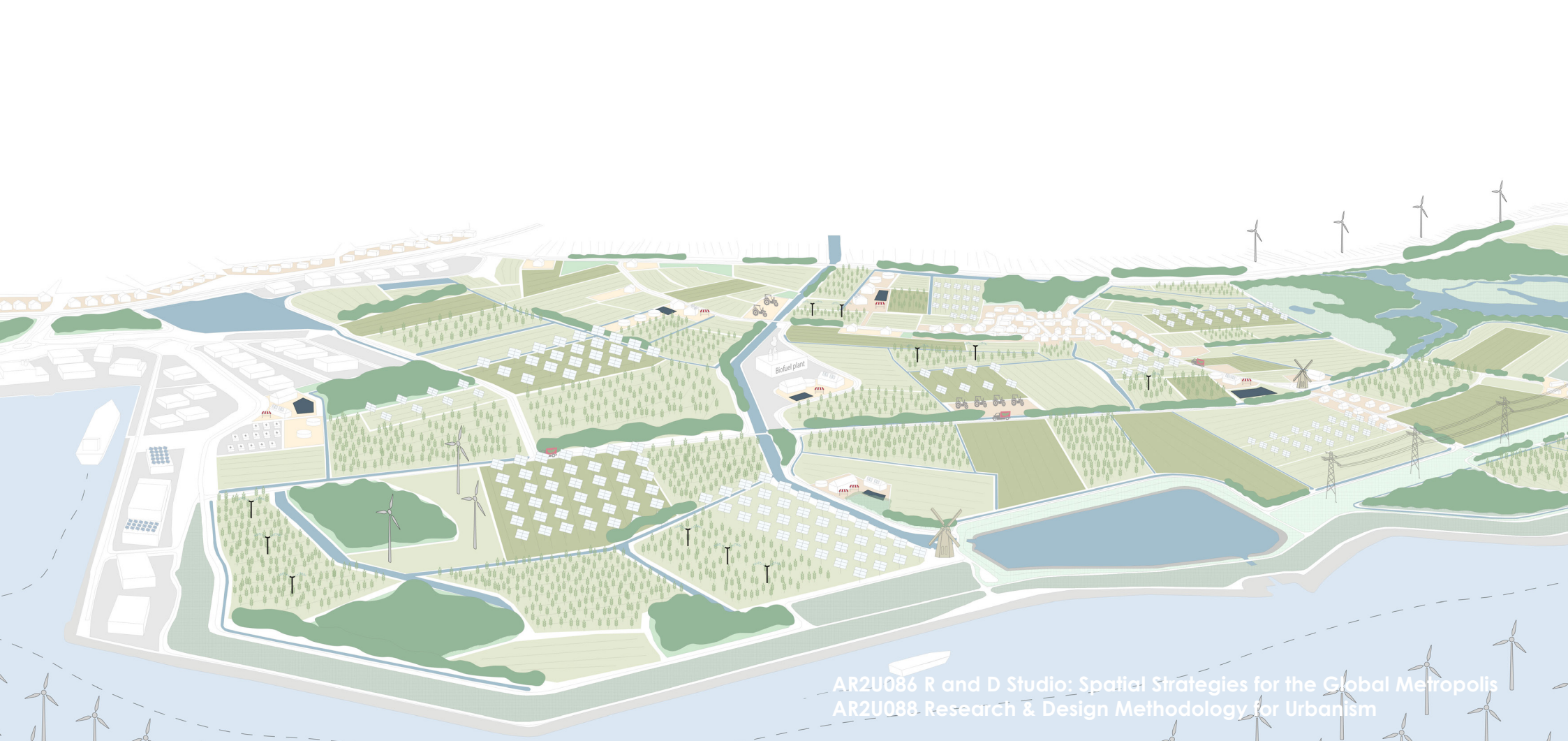
Zeeland for agriFUTURE



AR2U086 R and D Studio: Spatial Strategies for the Global Metropolis
AR2U088 Research & Design Methodology for Urbanism

Colophon

AR2U086 R and D Studio: Spatial Strategies for the Global Metropolis & AR2U088 Research & Design Methodology for Urbanism

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Abstract

Agriculture has a long history in the Netherlands as major contributor to the national economy. Resulting from its abundance in arable land and fertile soil, its food production exceeds national borders. As the farming intensity increased, the implications of the agricultural practices quickly caught-up manifesting in the ever increasing need of space for energy, water, agricultural land. Rising energy costs, water salinization, flooding risks and drought, and the effects of the nitrogen crisis are detrimental for the farming community in the Netherlands' south-western delta region Zeeland. Today, progressive farmers find themselves within the tensions and pressures of an on-going Polycrisis where their own personal needs and wishes of stability and security are competing with the national and regional policies accelerating the energy transition and meeting climate targets.

A community and media analysis allowed us to frame the project from the perspective of the transition community. Defining their wishes, needs and concerns highlighted a conflict between top-down expectations and bottom-up ambitions and initiatives. Complemented with a spatial analysis aided in positioning the spatial potentials of the Wagricultural landscape in Zeeland within the water, energy and food security nexus (WEF nexus) and determining, therefore, its competitions.

The project addresses the research question on how can the progressive farmers in rural Zeeland act as drivers of the energy transition, while safeguarding their emotional, economic and productive stability and security, and contributing to a future-proof rural system at the intersection of energy, water, and food security, while mediating between top-down policy frameworks and bottom-up practices?

Our project reimagines the agricultural value chain based on concrete strategic and tactical actions, that aim to enable the farmer to become a producer not solely a consumer. These fall within two main goals: creating a sustainable agricultural system and decentralising the existing energy system to achieve self-sufficiency for farmers in an environmentally supportable agriculture process. Initiated by pilot projects that encourage the participation and contributions of local stakeholders, it establishes collaboration and bridges the gap between bottom-up agency and top-down guidance and support.

The societal relevance is explored through the scalability and replicability of the strategy to other regions and provinces and its contributions to spatial justice.

Keywords: Agriculture, Farmers, Zeeland, Polycrisis, Energy transition, Spatial competition, Sustainable agricultural process, Decentralized energy production, Self sufficiency

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In this report, a regional strategy on the topic of energy transition for a region in the Netherlands is proposed. In regional design, agglomerations of dependent places across multiple administrative boundaries are explored. Seeking for imaginative, desirable spatial futures in a given regional planning and governance context (Delft University of Technology, Faculty of Architecture and the Built Environment, Section of Spatial Planning & Strategy, 2026). The goal is to explore how the energy transition influences spatial development in the chosen region, and in particular how a transitional community is affected by this development and pressured by expectations from top-down planning perspectives. Giving this community a voice and thinking through their perception will result in a vision where the wishes and concerns of this group is represented and respected. "In doing so, the studio engages critically with the spatial consequences of nationally planned energy infrastructure and its implications for regions and communities (Delft University of Technology, Faculty of Architecture and the Built Environment, Section of Spatial Planning & Strategy, 2026).

1.Introduction

1.1 General information
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1.Introduction
1.1 General Intro

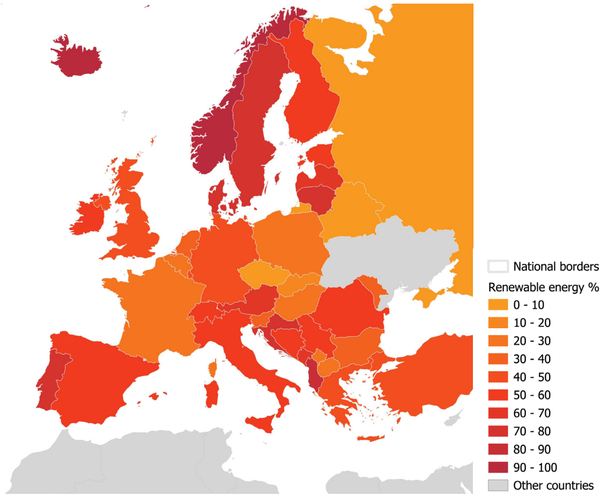
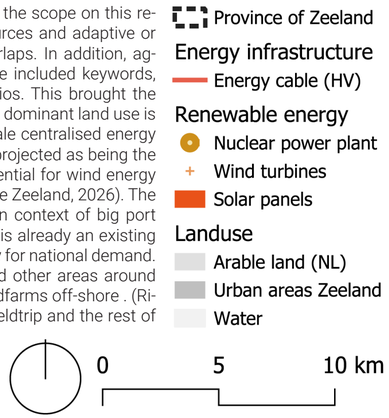


Figure 2; Broader map of renewable energy

The Netherlands has benefited from its access to fossil fuels as main source of energy, resulting in the contemporary climate crisis (Sijmons, 2014). As response to this accelerating crisis, the Netherlands introduced the National Climate Agreement (Rijksoverheid, 2019), to achieve climate neutrality by 2050. Embedded in a broader international movement in this crisis, relating to the Paris Agreement (2016), the European Green Deal (2019), and the European Climate Law (2021). In this international context, the imminent shift towards renewable energy differs per country, as illustrated in Figure 2. Countries as Sweden, Norway, and Portugal already rely for over 80% on renewables, while France, Belarus, Belgium and Cech are still depending more on other (non-renewable) sources of energy (Electricity Maps, n.d.). The Netherlands is with 64% in the middle, this rises the urgence of accelerating the national transition towards renewable energy production. Contributing to this urgency are the current (geo)political conflicts in the world, oil and gas distribution is dysregulated and this raises the question of dependability. Multiple arguments are building the urgency to become self-sufficient energy producers in this contemporary time, but most importantly to secure a sustainable future.

To start this project, shared interests laid the foundation for the scope on this regional transition. The opportunity of diversifying energy sources and adaptive or multipurpose use of space where the most prominent overlaps. In addition, agricultural land in relation to the everyday landscape became included keywords, together with the climate uncertainty and changing scenarios. This brought the scope of the project to the region of Zeeland, where the most dominant land use is agriculture, and where the challenge of embedding large scale centralised energy production for the whole country is a challenge. Zeeland is projected as being the renewable energy hub for the Netherlands, with its high potential for wind energy by large scale windfarms on both land and off-shore (Province Zeeland, 2026). The region of Zeeland is situated the south-west delta region, in context of big port cities as Rotterdam, Antwerpen, and Ghent (figure 3). There is already an existing centralised energy infrastructure producing renewable energy for national demand. With windfarms at the Delta park (Oosterscheldekering) and other areas around the region, but most importantly the enormous Borssele windfarms off-shore . (Rijksoverheid Wind op Zee, n.d.). This forms the base of the fieldtrip and the rest of the project.



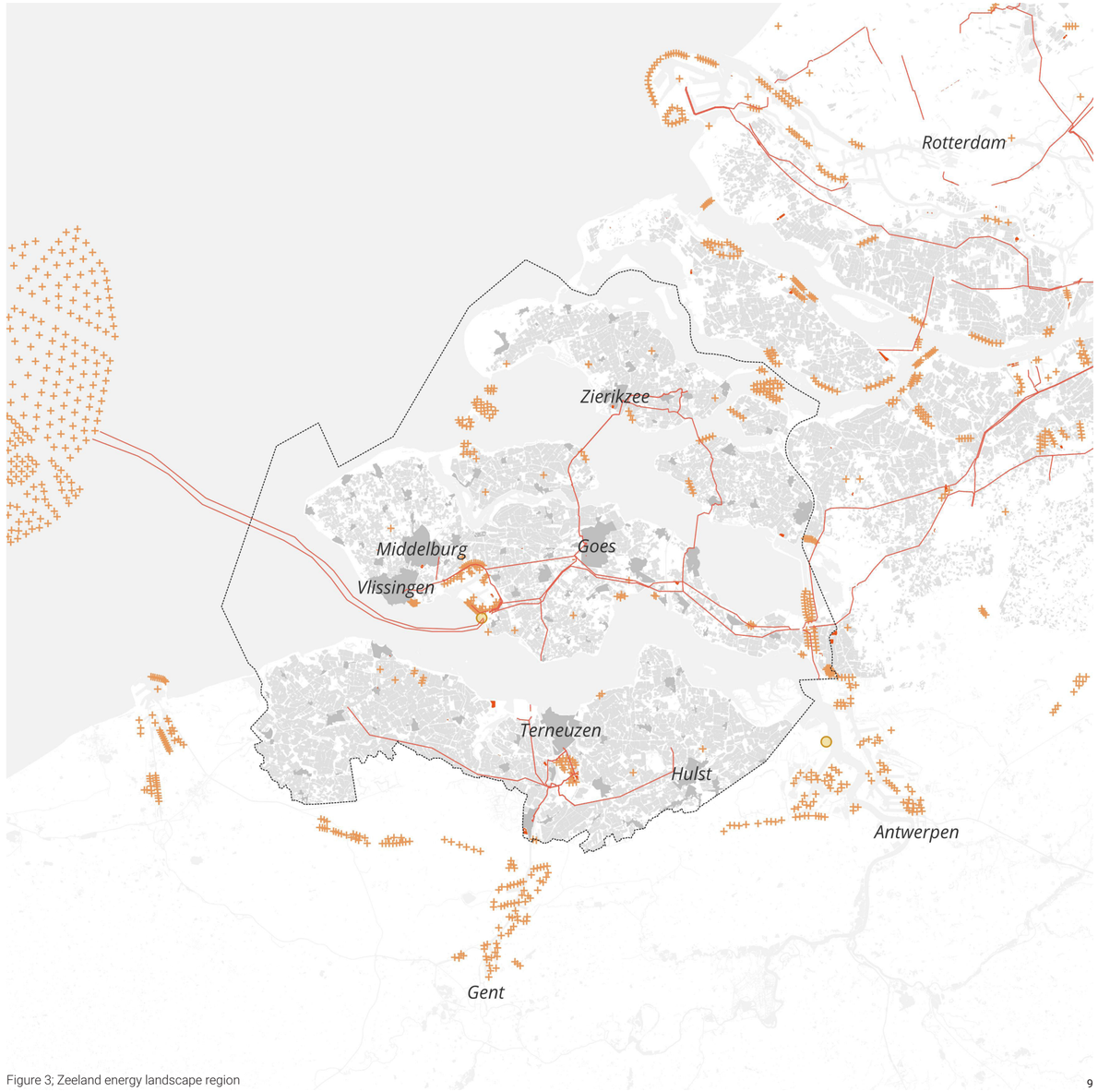


Figure 3; Zeeland energy landscape region

1.Introduction
1.1 General Intro

Figure 4; Fieldtrip pictures

During the fieldtrip to Zeeland (figure 8), the focus was on exploring existing spatial structures and understanding their relationships while keeping in mind potential principles such as diversifying energy sources in relation with agricultural land.

Agriculture remains the dominant land use in the region of Zeeland (de Vriend, 2024). During our visit in early February, most fields appeared as brown, inactive landscapes—reflecting the strong seasonal rhythm of the agricultural sector. Water has always been a defining force in Zeeland's history and continues to shape the region today. The 1953 flood left a lasting mark on both the landscape and the collective memory of its people. Visiting the Flood Museum offered a powerful reminder of this heritage. Yet, contemporary water challenges extend beyond flooding, including drought and salinization risks. Meanwhile, an emerging energy landscape is taking form, marked by wind turbines harnessing the region's potential to meet national energy demands. These developments invite reflection on how they might influence the visual and cultural identity of Zeeland.

Overall, the fieldtrip revealed the Zeeland landscape as a gradient in which agriculture continues to dominate, yet new forms of energy production are increasingly being embedded within the regional fabric (figure 7). Within this multilayered context, water remains an everpresent and structuring element. These intersections are shaping both environmental processes and spatial strategies across Zeeland.

