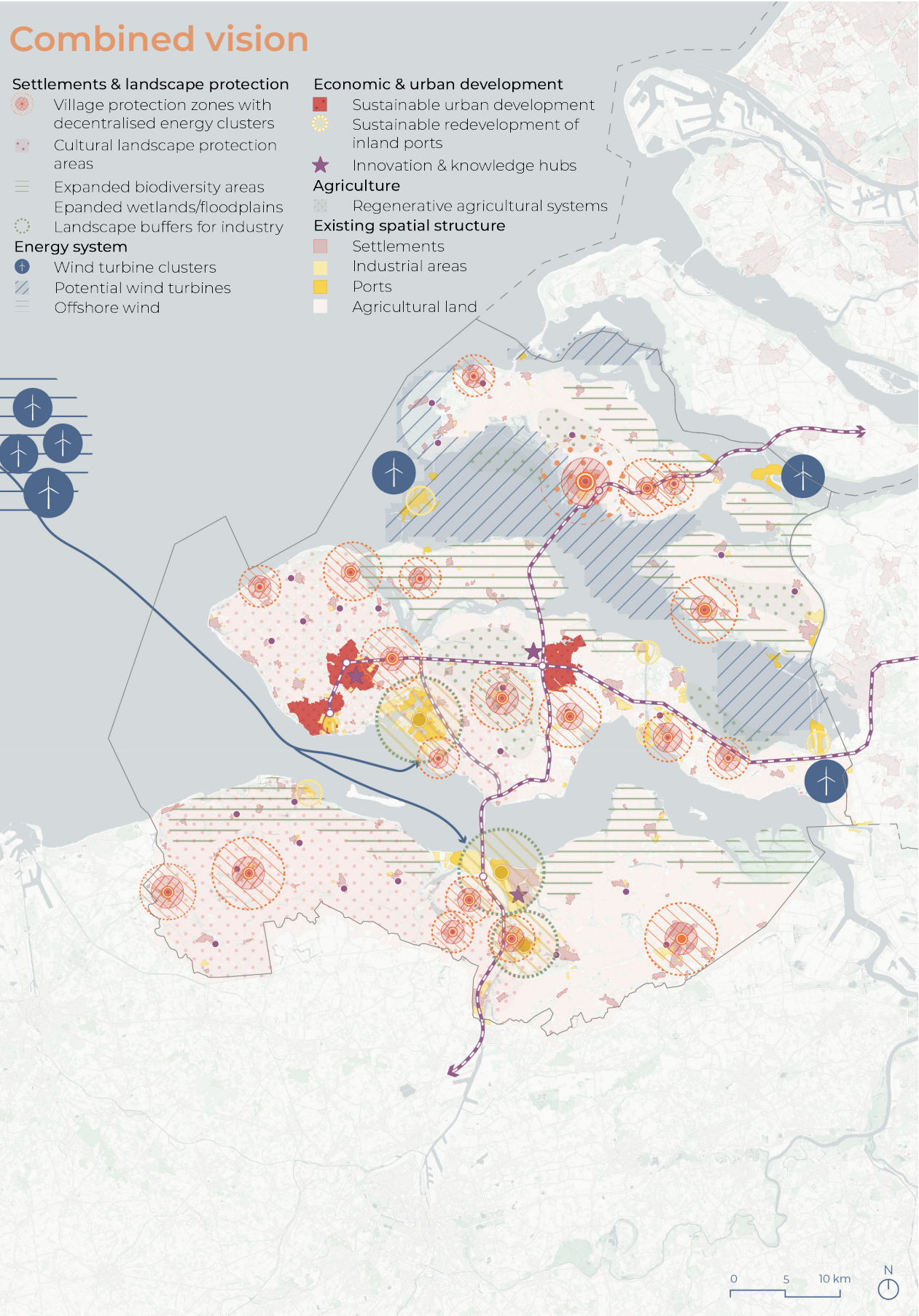
has to be performed in order to show that the decentralised energy production will be able to work together with the national grid to reduce net congestion and ensure the capacity for economic growth.