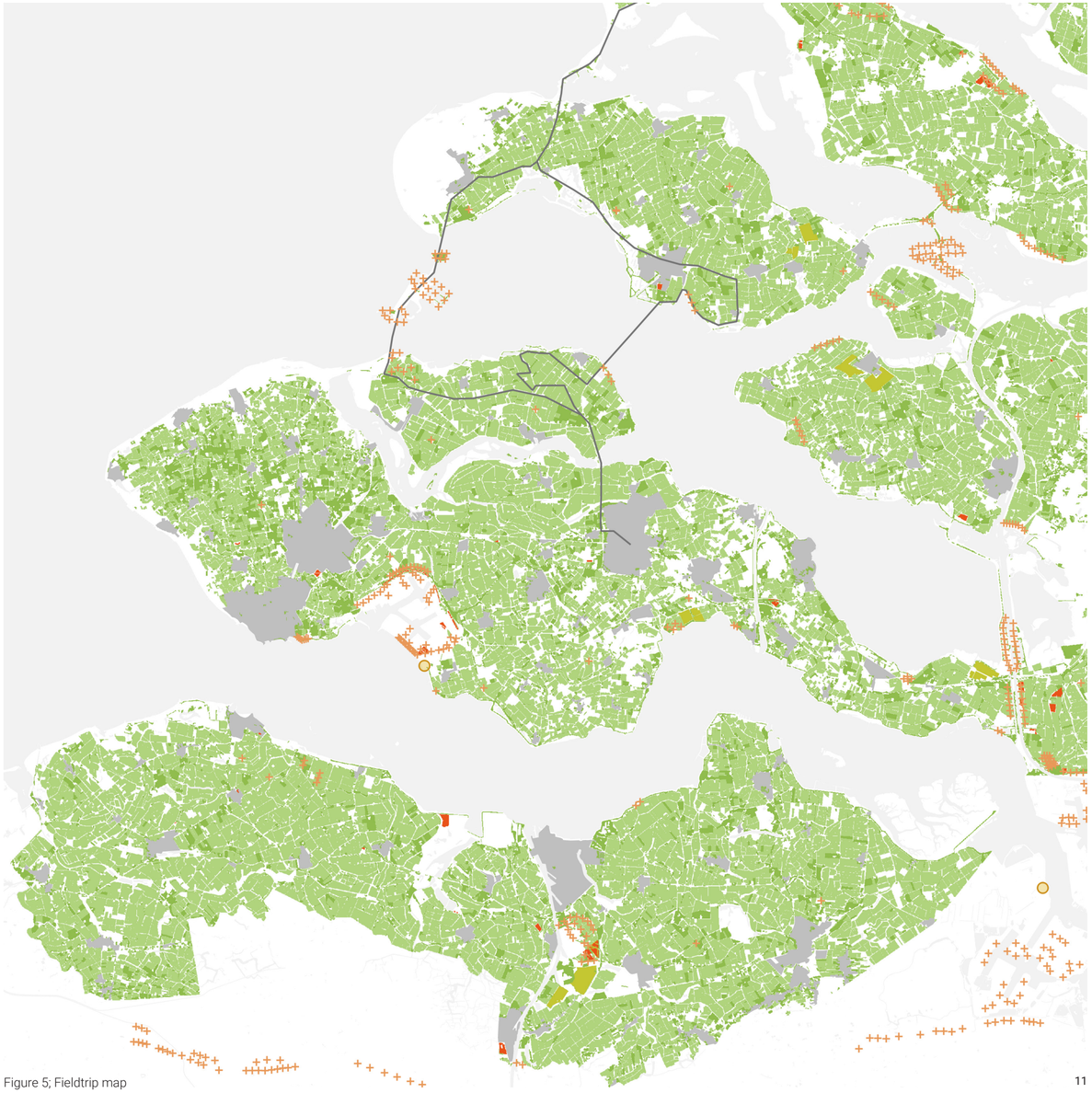


Figure 5; Fieldtrip map

1.Introduction
1.1 General Intro

The three present themes in the region of Zeeland can be identified through the fieldtrip and initial desk research: water, agriculture and energy. These different landscapes (figures 4,5,6) are illustrating the region with each their individual and intersecting challenges, risks, and opportunities. Water forms the base of the liveable landscape, without human intervention there would not be land to live on. Water is integrated in agricultural practices, which is the dominant land use, and historical seen the source of income (Zeeuws Archief, n.d). In this time of transitions, energy becomes to also play a increasingly important and visible role in Zeeland, with the construction of windfarms on- and off-shore (Rijksoverheid, n.d.).

Figure 6; Arable landscape

Figure 7; Water landscape

Figure 8; Energy landscape

1.Introduction
1.1 General Intro

Zeeland historical landscape has been characterised by the local agricultural practices. (Figure 9) In the 19th century more than 2/3 of the working population was working in the agricultural sector (Zeeuws Archief, 2025). Major developments happend in the 1950s after the great flood after which land reclammation resulted in the development of more agricultural land (Boerendonk, 1934; Zeeuws Archief, 2025). Till then agriculture practices were bottom-up and small scale. Farmers were producing on a smaller scale for themselves and their immediate environment (Zeeuws Archief, 2025). As the agricultural landscape and intensity was growing so were the demands for energy and water (Afrian et al., 2020; Dekkers et al., 1974; Jukema et al., 2024). Simultaneously the use of artificial fertiliser also marked a turning point, diminishing the needs for lifestock in Zeeland. Over the last 40 years this has lead to an increase in emissions related to the agricultural sector with interventions from the government that reached a clash in 2019 with the farmers protests against the drastic measures to manage nitrogen emissions (Tullis, 2023). Changes in scale of production, machinery and demands of energy and water consumption have culminated in a need for top-down management to meet regional and national demands and european regulations (Ministerie van Algemene Zaken, 2023).

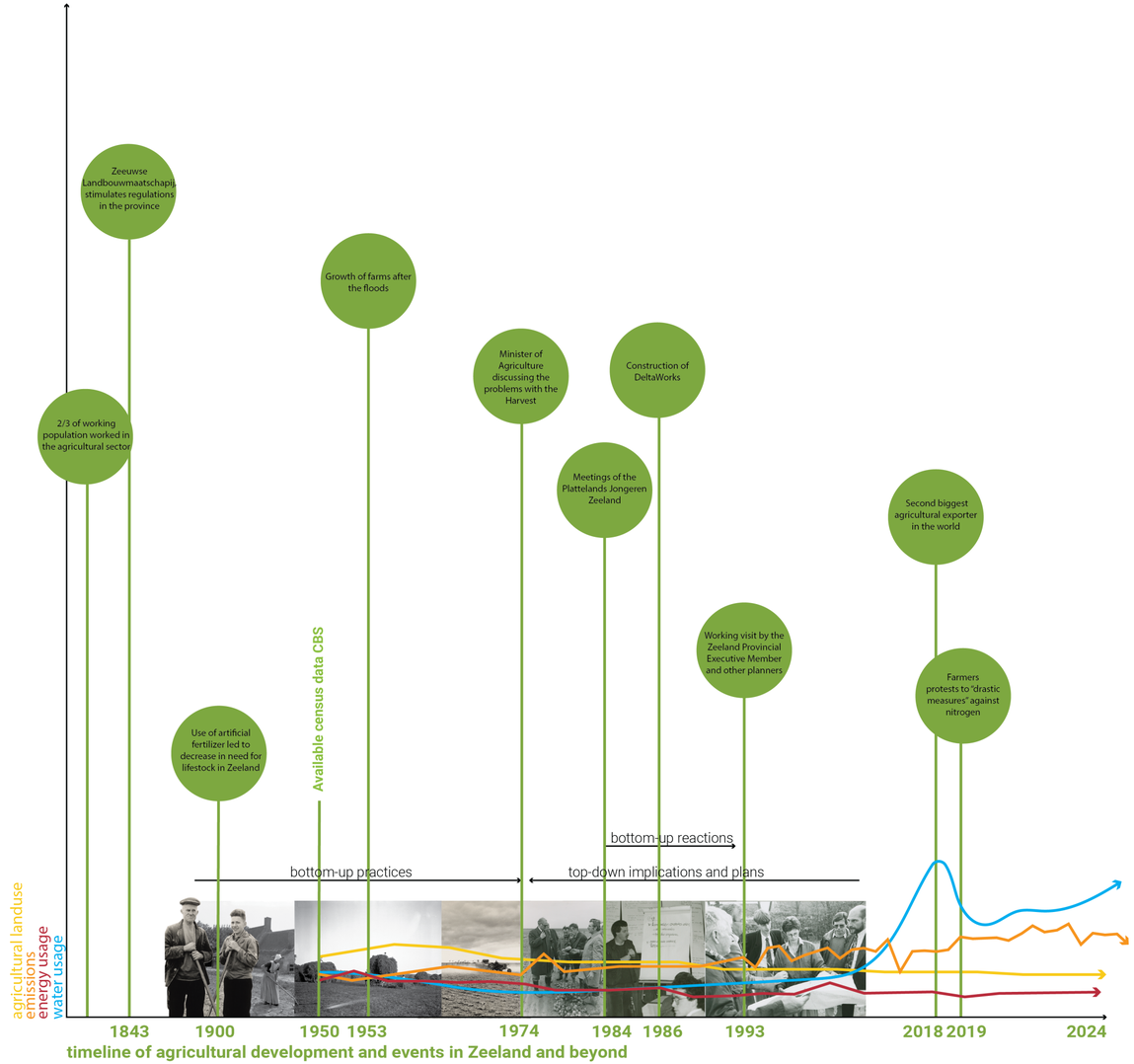


Figure 9; Historical Timeline

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1.2 Context

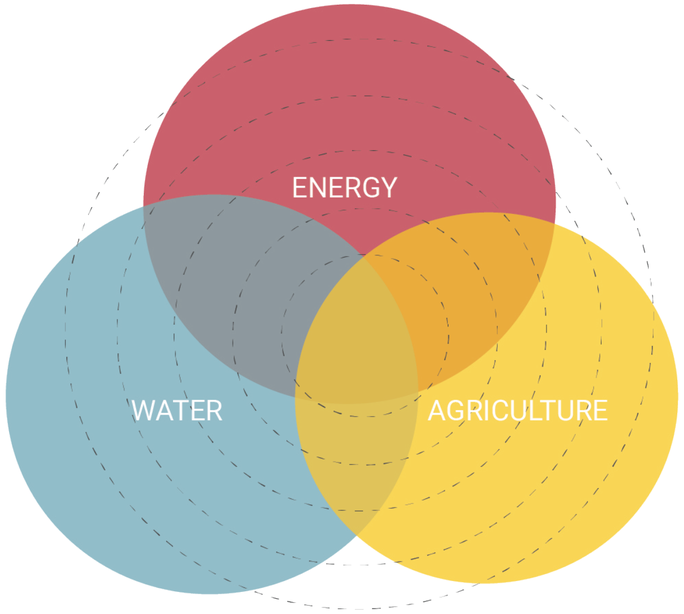

Figure 10; Diagram intersection of three main themes

There is an important relationship between agriculture, energy and water (figure 10). Besides that, farmers deal with these systems on a daily basis. These systems are interconnected with each other (Planbureau voor de Leefomgeving, 2020). For example, farmers rely on water for their irrigation, while agriculture depends on that water, and at the same time agriculture also relies on energy because of machinery and production (Rijkswaterstaat, 2023). In other words, these systems cannot be seen separately.

Within this system, the farmer plays a central role. As the important stakeholder, the farmer is directly involved in how agriculture, energy, and water come together in practice. This means the farmer constantly must respond to and balance these interconnected systems in daily work.

This is also visible in Zeeland (figure 11). Around 33% of water is used in agriculture. Next to that, agriculture demands 7.8% of the total national energy demand, which is the second highest in Europe. To also see it in perspective why these systems are so important, 65% of the land is used for agriculture in Zeeland (Provincie Zeeland, 2025).

Figure 11b; Energy usage in agricultural sector

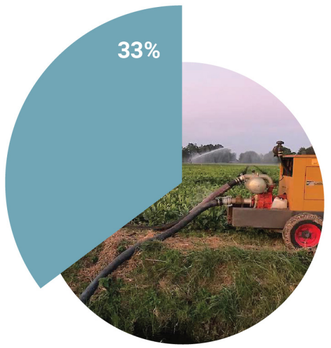

Figure 11a; Water usage in agricultural sector

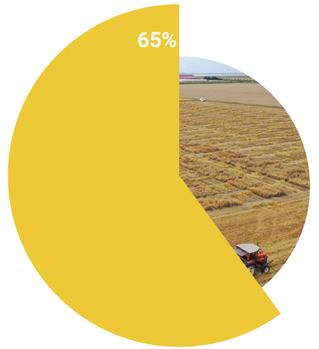

Figure 11c; Amount of agricultural land in Zeeland

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1.2 Context

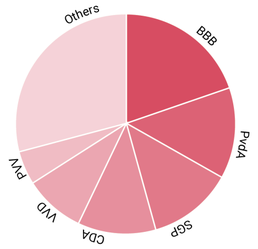


Figure 12a; Provincial Election results March 2023

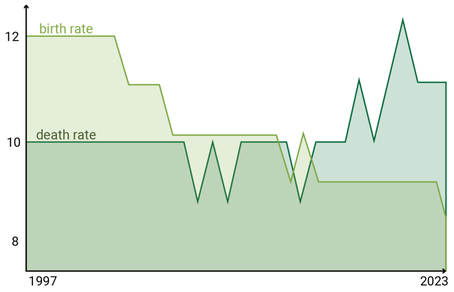


Figure 12b; Death and birth rate Zeeland

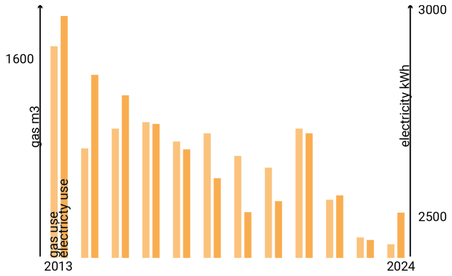


Figure 12c; gas and electricity consumption of homes

Zeeland can be understood as a region that is shaped by several overlapping challenges rather than by a single problem.(Figure 13) Its coastal location, strong agricultural sector, and important role in the national energy infrastructure make the region particularly sensitive to different kinds of pressure. Climate change, ecological decline, agricultural change, and the energy transition are not separate developments. Instead, they interact with each other and influence the same spaces. For example, decisions about water safety affect how land can be used, agricultural changes impact ecological systems, and new energy infrastructure changes both the landscape and the regional economy. Because of these interacting developments, Zeeland can be seen as a polycrisis: a situation in which multiple transitions take place at the same time and reinforce each other. This creates uncertainty and makes long-term spatial planning more complex.

According to the statistical data the population of Zeeland is slowly declining. This is can be seen in the birth and death rate as well. Much less children are born than people are dying (Allecijfers, 2023; AdminStat, 2023; CBS Statline, 2026). This is also raised as a concern by the regional government as many young adults are moving away from Zeeland (Cauwels, 2021). This may also be reflected in the decrease in energy use, especially in gas and electricity. Overall, we can notice a slow transition to electrification where in 2024 the electricity use is almost three times as high as the use of gas (Allecijfers, 2023). Additionally, the provincial election results from March 2023 show that the local population feel their wishes and needs best represented by the BBB (the Farmer Citizen Movement) and the PvdA (the Workers Party) which losely highlight their ambitions and wishes for the future (Kiesraad, 2023).

What does the media say about water Crisis

"Wet meadows and yet the Netherlands is drying up: the hidden water crisis"
Sjoerd Marcelissen. (2025, January 20). Natte weilanden en toch verdroogt Nederland: de verborgen watercrisis. Eindhovens Dagblad.nl.

"The Wennink Report signals that the Netherlands is heading for a water crisis. According to Techniek Nederland, the challenge is broader than just the availability of clean water. We must prepare for both flooding and water shortages. Consider water-saving new construction, sewer modifications, measures in industry, and smarter design of pumping stations."
Robert van den Ham. (2025, December 12). Techniek Nederland: 'Tijdens formatie nieuw kabinet zou rapport-Wennink prominent op tafel moeten liggen'.

"But the new crisis looming is about our water; in fact, we're already in the midst of it. Water quality is a problem, especially in the Netherlands, due to pesticides, PFAS, and pharmaceutical residues. Agriculture also plays a major role, of course."
Robert van den Ham. (2025, December 12). Techniek Nederland: 'Tijdens formatie nieuw kabinet zou rapport-Wennink prominent op tafel moeten liggen'.

What does the media say about agriculture Crisis

"But the Netherlands "must and can" get off the nitrogen lock, according to the new cabinet. Not least because it also keeps the agricultural sector safe. "If we get the Netherlands off the nitrogen lock, entrepreneurs can start doing business again."
Wim van Gruisen. (2026, January 30). Bij nieuw landbouwbeleid staat stikstofreductie op één. Akkerwijzer.nl.

"Stop telling farmers to change. Change the rules. Draw the three-point line, start the clock, and let healthy soil and clean water earn points. Then the rest will follow."
(2025, November 13). Pas spelregels aan en niet de boeren. De Telegraaf.

"The cabinet is moving towards new calculation rules that will no longer include small amounts of nitrogen deposition in nature. It's high time, writes Rosanne Hertzberger. The current model is highly inaccurate, but farmers are being held accountable for it."
Rosanne Hertzberger. (2025, February 18). Opinie Rosanne Hertzberger: Het huidige rekenmodel voor stikstof deugt echt niet. En boeren zijn de klos - Trouw.nl

What does the media say about energy Crisis

"Europe sees wind energy as a lifeline from the geopolitical crisis, but the sector is at a standstill. The European wind sector is in crisis"
Rosa Uijtewaal. (2026, January 27). Europa ziet in windenergie een reddingsboei uit de geopolitieke crisis, maar de sector ligt stil ; Energie De Europese windsector is in crisis . NRC

"Fortunately, the solution to the dual crisis is the same: save energy and generate sustainable energy. This way, we kill two birds with one stone: less climate change and less dependence on dubious countries."
(2022, June 11). Zo slaan we twee vliegen in één klap. De Telegraaf.

"Europe will soon have the luxury of low gas prices back, not the luxury of complacency. The real test is whether it can invest in resilience now. Because the next energy crisis won't come from excessively high prices, but from a lack of certainty."
(2025, November 17). Nederlandse topanalist Daan Struyven (39) van Goldman Sachs: 'Te weinig grondstoffen en verouderd stroomnet bron nieuwe energiecrisis'. De Telegraaf.nl.

Figure 13; Media about Polycrisis

WATER

Zeeland's geographic position at the edge of the North Sea makes it structurally vulnerable to flooding. Although the Delta Works provide a high level of protection, climate change introduces increasing uncertainty through sea-level rise, heavier rainfall, and stronger storm surges. Flood risk is therefore not a temporary threat but a long-term spatial condition. Water safety infrastructure shapes land use, settlement patterns, and future development possibilities. In the context of climate change, flood risk becomes a dynamic challenge that requires adaptive planning rather than fixed solutions. Water safety infrastructure shapes land use, settlement patterns, and future development possibilities. In the context of climate change, flood risk becomes a dynamic challenge that requires adaptive vision rather than fixed solutions.

AGRICULTURE

The existing agricultural practices of zeeland intensify the policrisis situation going on, around salinization, nitrogen emissions, while enhance water vulnerability, when compounded with climate change and the imminent risks of severe flooding or drought, together with rising energy cost and its scarcity . These growing tensions, arising from competing interests and spatial demands among stakeholders, create increasing pressure on the landholders of this crucial territory, the farmers and their farmlands. . Traditional monocultural production systems are increasingly unsustainable, both ecologically and economically. The agricultural transition requires structural changes in land use, ownership models, and production methods.

ENERGY

Zeeland has become a strategic node in the Dutch energy system, hosting offshore wind infrastructure, nuclear energy at Borssele, and industrial energy clusters. The expansion of renewable energy, hydrogen networks, and grid reinforcement introduces new spatial claims on both coastal and rural areas. At the same time, grid congestion and infrastructure concentration create regional pressures and governance challenges. The energy transition is not only a technical transformation but a spatial and political process that reshapes landscapes, economic structures, and power relations.

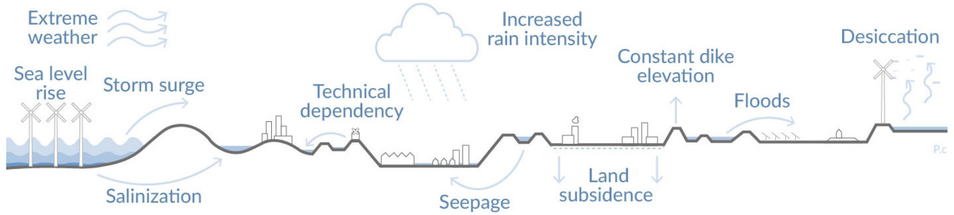


Figure 14a; Polycrisis water section

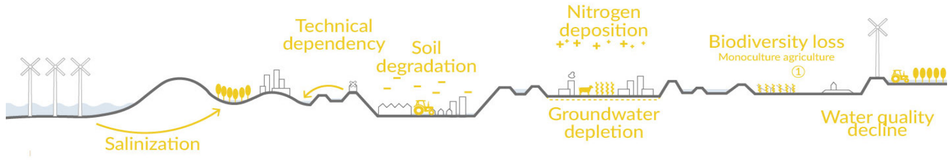


Figure 14b; Polycrisis agricultural section

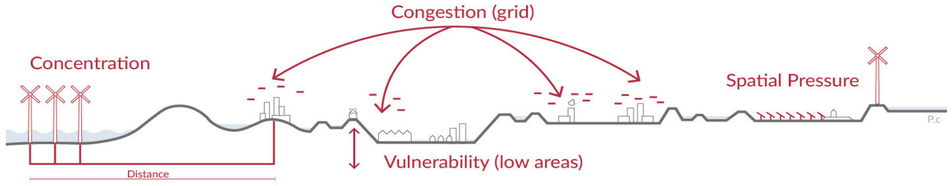


Figure 14c; Polycrisis energy section

Figure 14a, 14b and 14c together show the context of the polycrisis in Zeeland. The three sections focus on water, agriculture, and energy, each showing the main problems and pressures within these systems. From water issues like flooding and salinization, to agricultural challenges such as nitrogen and bio-diversity loss, and energy problems like grid congestion and spatial pressure. Together, they show how each system is under pressure within the polycrisis.

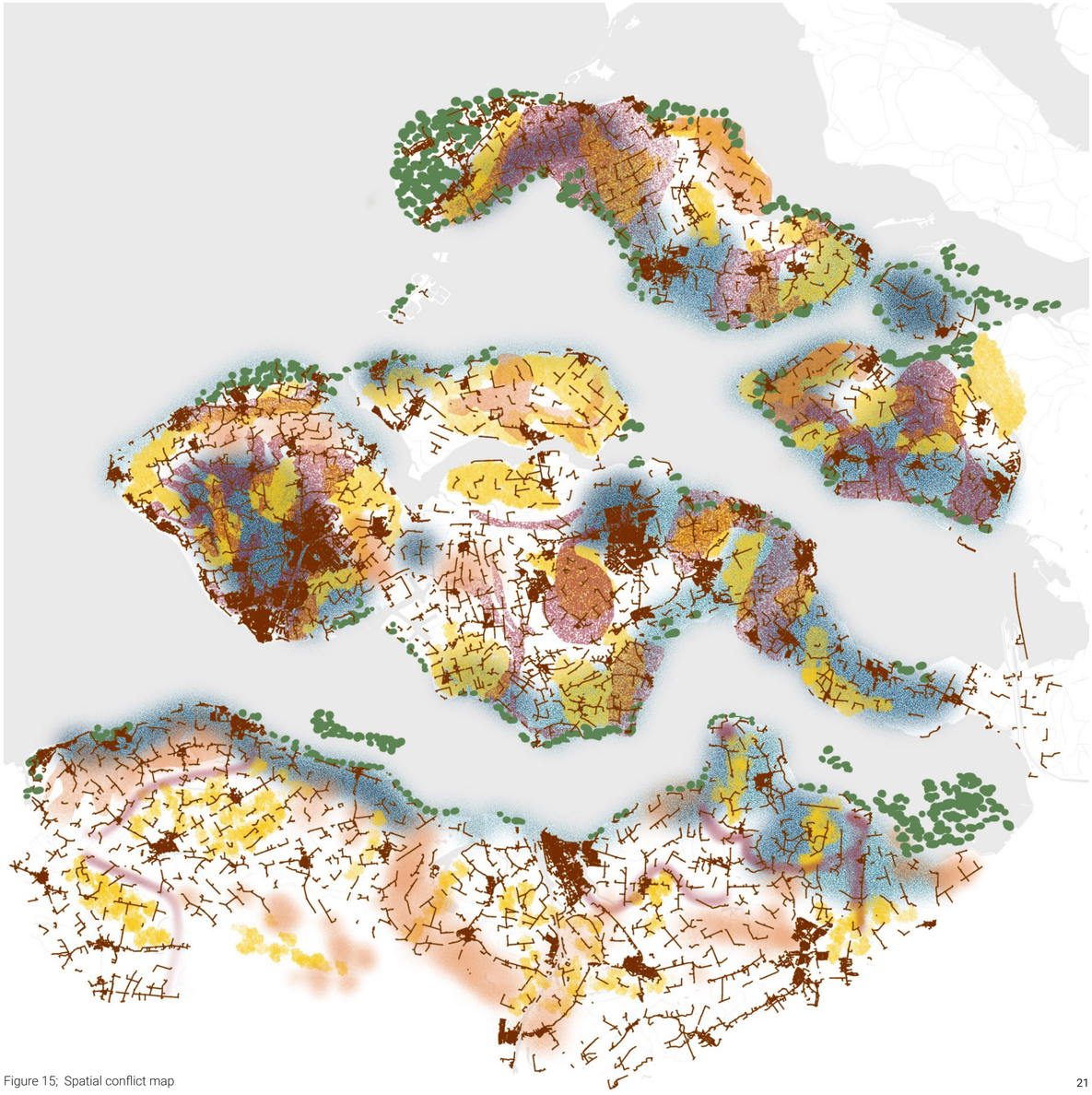


Figure 15; Spatial conflict map

1.Introduction
1.2 Context

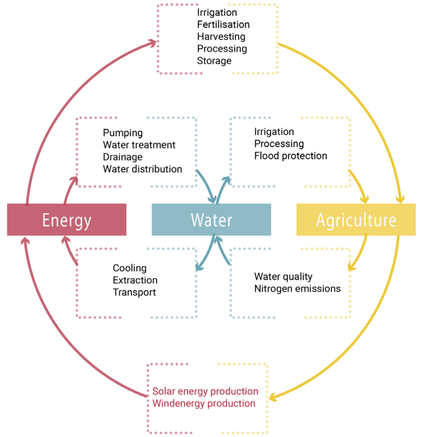


Figure 16; Systematic interaction of WEF Nexus

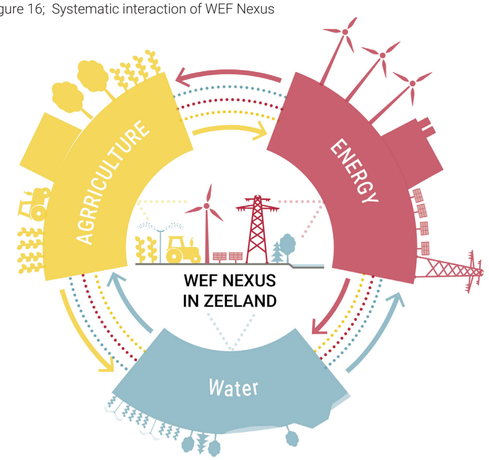


Figure 17; Integration of WEF in 3 topics

The project can be situated within the WEF Nexus (WEF Nexus, n.d) theory with the different themes of watern energy and agriculture interacting in Zeelands landscape (Figure.17). All three themes interacting are accumulating to a competition of space.

The water, agricultural and energy system are co-dependent and strongly influence each other (Figure.16). The agricultural system is strongly dependent on the availability of energy and water to continue its production and development processes. Inversely the type of agriculture practice also heavily impacts the water quality and the intensity of emissions. Energy is also needed for water treatment and distribution.

Something that remains under explored are the possibilities that the agricultural landscape leaves for energy production to meet the increasing energy demands of the agricultural processes.

Comparing this with a large scale analysis within the WEF Nexus (n.d.) as can be seen in Figure.18, it becomes clear that the access to water energy and agriculture is already strong but that the availability of all three is an urgent challenge that needs to be addressed.

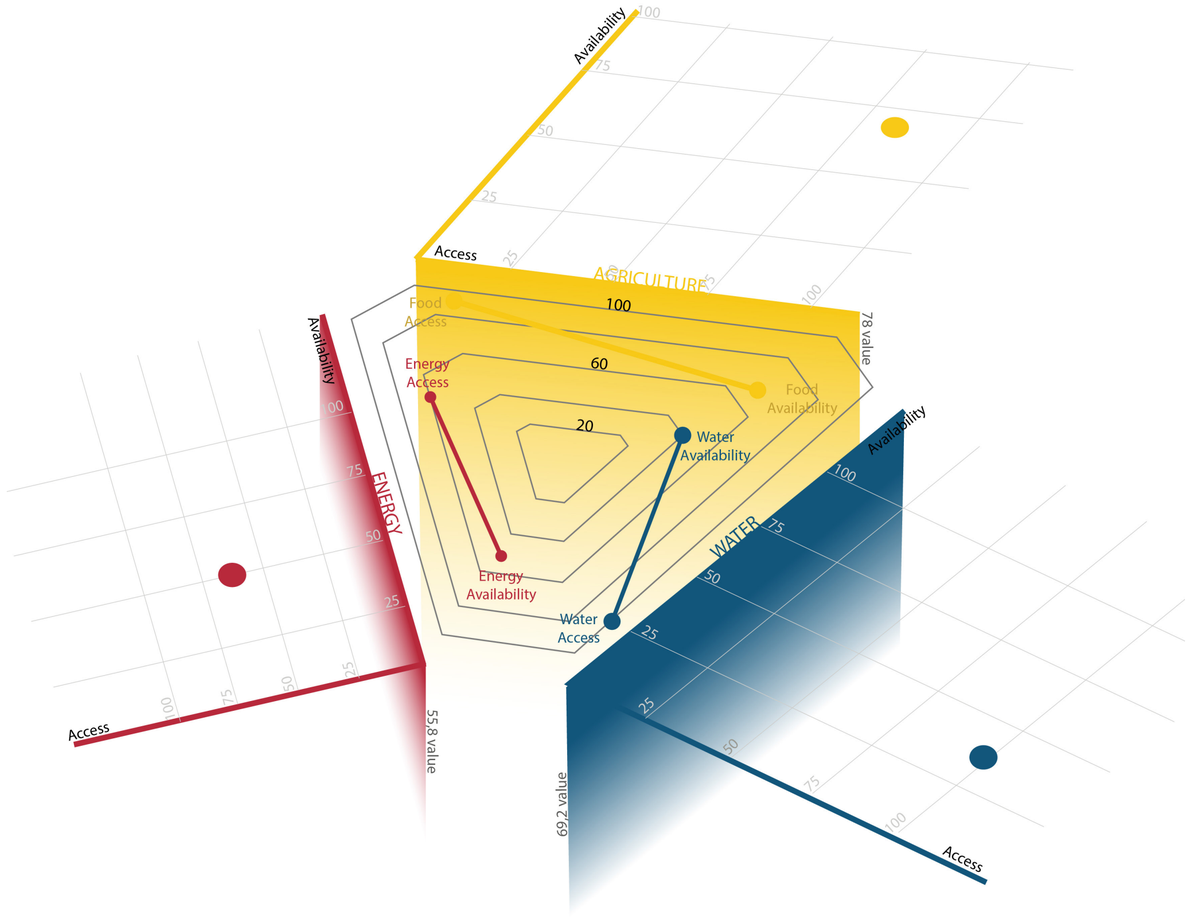


Figure 18; Access and Availabilty of the 3 themes in Nethelands

1.Introduction
1.3 Stakeholder arena

"The national government and the Province, position Zeeland as a key region for energy security and strategic autonomy [...]".
Province, Zeeland Informal chat.

"Young farmers want to move forward. Give them the confidence and space to make a difference."
Zeeland Agricultural Youth Contact.

"We have been coming to Zeeland for over 40 years. Everyone is so open and friendly and the space is so calm and accesible."
Informal chat with a German tourist, Field trip.

"To become more sustainable more and more companies are switching to electricity. This leads to grid congestion [...]."
Tennet, Energy Company.

Together, these fourteen stakeholders, represented in the figure 19 to the side, define, influence, coordinate, and manage the decisions relating to the energy transition in Zealand. Those in red are those whose responsibilities lie at the institutional level, and therefore the power attributed to them is greater. The province of Zeeland has a more decisive character in this scenario and tends towards a productivity perspective. Those in green are those who would be most significantly affected by the decisions and, therefore, generally represent greater interest. In this case, progressive farmers appear as the most engaged in the topic, giving an action-oriented character to the scenario. Those in blue are those whose power over decisions is not exercised actively and directly, although it is high. In this case, the energy companies, which have the greatest interest in a transition, given the need for expansion and continued participation. Finally, those in yellow are those whose influence is minimal, but still significant. In this case, tourism enters the scene not only as an economic pillar, but also as a cultural one for Zeeland.