Stepan Prikazchikov

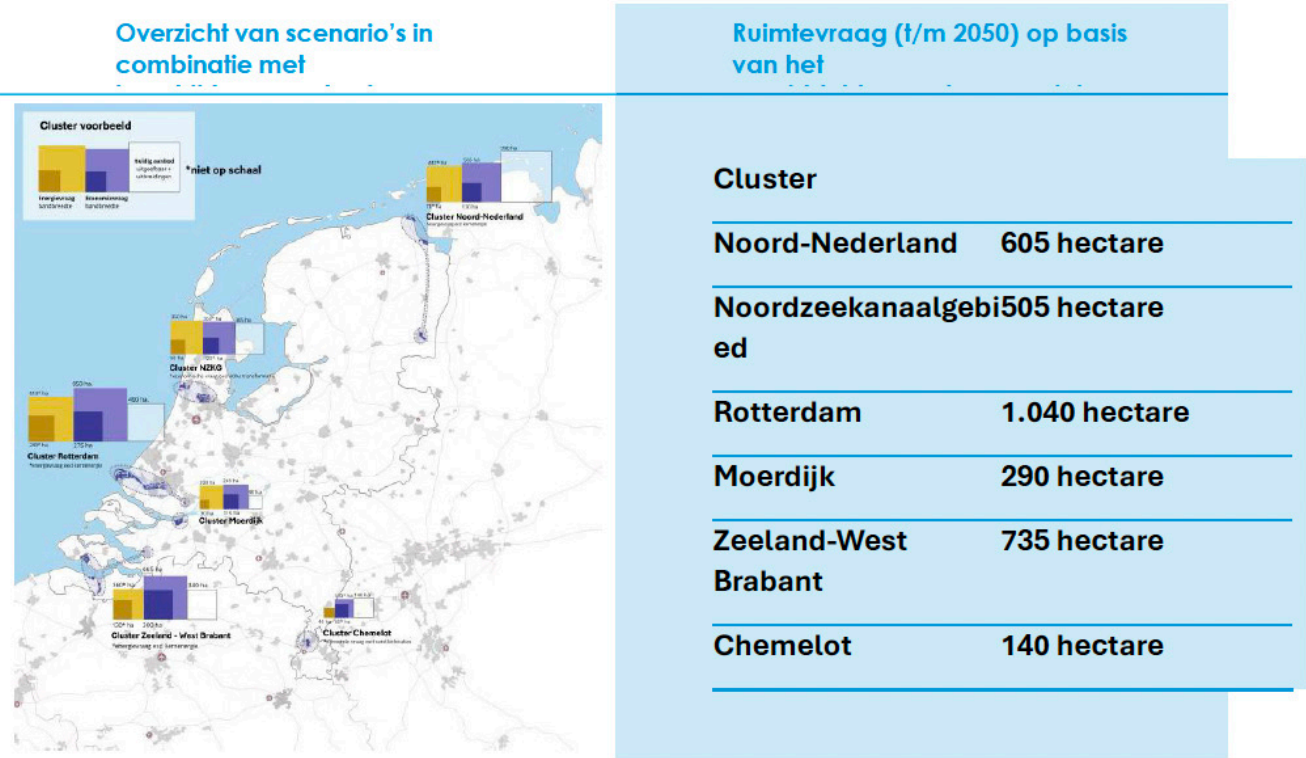
Reference:

- 1 Ontwerp Nota Ruimte, September 2025, Ministerie van Volkshuisvesting en Ruimtelijke Ordening
- 2 Kamerbrief Toelichting op uitvoering motie-Kostić, DGBI-TOP / 103269017
- 3 Kamerbief Voortgang verduurzaming industrie, DGBI-VI / 97628516
- 4 Nationale prognose ruimtebehoefte industrieclusters, 7 april 2025, stec groep.
- 5 CES 3.0 – Schelde Deltaregio, September 2024, Smart Delta Resources
- 6 <https://www.energieoprijksgrond.nl/default.aspx>
- 7 Kamerbrief Zonnebrief, DGKE-DSE / 96006603
- 8 see: <https://www.zeeland.nl/sites/default/files/2023-04/PMIEK%20Zeeland%202023%20-%20definitief%20vDT.pdf>
- 9 Kamerbrief Voortgang aanpak netcongestie, KGG / 97825449
- 10 Oplossingen voor de ruimtelijke inpassing van zon-pv, July 2024, CE Delft

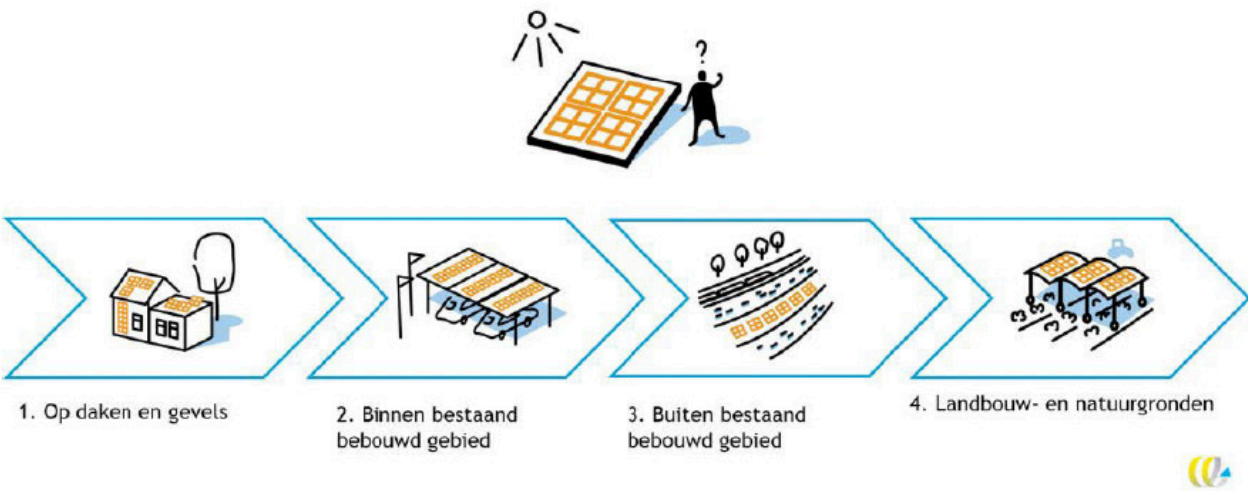
Appendix 1 – Combined community future energy vision: Zeeland 2100



Appendix 2 – Space demand in industrial clusters according to medium-range scenarios, up to and including 2050, in net hectares5



Appendix 3 – CE Delft: preferred order of priority Photovoltaic (PV) implementation11





Authors

Elerina Karolou | 6295843

Kiki van der Veen | 6343651

Mila Veenboer | 6376274

Stepan Prikazchikov | 5253314

Supervisors

Alex Wandl & Marcin Dabrowski

0 5 10 km