In the figure 19a, progressive farmers, although today they have a high interest in matters related to the energy transition and are highly engaged in and part of it, do not have significant power to act in the face of these decisions. Because they are the ones who would suffer the most from the consequences of these decisions, and because they have such a strong interest, they are the group that this project aims to

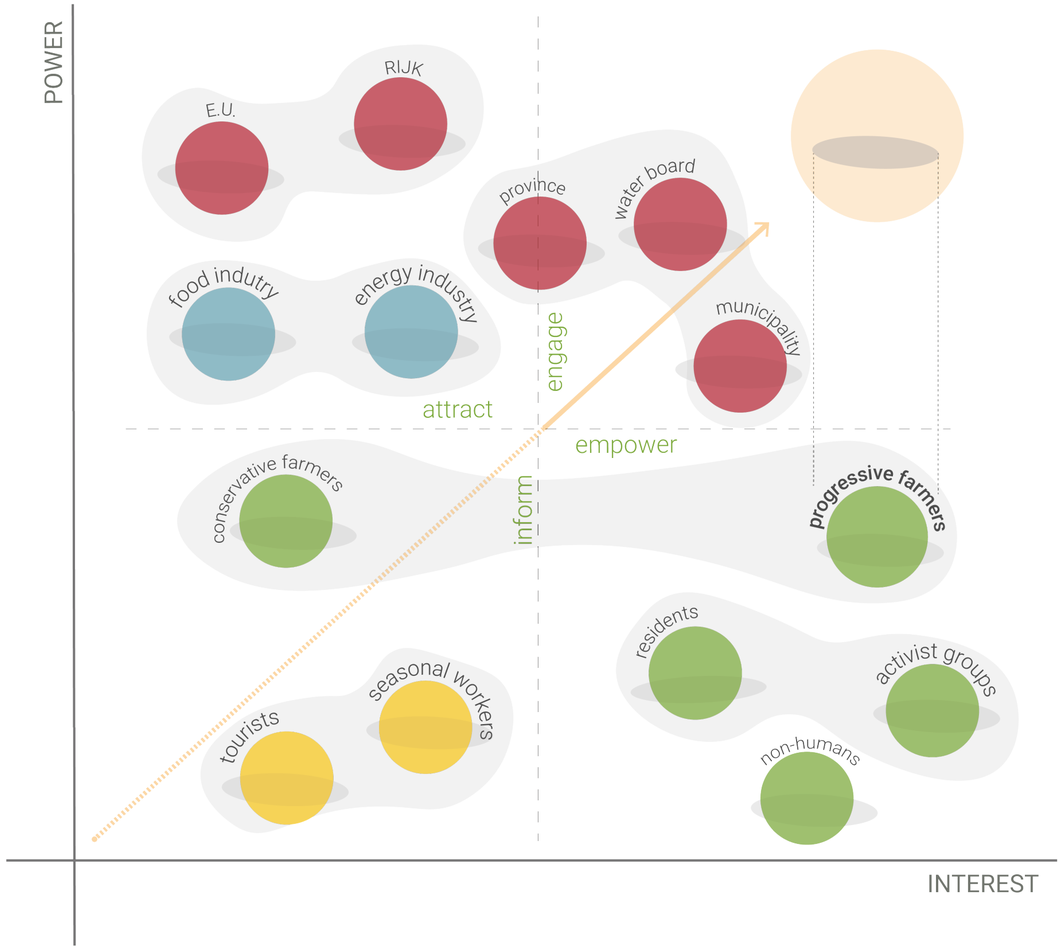


Figure 19; Power Interest matrix of stakeholders

1.Introduction
1.4 Problem Statement

The existing agricultural practice in Zeeland intensifies the on-going Polycrisis. From increasing levels of salinization as a result of sea-level rise and increasing temperatures is intensifying climate change related implications (Van Baaren et al., 2017). wWhen compounded with the political tensions regarding the nitrogen crisis and the rising energy costs connected to the on-going geopolitical tensions local spatial, economic and social pressures will continue to rise (Van Putten & Aten, 2026).

All over the Netherlands plans and policies on national and regional level are rushing the energy transition to meet prior set climate targets in an attempt to dim the ever-increasing effects and spatial implications of climate change (Zeeland RES, 2025). These unevenly affect different regions and populations, based on their geographic and geomorphological characteristics, one of which is Zeeland. As an important region in the agricultural and touristic landscape of the Netherlands, surrounded by the Oosterschelde and Westerschelde and the North Sea, the current working and living practices are highly dependent on the existing water management and engineering solutions.

Today, Zeeland is considered an important contributor to the national economy in terms of agriculture and simultaneously is counted on harnessing its potential on powering the Dutch renewable energy grids (Province Zeeland, 2026a). Farms and farmers are working at the intersection of agricultural production and food consumption and are strongly impacted by the energy and water demands that underlie their existence and possibilities for development (Van Dijk, 2018). The regions' inhabitants and more specifically the local farmers are suffering from their vulnerability to environmental and ecological pressures and economic uncertainties as well as the governmental and political demands from national and regional policies that aim to transform the region into an attractive, connected and accessible environment for inhabitants and tourists alike (Vision Zeeland 2050, 2025; RES, 2024). Framing the farms and the farmers potential as backdrop in the energy transition.

How can the farmer become an active participant rather than merely a tool?

The on-going narrative conflicts with the ambitions of the motivated young Zeeuwse farmers who are willing to change their approaches and practices to future proof their farms and contribute to the transition. But the "large distance between policy makers and the farming industry" (Huga de Jonge) is resulting in the farmers perspectives to be partially out of sights and possibly conveniently forgotten (Van Steenbergen, 2025). From the scarcity and availability of sweet water, the salinisation, sea level rise and the remaining effects of the nitrogen crisis, together with the increasing competition of agricultural land and the planned urbanisation and commercialisation of the Zeeuwse landscape (Zeeland RES, 2024; Vision Zeeland 2050, 2025).

Zeeland's young farmers find themselves caught in-between the top-down political and governmental tensions and expectation and their bottom-up ideas and wishes to shape their own future. These ambitions are also publicly supported and shared within the Zeeland Agricultural Youth Contact: "Young farmers want to move forward, not hindered by uncertainties, give them the confidence and space to make a difference in the Zeeland countryside" (Provincie Zeeland, 2025a; ZAJK, 2025). Henceforth, we need to start envisioning a better and more sustainable future for Zeeland's farmers and the region. Ultimately, this results in allowing the young farmers to take the space to actively participate in the transition to share their ideas on the best practices in the field. They are the ones who will be incorporating the changes and are currently dependent on the outcomes of the top-down decision making of individuals who are far removed from the reality of working with the agricultural land.

The demands of the young farmers can be summarised in four steps: inclusion in the process, participating in the discussions and the decisions, contribute to the transition with their experiences and ideas and lastly develop a sense of security and stability towards their profession.

"When I look around here and listen to people talking about how they are engaged in innovation, how they are willing to move with the times and adapt, I think that farmers are not going to disappear any time soon. I think these people are all putting their shoulders to the wheel. That we can move forward in a different way. And that's what's being said here, too. The farmers, the young farmers we've spoken to, won't farm the way their parents did, but they'll still be farming." by Proefboerderij Rusthoeve (Omroep Zeeland, 2025)

Main research question

How can progressive farmers in rural Zeeland act as drivers of the energy transition while safeguarding their emotional, economic and productive stability and security and contributing to a future-proof rural system at the intersection of energy, water, and food security, while mediating between top-down policy frameworks and bottom-up practices?

Subquestions

1. Understanding: What are the wishes and demands of the young farmers and how do these interact with the plans, guidelines and vision of regional and national policies?

2. Identifying: What types of decentralized renewable energy production are spatially suitable within Zeeland's agricultural landscape?

3. Applying: What spatial principles and phasing strategies are needed to transition Zeeland to a diverse and productive energy landscape?

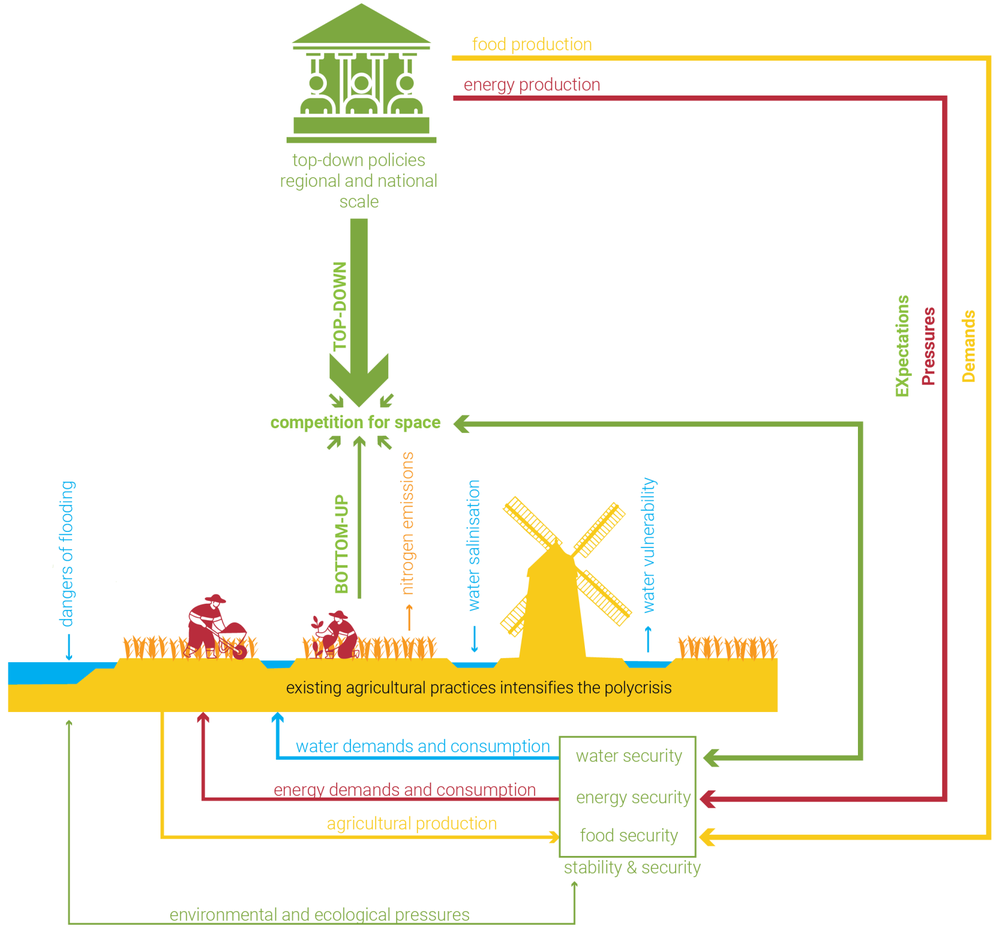


Figure 20; Problem statement diagram

"When I look around here and listen to people talking about how they are engaged in innovation, how they are willing to move with the times and adapt, I think that farmers are not going to disappear any time soon. I think these people are all putting their shoulders to the wheel. That we can move forward in a different way. And that's what's being said here, too. The farmers, the young farmers we've spoken to, won't farm the way their parents did, but they'll still be farming." - Proefboerderij Rusthoeve (Omroep, 2024)

1.Introduction
1.4 Problem Statement

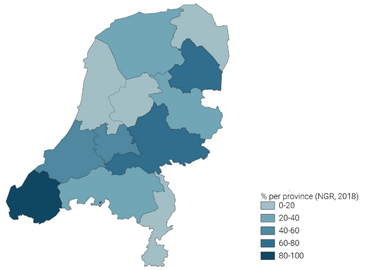


Figure 21a; Past impact of floods per province

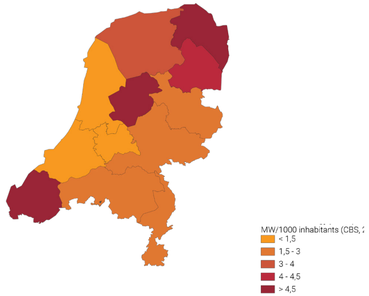


Figure 21b; Renewable energy per capita

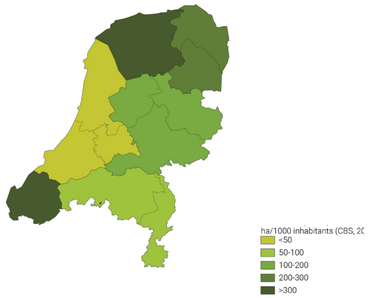


Figure 21c; Arable land per capita

As stated in the problem statement, the province of Zeeland is facing increasing pressure from national demands and spatial transitions, particularly when looking at the intersection of agriculture, energy, and water. These developments place significant pressure and stress on the identified transitional community: the farmers, as it is their land where they build their livelihood, which is directly affected by the changes.

Zeeland is one of the provinces with the highest amount of arable land per capita in the Netherlands, which underlines its strong agricultural function and importance of farmland in the regional system and economy (CBS, 2025-1). At the same time, the region of Zeeland is portrayed as an important producer in the energy transition. Since the region has a considerable potential for renewable energy production, alongside provinces such as Flevoland and Groningen (CBS, 2025-2). In addition, Zeeland has a long history of vulnerability to water-related risks, most notably the 1953 flood, which remains a defining event in the Dutch memory of flood protection and spatial resilience (Nationaal Georegister, n.d.).

Taken together, these spatial pressures and policy changes contribute to a growing frustration among farmers, sometimes expressed through protest movements and public slogans (figure 1.4-protes collage). This highlights the importance of recognising farmers not only as land users, but also as actors in broader spatial transitions. A more balanced approach is therefore needed, one that integrates and takes their perspectives seriously while still addressing to this polycrisis.

Figure 22- Collage Farmers protesting in Zeeland

This chapter details, in three stages: Theoretical Framework, Conceptual Framework, and Project Methodology, the methodological approach for developing the project in practical and theoretical terms. It investigates the complex intersections between water, energy, and food security in the province of Zeeland, operating within planetary boundaries and the context of polycrisis. The research structure is divided into three progressive phases: Understanding, Identifying, and Applying , as illustrated in the methodological diagram (Figure 25). Through a process that integrates data analysis, QGIS mapping, and the development of future visions, the project seeks not only to diagnose systemic conflicts but also to empower, through analysis and design, the transition community to assume a leading role in building a sustainable future.

2. Methodology

2.1 Theoritical Framework

2.2 Conceptual Framework

2.3 Project Methodology

2.Methodology
2.1 Theoritical Framework

Our project situates itself at the intersection of water, energy and food security, as introduced by the WEF nexus (WEF Nexus Index, n.d.), which is illustrated in the theoretical framework (figure 23). These are challenges that the region and province of Zeeland are currently facing and are intensified by an increasing frequency of climate change-related events. From these challenges and ambitions arise: water scarcity, the need for food within a circular economy driven by bottom-up processes, and lastly the need to make the energy transition sustainable and secure for everyone included.

This raises the question whether that is the sole way of achieving this transition on a larger scale and in what way the transition community can take a more prominent role. These processes occur within the planetary boundaries and the context of the polycrisis. With this all together, the different systems and conflicts are strongly interconnected; Not only do they influence each other, but the complexity of the transition increases, and the solutions should not only be approached from one perspective, but need a more integrated approach to come to the right conclusion.

However, it is specifically important to look at the intersections of the different systems: water, energy and agriculture. In the theoretical framework, there is not one clear theory that completely explains these relationships. Instead, we interpret the intersections through our research; Combined with our knowledge and literature, this shows that there are increasingly more recent studies, but this field still needs further development.

Therefore, in our project, the intersections are further researched and structured in the conceptual framework (figure 24). In this framework, they are translated into spatial concepts to address the challenges and find the right ambitions to move forward.

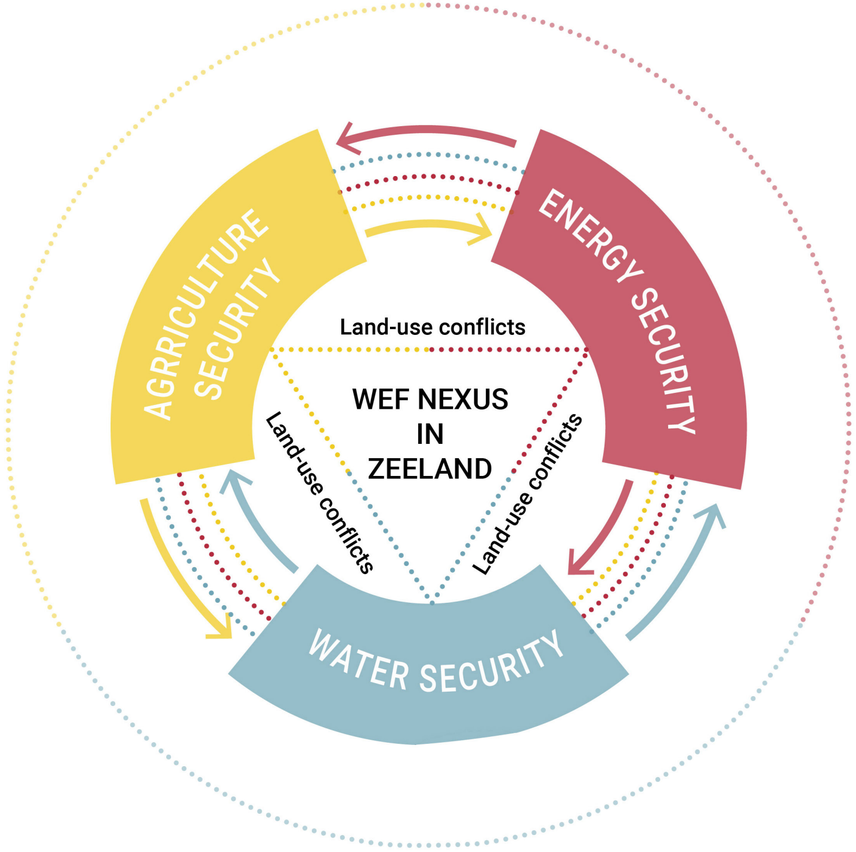


Figure 23; Theoritical Framework

2.Methodology
2.2 Conceptual Framework

The conceptual framework (figure 24) expands on the theoretical framework. It aims to outline the problems related to the polycrisis in the region and province of Zeeland, translating the WEF Nexus into a spatial and regional context. By introducing the interrelations between challenges and their conceptual development within the province of Zeeland, the framework makes these relationships visible and tangible.

We identified extreme rainfall and flood risks to be the main drivers of rising sea levels. These directly impact blue and grey water systems, as well as water treatment, and increase the risks related to water availability. Especially within the agricultural process, soil salinisation is not solely impacting water availability but also the agricultural landscape and crop production.

Current agricultural practices are driven by monoculture of specific crops including onions, potatoes and beets. These intensify the ongoing nitrogen crisis, which in turn directly impacts soil degradation and leads to an overall loss of biodiversity. Recognising this and making changes related to agricultural practices, as well as the spatial configuration and land use of arable land, can be seen as an initial step towards creating a more sustainable and resilient food system for Zeeland.

Agricultural practices are energy intensive during their different stages. Within Zeeland, the agricultural sector is slowly phasing out its fossil fuel dependency, which is partially driven by top-down political pressure and national and European climate agreements. These increase the awareness and interest of stakeholders in renewable energy and may even result in behavioural changes.

The existing system can be adapted in different ways to cater to changing energy production, through transformation, extension and construction. These are at the base of a strong energy transition and renewable energy production.

Overall, these themes and challenges interact as they create a direct spatial competition between each other, particularly in relation to land use, where water management, energy production and agricultural activities all require space within the same region.

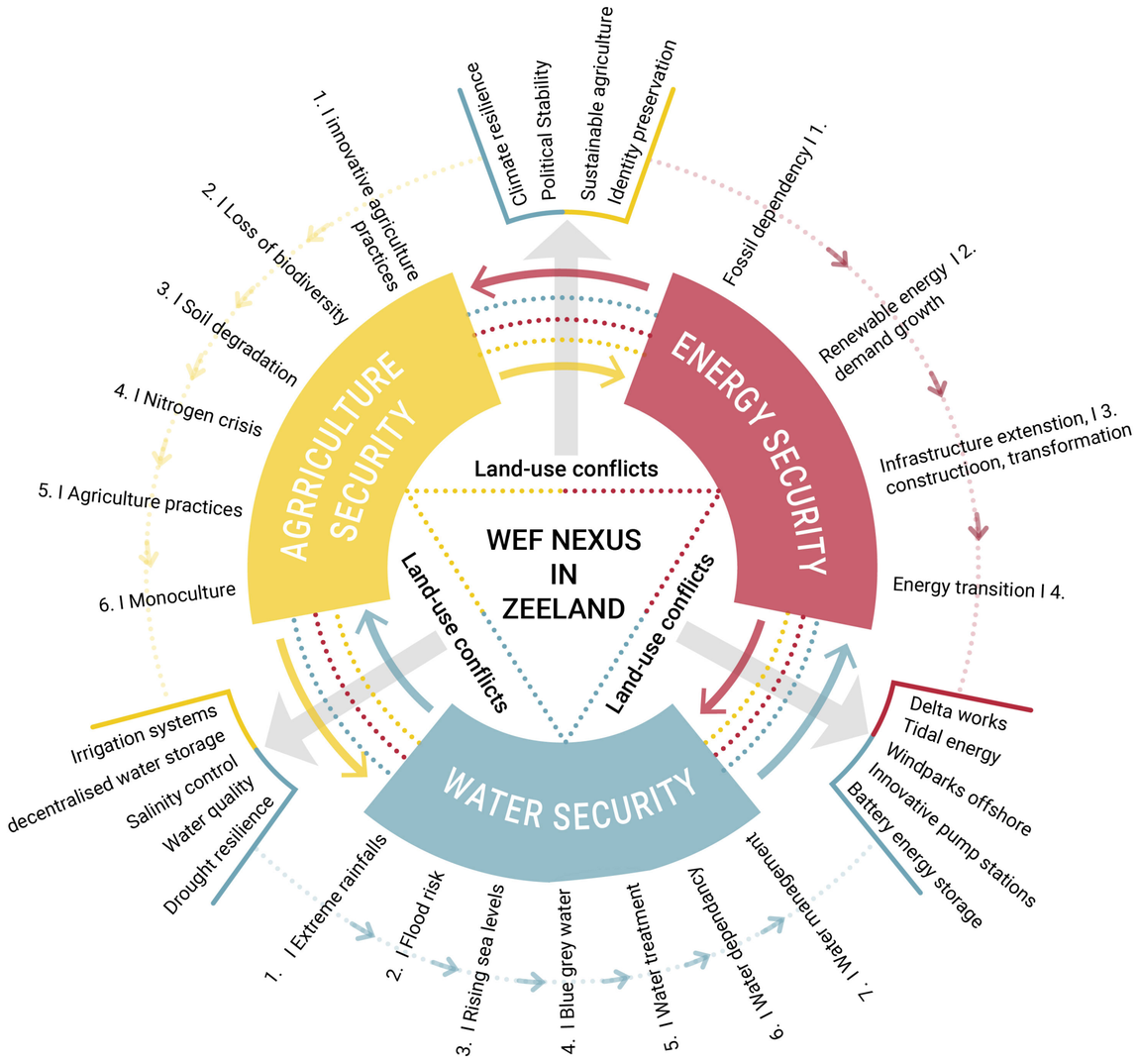
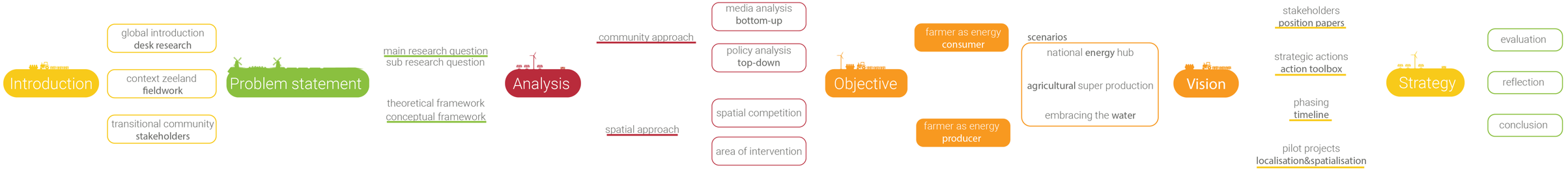


Figure 24; Conceptual Framework

2.Methodology
2.3 Project Methodology



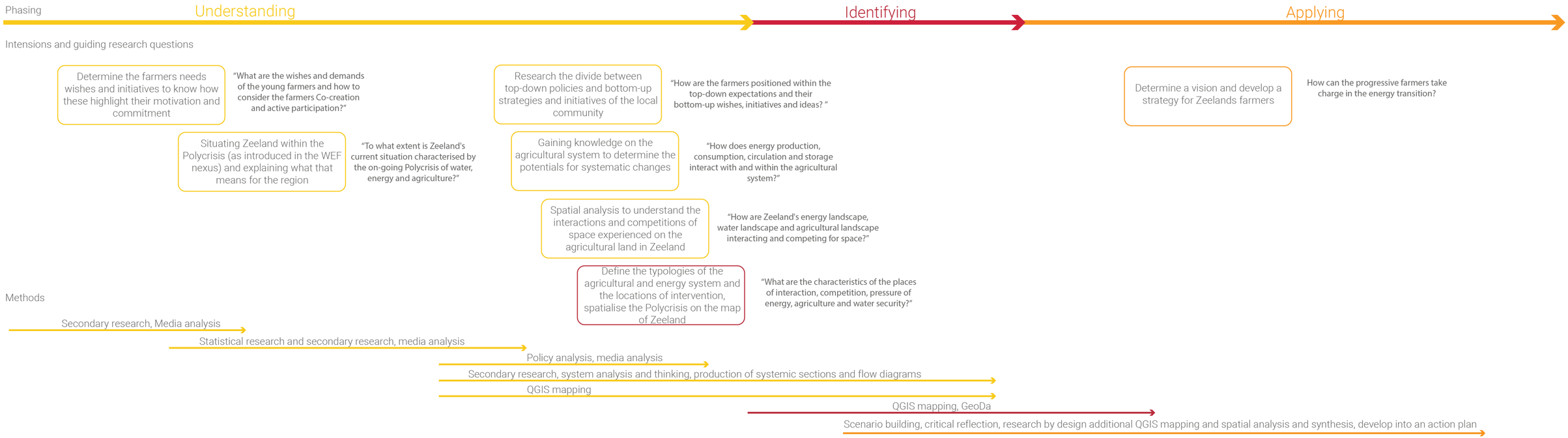


Figure 25; Methodology diagram

This chapter presents an in-depth analysis of the interconnected challenges of water, energy, and agriculture in Zeeland, starting from an approach that amplifies the voice of the community most affected by the energy transitions planned for Zeeland: the farmers. The Community Analysis explores the aspirations and concerns of local farmers, revealing a strong desire for active participation. Next, the Policy Analysis exposes the mismatch between national sustainability goals and the operational reality of farms. Finally, the Spatial Analysis systematizes these tensions through mapping and systemic sections, demonstrating how soil needs, water scarcity, and energy infrastructure compete for space. By crossing these layers, the chapter concludes that for the region's future, all productive potential must be aligned with the aspirations and actions of farmers, as well as their water, food, and energy security.

3. Analysis

3.1 Community Analysis
3.2 Policies
3.3 Spatial Analysis
3.4 Conclusions

3. Analysis
3.1 Community Analysis

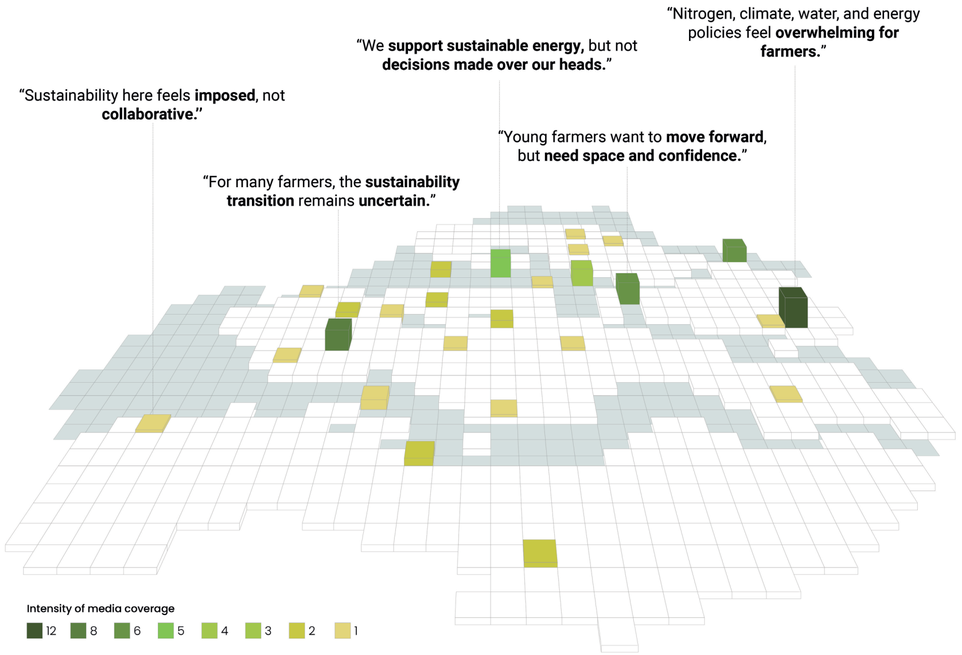


Figure 26; Media Analysis diagram

The media analysis (figure 26) shows the level of media intensity about agriculture, energy, and water, and most importantly what farmers think across the whole of Zeeland. The map shows how this news is spread throughout Zeeland and how high the intensity of different media reports is in each area. All in all, it shows that these challenges, as experienced by farmers, are not limited to one location in Zeeland but occur throughout the whole region.

To better understand and represent these perspectives, we translated the different viewpoints of farmers into a series of cards (figure). In the different media reports, a strong bottom-up perspective from farmers comes forward. Quotes like "Sustainability here feels imposed, not collaborative" (TU Delft Delta,) or "We support sustainable energy, but not decisions made over our heads" (Nieuwe Oogst, 2025) show that farmers experience many developments as top-down. They are left out of the picture and feel that they are not being asked to be involved. This results in a situation where the transition, which they also want to contribute to, is actually slowed down by top-down pressure and a lot of uncertainty. The last quote describes this well and, in our opinion, also shows a direction to strive for: "Young farmers want to move forward, but we need space and confidence." (Wageningen University & Research, 2026). Overall, these challenges can be found throughout Zeeland. They are often overlooked, while the developments and problems are already complex enough. All of this shows that participa-

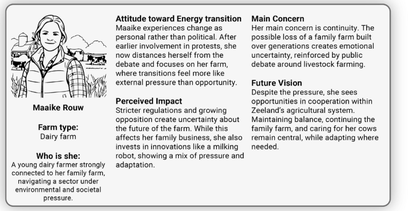


Figure 27a; Farmer ID card 1

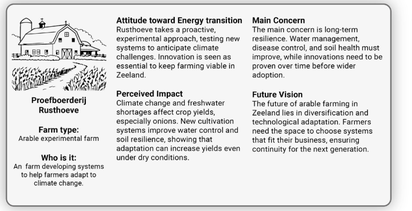


Figure 27b; Farmer ID card 2

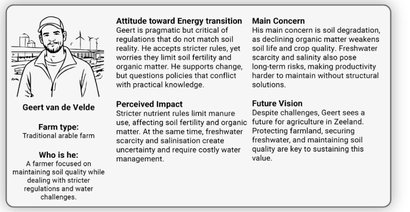


Figure 27c; Farmer ID card 3

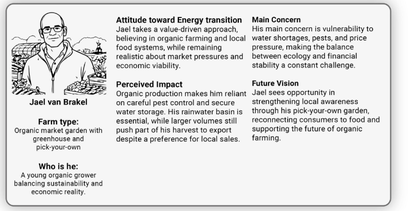


Figure 27d; Farmer ID card 4

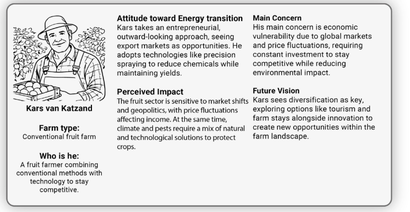


Figure 27e; Farmer ID card 5

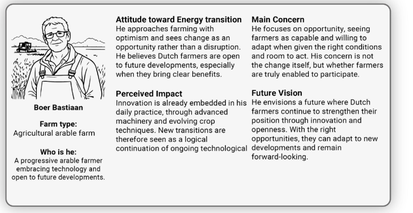


Figure 27f; Farmer ID card 6

3. Analysis
3.1 Community Analysis

Energy

Community-based cooperative for the production of solar and wind energy.

Zeewind currently produces enough wind energy in Zeeland to power approximately 400,000 homes, double the number of residences currently existing in the province (Zeewind, 2026). However, problems related to the national high-voltage cable system cause congestion issues and thus hinder the proper routing of the energy produced once it is integrated into the grid.

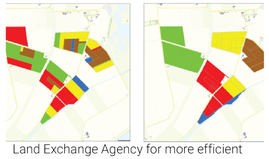
"We conclude that the Dutch policies for small-scale energy initiatives have not been consistent and alignment of policies between different levels of governance was missing " (Maqbool et al., 2023).

Water

Individual Rain Water Basin in farm in Zeeland

The implementation of a rainwater basin on a farm in the Zeeland region consists of building a reservoir capable of storing large volumes of rainwater for use during periods of drought. This practice, already adopted by more innovative farmers, ensures greater water security for crops.

"So this is the basin. It can hold 6,000 cubic metres of water. It's a kind of giant rain barrel" (Omroep Zeeland, Jael van Brakel (26) 2025).



Land Exchange Agency for more efficient crops distribution.

A group of residents, acting neutrally within this agency, ensures the productivity of agricultural lands throughout the year by facilitating fair and voluntary land exchanges that improve land use efficiency and coordination among stakeholders.

"With the help of the Land Exchange Agency, governments can work on solutions for society[...]. " (Province, Zeeland 2025)

Agriculture

Local Initiative to colet,treat and transform into fertilizer the nitrogen generate by agricultural practices in Zeeland

AMFER technology allows nitrogen to be extracted from different sources and transformed into high-quality fertilizer. This contributes to more sustainable resource management and improves the utilization of manure in the region, for example, by using it in the production of green gas.

"An award-winning initiative by Zeeland farmers to capture nitrogen from their crops and convert it into their own fertilizer" (Zeeland,2025).

Figure 28; Farmers' Initiatives

Viewing the farmer as an agent of urban design not only expresses their willingness to participate in decision-making, but, above all, seeks to guarantee this community an active voice in participation and management. By placing them at the same discussion table, a more balanced level of debate is promoted, with decisions built in a more

Figure 29; Collage "Farmer as a planner"

3. Analysis
3.1 Community Analysis

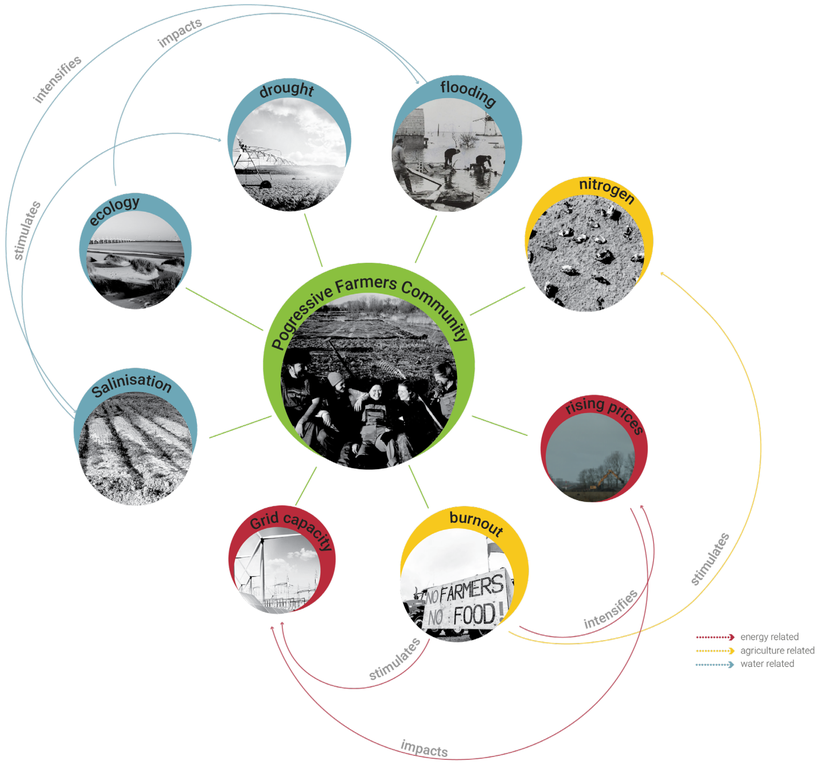


Figure 30; Concerns

In figure 30, we aim to schematically and comprehensively synthesize the main concerns of the progressive farming community regarding their land permanence, such as their land practices, in relation to climate crises, socio-economic tensions, and spatial and power disputes. Among the main fears related to climate issues and water security are constant concerns about flooding, droughts, preservation, and sanitation. This is largely justified by the geographical spatial context of Zeeland. The spatial security of farms, built on polders, depends directly on water security. Regarding their own agricultural practices, the nitrogen crisis and the 'burnout' caused by the constant and increasing spatial pressure set on them are the most prominent issues. Finally, regarding energy security issues, their main concerns focus on the congested grid, which sometimes hinders the full functionality of their operations. Adding to their distress is the exponential rise in energy prices in general, which affects them more intensely.

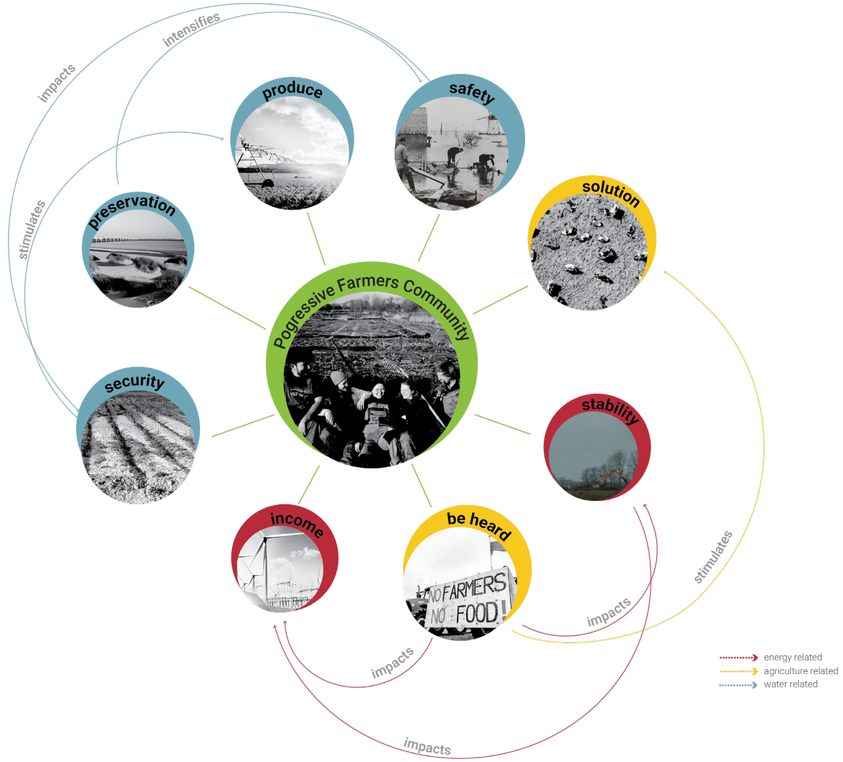


Figure 31; Wishes

The figure 31 complements and synthesizes the responses already raised by the progressive farming community regarding their concerns, and how to develop their aspirations based on this. Immediate concerns include answers regarding their security and stability, and many associate this with issues of water security. Therefore, they understand that the aspiration to preserve nature and its landscapes should be closely aligned with their productivity goals. Regarding the resilience of their agricultural practices, they not only seek solutions from the authorities, but, more importantly, they produce such solutions, which further stimulates their main desire to be heard.

3. Analysis
3.2 Policies

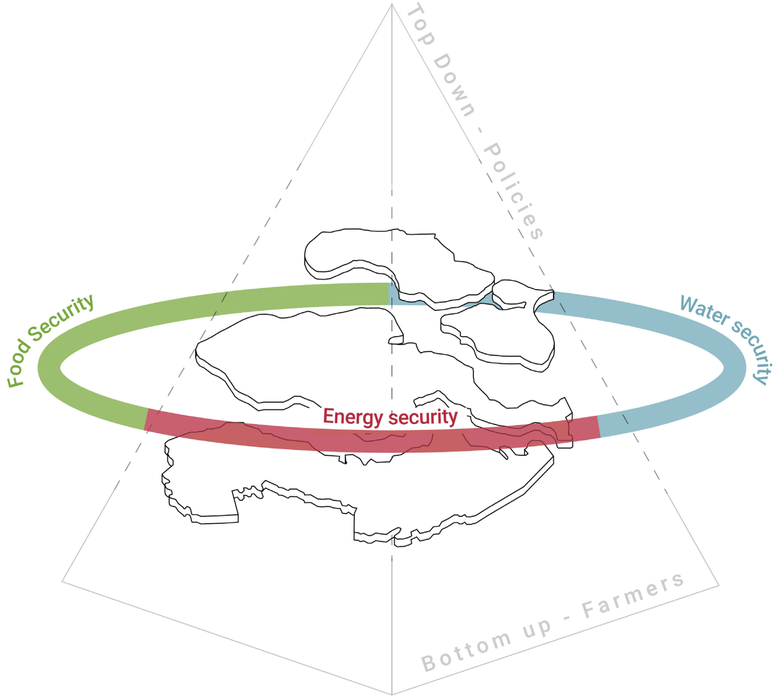


Figure 32; Top - down / bottom - up diagram

The policy analysis highlights a conflict between top-down expectations of national and regional government and the bottom-up motivations and initiatives of the farmers at local scale that or often are hard to bridge due to their scalability and reach (figure 32). At the national scale the Ontwerp Nota Ruimte (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025) notes that the farmers are a major contributor to the food security of the country and the importance of ensuring this. On the other hand, the Klilmaatakkoord and Programme Energie hoofdstructuur (Ministerie van Economische Zaken en Klimaat, & Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2024; Ministerie van Economische Zaken en Klimaat 2019) frames the farmers within their possibilities to contribute to the national goals and suggests a reduction in agricultural intensity and land use close to the protected nature. At the same time they are also stressing the importance of engaging the young farmers through participation and offering support for agricultural innovation (Ministerie van Economische Zaken en Klimaat 2019).

And at the regional scale, the vision for Zeeland 2050 (Zeeland Vision 2050, 2025) by the province of Zeeland and the Regional Energy Strategy for Zeeland (RES Zeeland, 2024) have defined expectations towards the farmers. Overall, an agreement is reached that agriculture needs to become more sustainable and that farms “need” to contribute to the generation of renewable energies (Zeeland Vision 2050, 2025; RES Zeeland, 2024). These are outlined in the policy roadmap in Figure.33. is intended to ease the reader into understanding the top-down demands and expectations on multiple scales and determining how the farmers can gain agency within the energy transition and reach energy security, food security and water security.

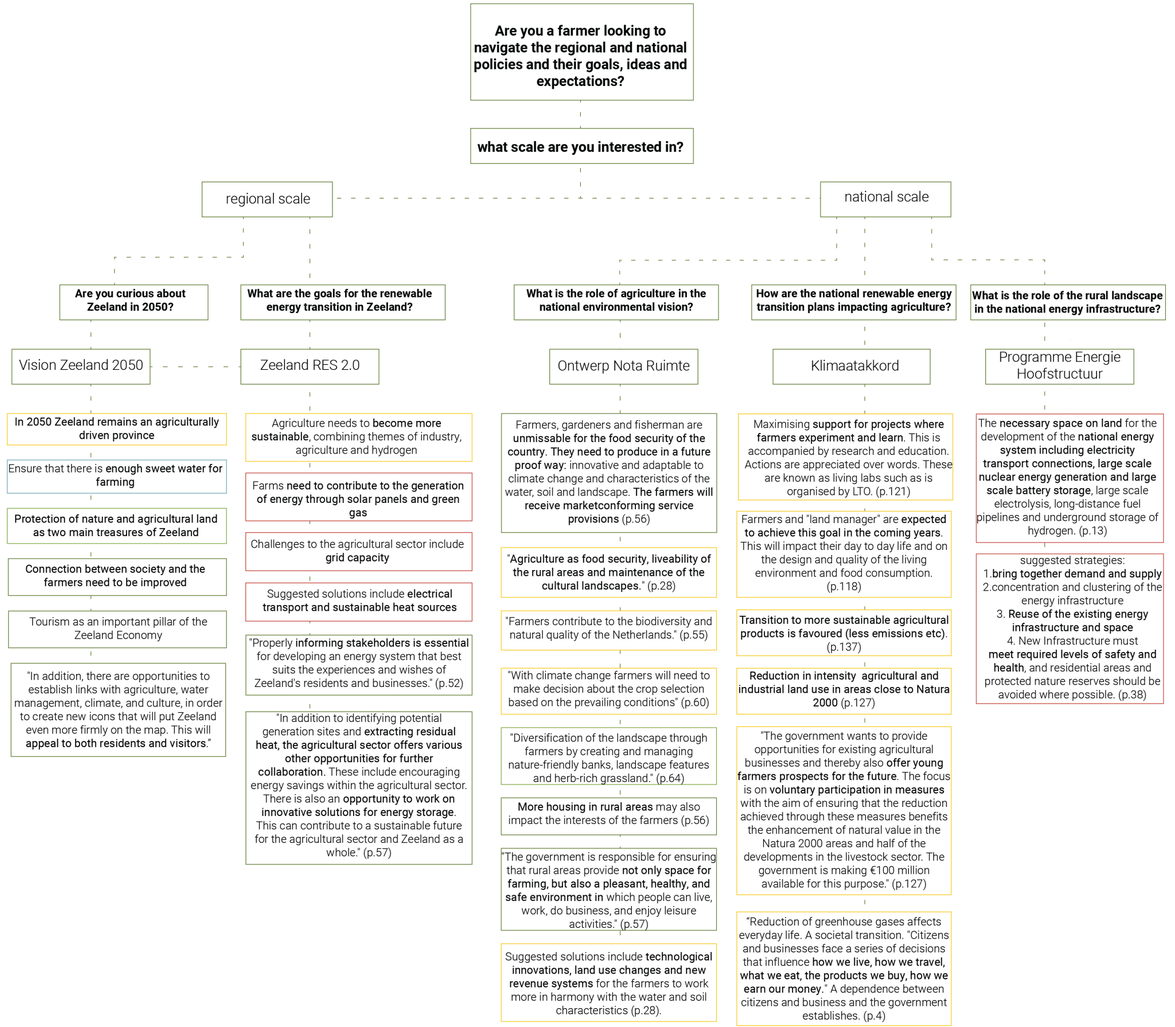


Figure 33; Policies diagram

3. Analysis
3.3 Spatial Analysis

To begin the spatial analysis of how water, energy, and agricultural security issues not only operate but also, and primarily, interrelate in Zeeland, it is necessary to analyze from which urban landscapes this interconnection and exchange occurs. (figure 34) Using the agricultural process as a basis for outlining goals and plans based on farmers' demands, in addition to the agricultural landscape, three other landscapes prove highly relevant to the process of production, distribution, and consumption in this sector. These are the urban landscape, as well as the direct consumers of food produced on the farms that surround them. Furthermore, they actively suffer from problems related to the province's water and energy security. The industrial landscape, besides being a high consumer of energy and water for its activities, also influences network congestion, pollutant emissions, and the water crisis that generates drought tensions for farmers and the community in general. Furthermore, related to the agricultural process, it is in this landscape that the processing and distribution of food produced on farms occurs, generating potential dependence and market monopolies. Finally, the natural landscape, which constantly suffers from the practices of the energy, urban, and agricultural sectors, must therefore be respected in decisions relevant to water, energy, and agriculture security.

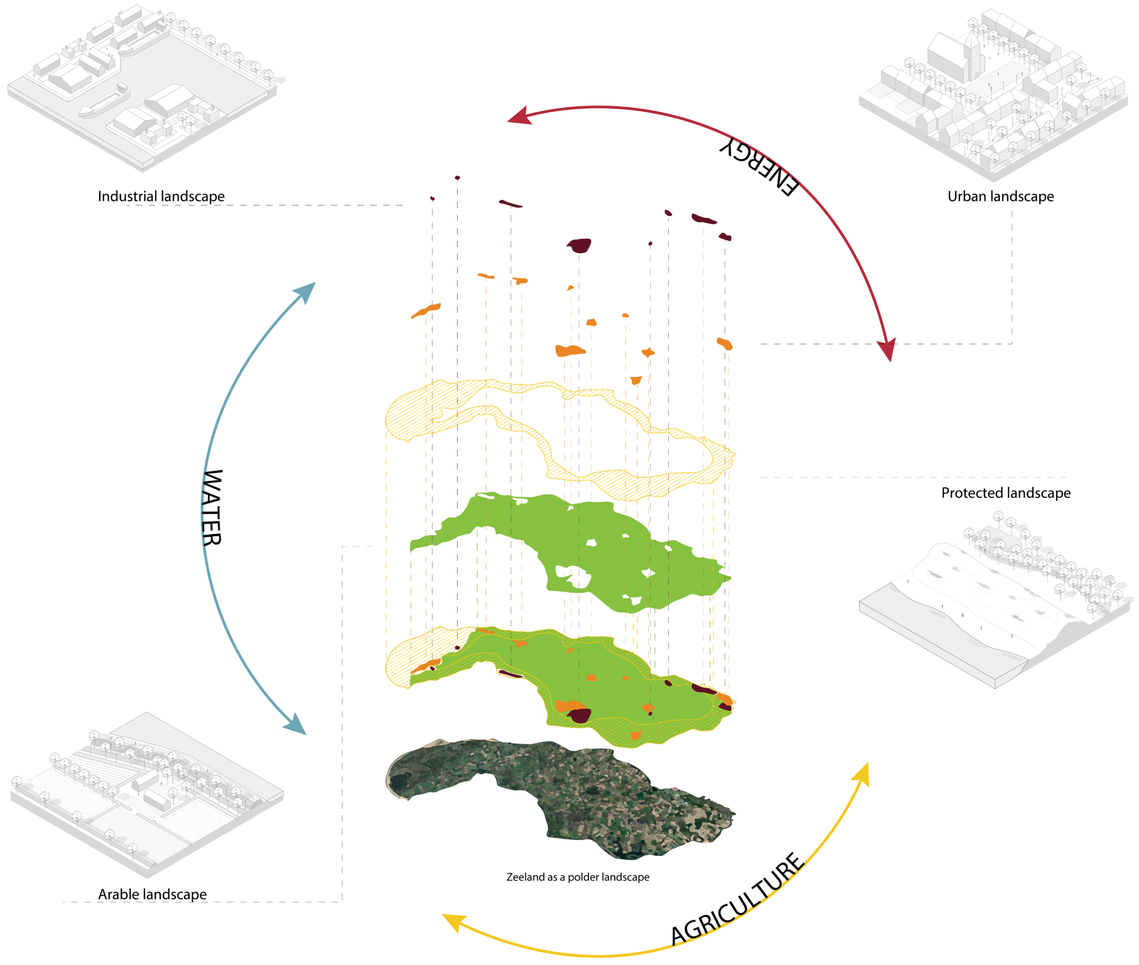


Figure 34; Landscape typologies of Zeeland integrated with the 3 topics

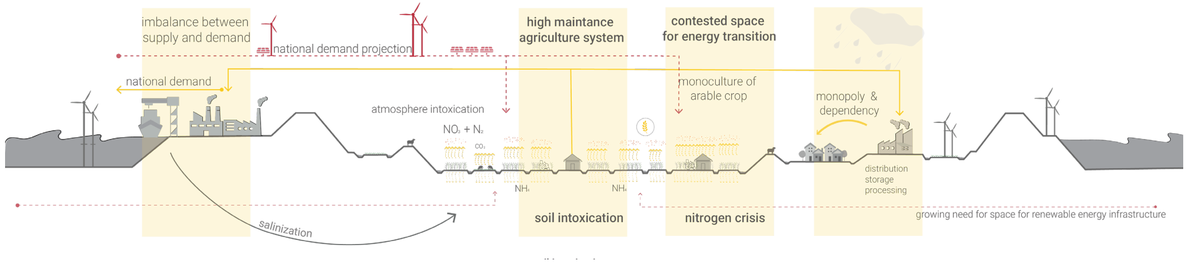


Figure 35a; Agriculture section

Agriculture in Zeeland can be spatialised as a predominantly arable landscape, shaped by the presence of crop production across the region. The regional map (figure 35b) shows nine different crop types forming the main agricultural land use, with agricultural grassland as a secondary category, while greenhouse cultivation remains limited compared with other regions in the Netherlands as Westland. This illustrates the character of the region being mainly open-field agriculture, rather than intensive horticultural production or livestock production with cows or other animals. This arable land use is further supported by the underlying soil conditions, as much of Zeeland consist of sea clay and sand, which provide fertile conditions that make the delta region highly suitable for agriculture (Geologie van Nederland, n.d.). At the same time, the dikes contribute to local biodiversity, while protected coastal areas and Natura 2000 zones frame the land of Zeeland.

In the systemic section (figure 35a), agriculture appears not only as a productive land use, but also as a highly-maintenance system under pressure form soil intoxication, fertilizer use, resulting in the nitrogen crisis as mentioned before. Other issues act on the intersection of agriculture and water, especially salinization, which reduces the availability of ditch water for irrigation and increases the pressure on, and highlights the vulnerability of the agricultural system. As a result, agriculture in Zeeland must be understood as a system balancing fertile soils, ecological value, environmental pressure and water scarcity.

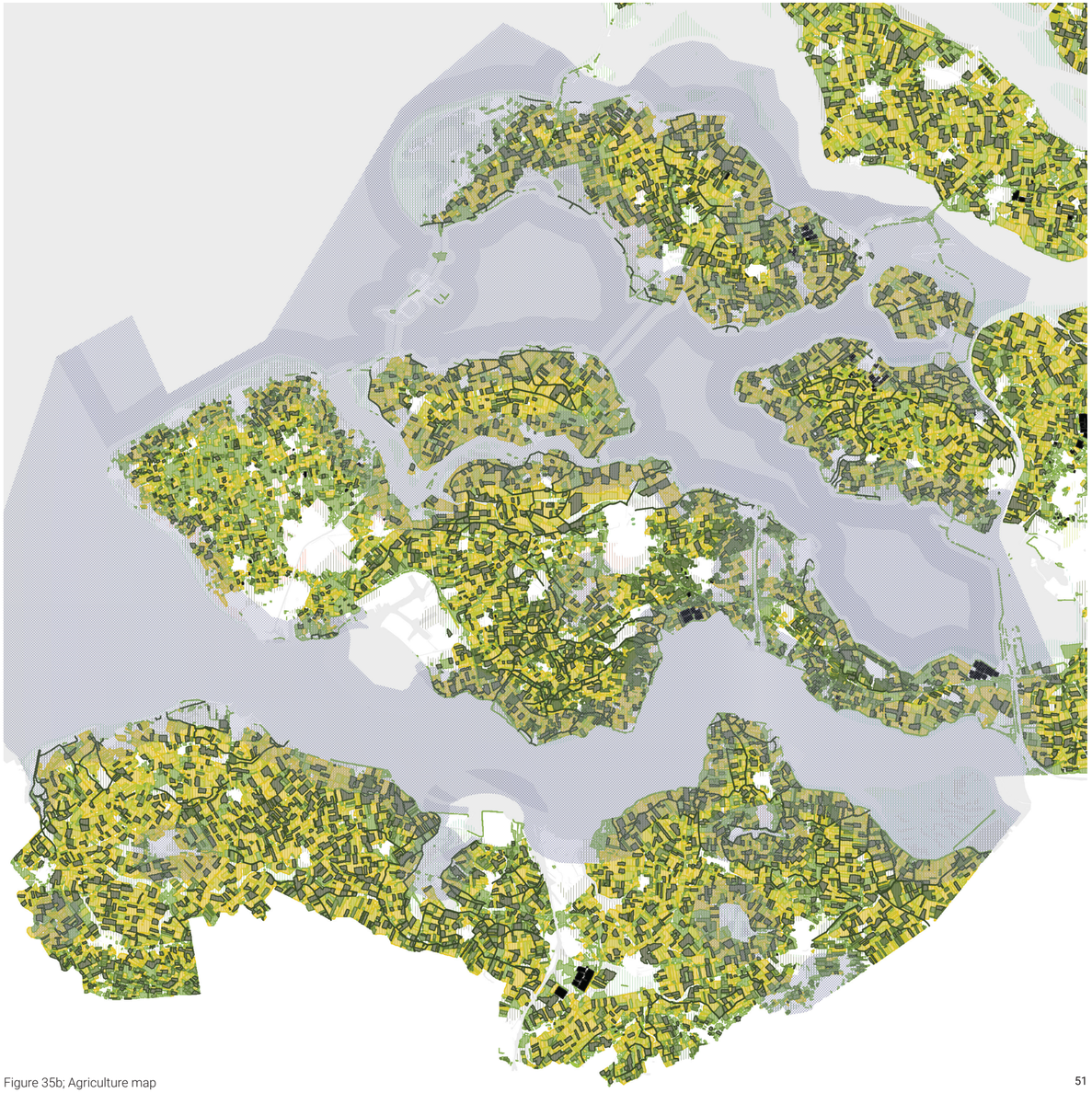


Figure 35b; Agriculture map

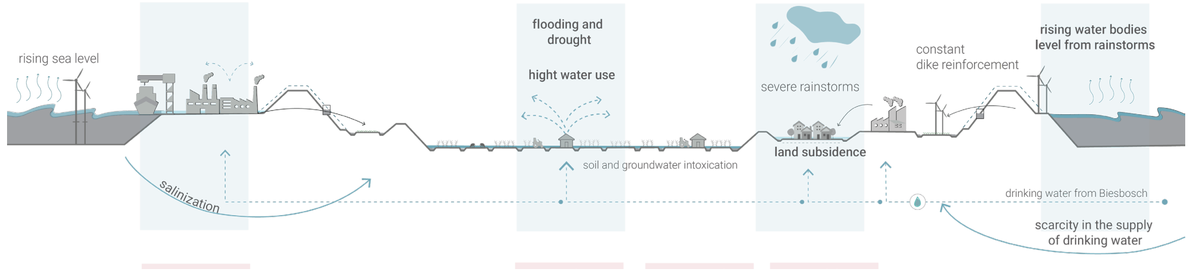


Figure 36a; Water section

In Zeeland, the areas most susceptible to flooding due to rising sea levels are located along the coastline, next to the dikes . Meanwhile, the areas most prone to flooding from torrential rains are in the interior of the province (Klimaat Atlas, n.d.). This high probability of flooding justifies the number of pumping stations located among the polders. The amount of energy used to maintain such a water protection system is high and also contributes to the region's drinking water crisis. This crisis affects the well-being of protected areas, from parks to the Oosterschelde reservoir in the province. (figure 36b)

On this theme, the environmental challenges shaping the region, regarding the water security aspects, as illustrated in the systemic section (figure 36a). Rising sea levels and increased rainfall intensify flooding risks, across the whole area, while periods of drought lead to high drinking water demand, coming from Biesbosh Park, which is currently under high demand and pressure (Posad-Maxwan, 2023). Due to the high levels of agricultural practices in Zeeland, there is even greater intensification during the crisis caused by the demand for drinking water. The rising sea level contributes to soil and groundwater salinization, reducing agricultural productivity and freshwater availability while hindering the possibility of storing and using potable water from the soil. Agricultural practices themselves intensify soil pollution, which accelerates effects such as land subsidence. (WEF NEXUS, n.d.). This further exacerbates vulnerability, making coastal and low-lying areas more exposed. Altogether, these processes create a growing scarcity of drinking water and increasing pressure on natural systems.

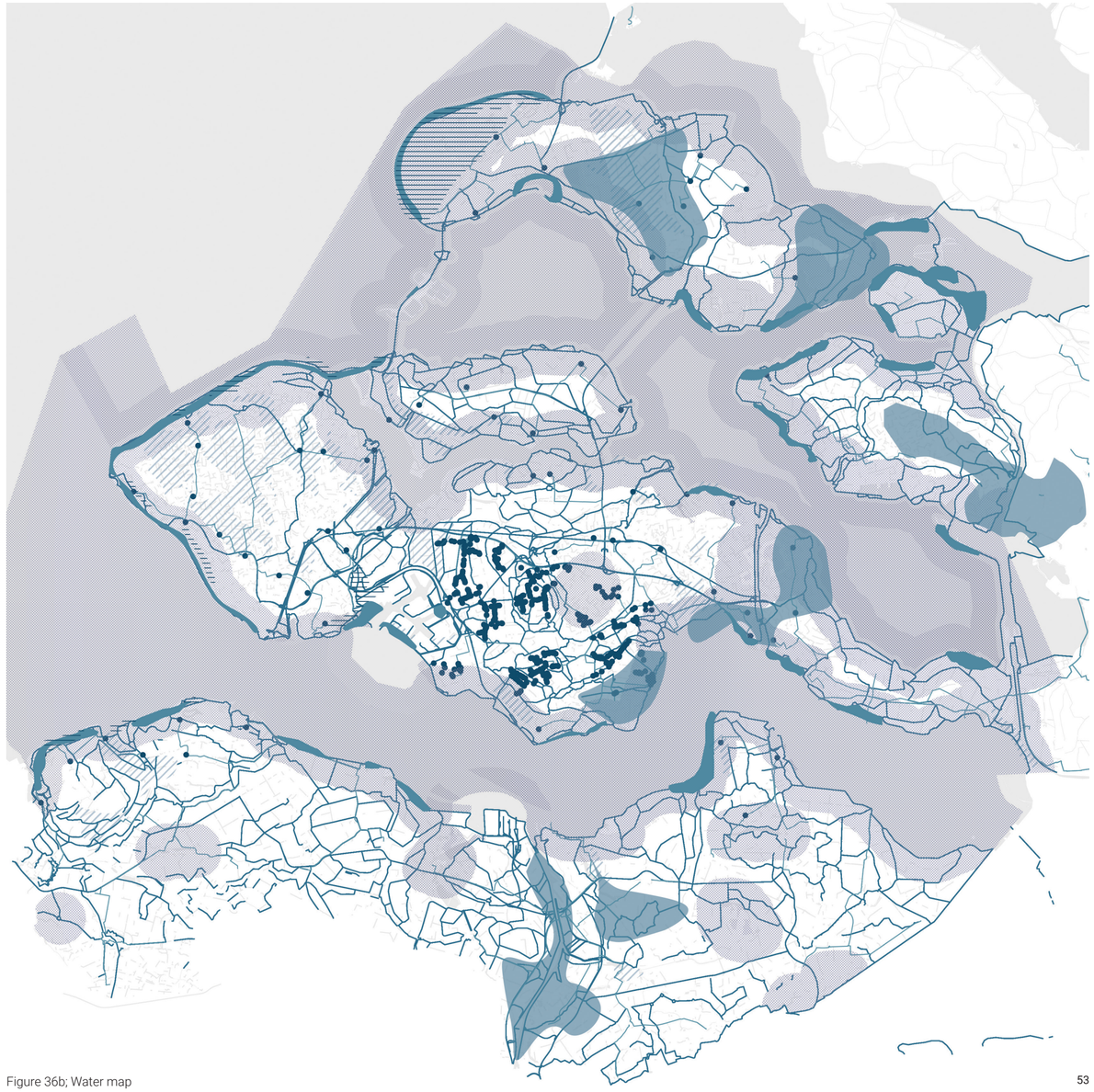


Figure 36b; Water map

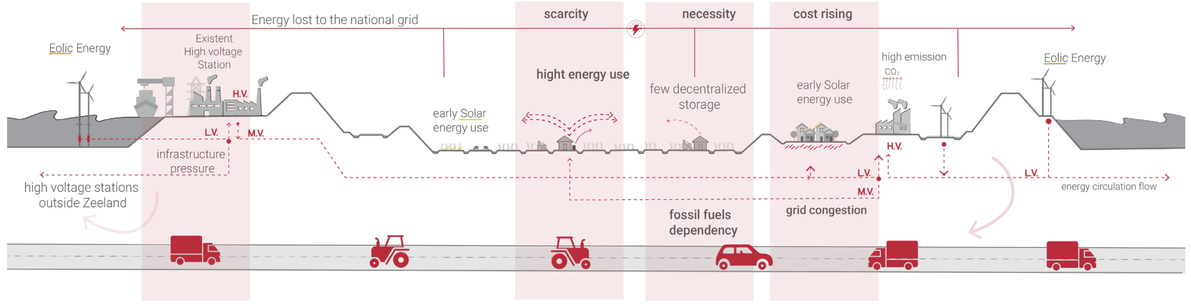


Figure 37a; Energy topic section

This layer (figures 37a, 37b) focuses on the energy transition and its infrastructural implications on agricultural land. Firstly, it highlights the high energy consumption required to maintain the agricultural process, and how this influences the saturation of the existing grid. There are inefficiencies related to rising energy costs and continued dependence on fossil fuels. The lack of decentralized storage and infrastructure highlights the need for a more resilient and locally integrated energy network. The concentration of industries in Zeeland can be attributed to and is closely linked with the agricultural demands of the province. These activities require high energy capacity and result in significant CO_2 emissions into the atmosphere (European Environment Agency, 2023) However, there are principles of renewable energy production, on local scales, such as on farms, urban centers, with just three biogas stations, and even some industries with some Solar panels around the business parks but in a small density (PDOK, n.d.). The high-voltage power transmission network, however, is concentrated only around Oosterschelde, while high-voltage substations and connections to the national grid are located at the extremities of the province, towards Belgium. This explains why grid congestion and uneven distribution (high, medium, and low voltage networks) create bottlenecks, while increasing energy demand intensifies pressure on the system (Zeeland Provincie, 2025).

Although renewable energy (such as wind and solar) is being introduced, much of the generated energy is lost to the national grid due to centralized systems and limited local storage. This leads to inefficiencies, rising costs, and continued dependence on fossil fuels. Together, the three layers reveal an interconnected system where climate pressures, energy transition challenges, and agricultural practices reinforce one another. Addressing one layer in isolation risks inefficiency or unintended consequences; instead, integrated and systemic solutions are required to balance water, energy and food security (WEF NEXUS, n.d.) .

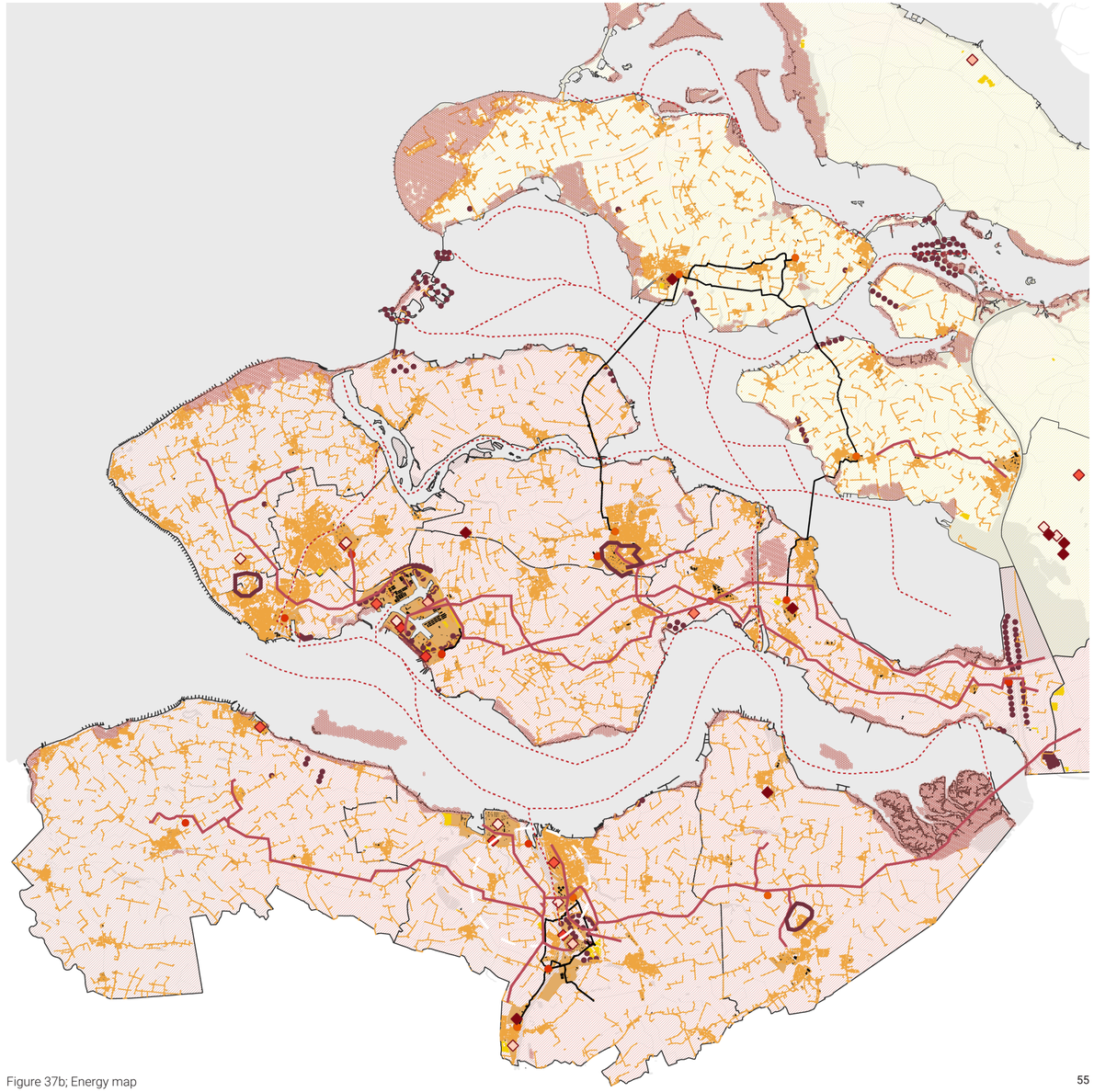


Figure 37b; Energy map

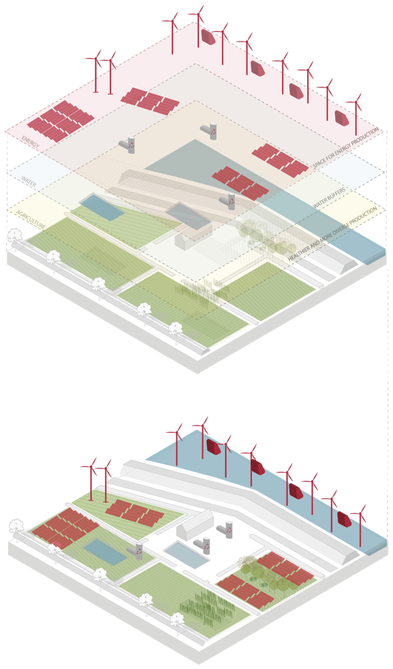


Figure 38; Spatial Pressure

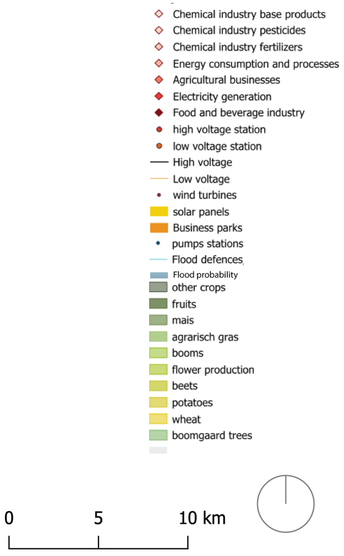


Figure 39; Intersection map

3. Analysis
3.4 Conclusions

As introduced in Chapter 1.2, the conflict of diverse interests surrounding Zeeland's agricultural land is intensifying. The growing demand for energy production is reflected in ongoing national and regional plans to position Zeeland as a renewable energy hub. The space required for the implementation of solar or wind farms, biomass processing plants, and hydrogen plants, for example, is enormous, and the impact on those who currently depend on this land is huge. The space required for the implementation of solar or wind farms, biomass processing plants, and hydrogen plants, for example, is enormous, and the impact on those who currently depend on this land is huge.

Water management and environmental concerns add further pressure, particularly through the need for expanded buffer zones to manage torrential rainfall and prevent flooding. When these flood-prone areas are not planned in collaboration with farmers, the primary landowners, this can lead to not only significant tension and strained relationships, but mainly the(figure 40) loss with no reward, of their production source. Additionally, the nitrogen crisis and harmful agricultural practices contribute to this ongoing conflict as an additional spatial layer, prompting discussions not only about reform but also about diversification within the sector.

Together, these overlapping demands place increasing pressure on agricultural land and the farmers who manage it. The following chapters address these challenges by proposing strategies that aim to transform (figure 42a, figure 42b)

Moreover, the current agricultural value chain (figure 41) follows a fully linear process from phase 1 to phase 4, where farmers mainly act as energy consumers and are dependent on external systems, resulting in a less efficient and vulnerable system.

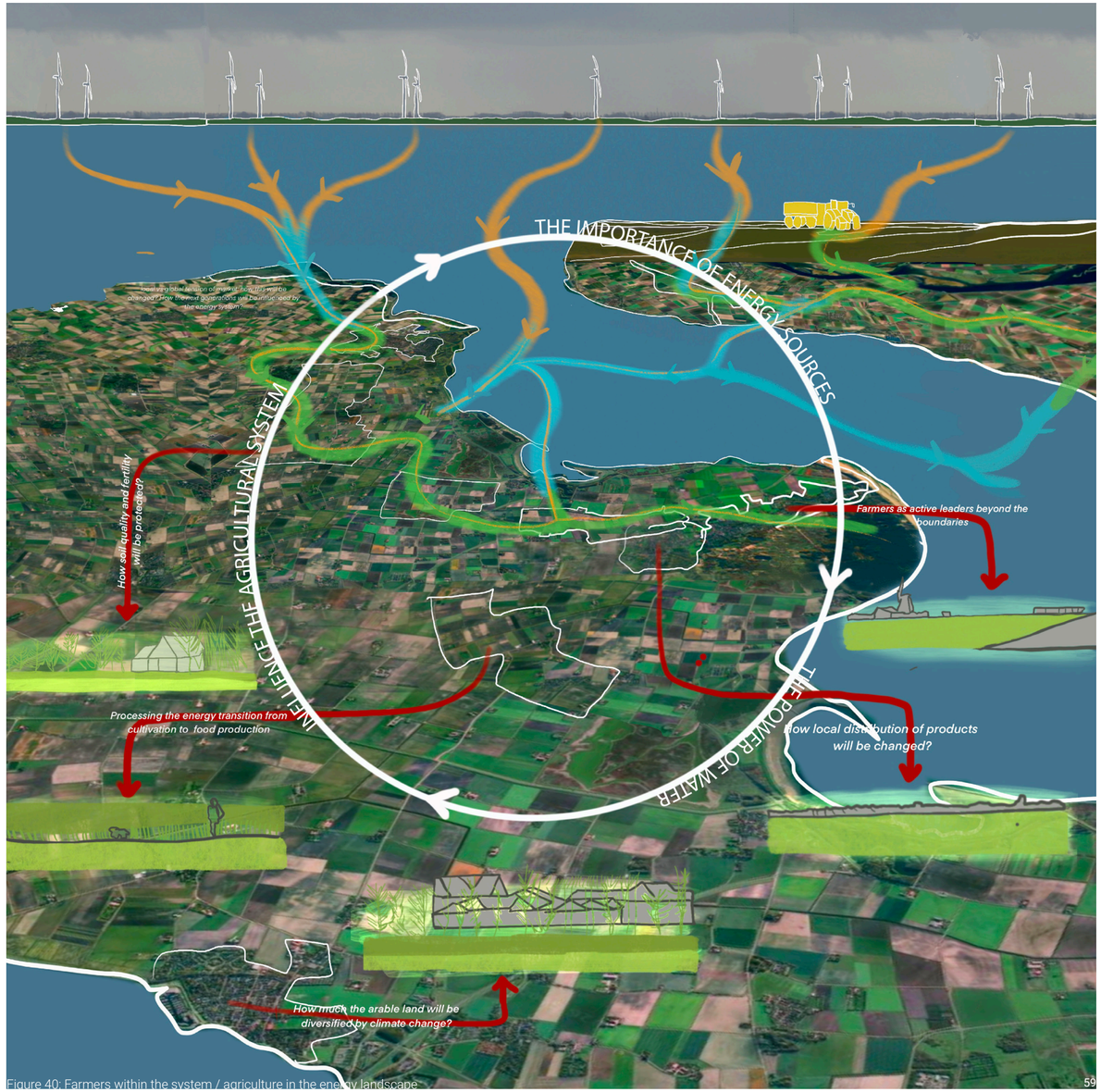


Figure 40: Farmers within the system / agriculture in the energy landscape

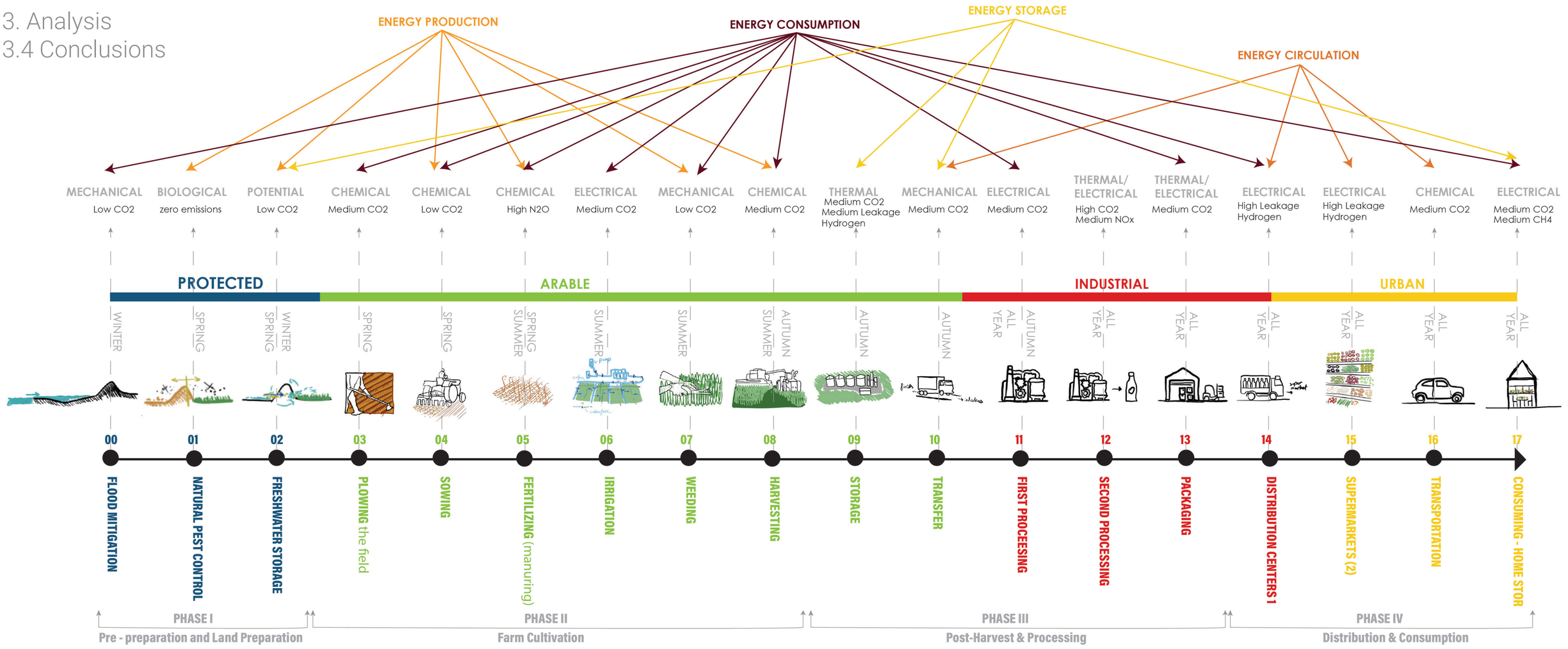


Figure 41; Agricultural value chain

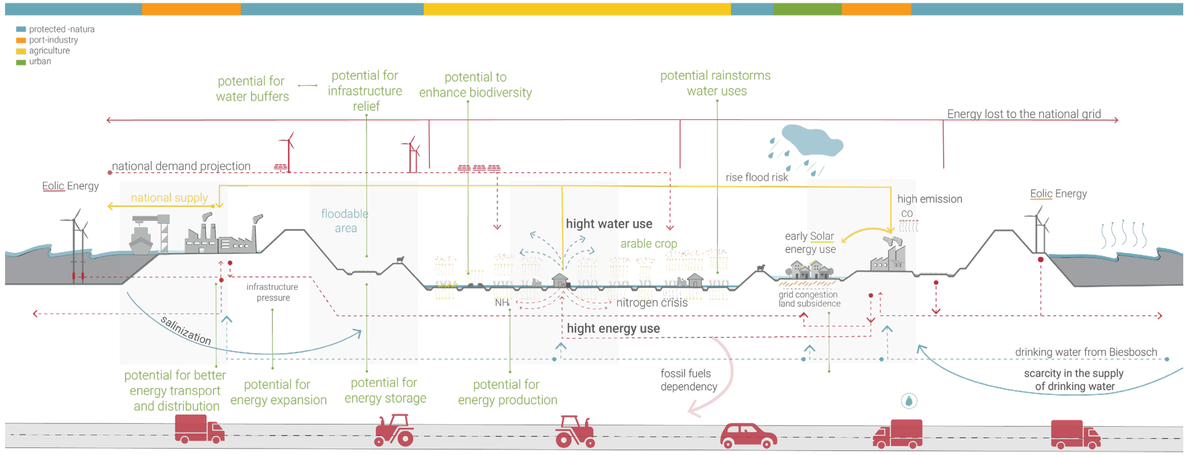


Figure 42a; Potential section

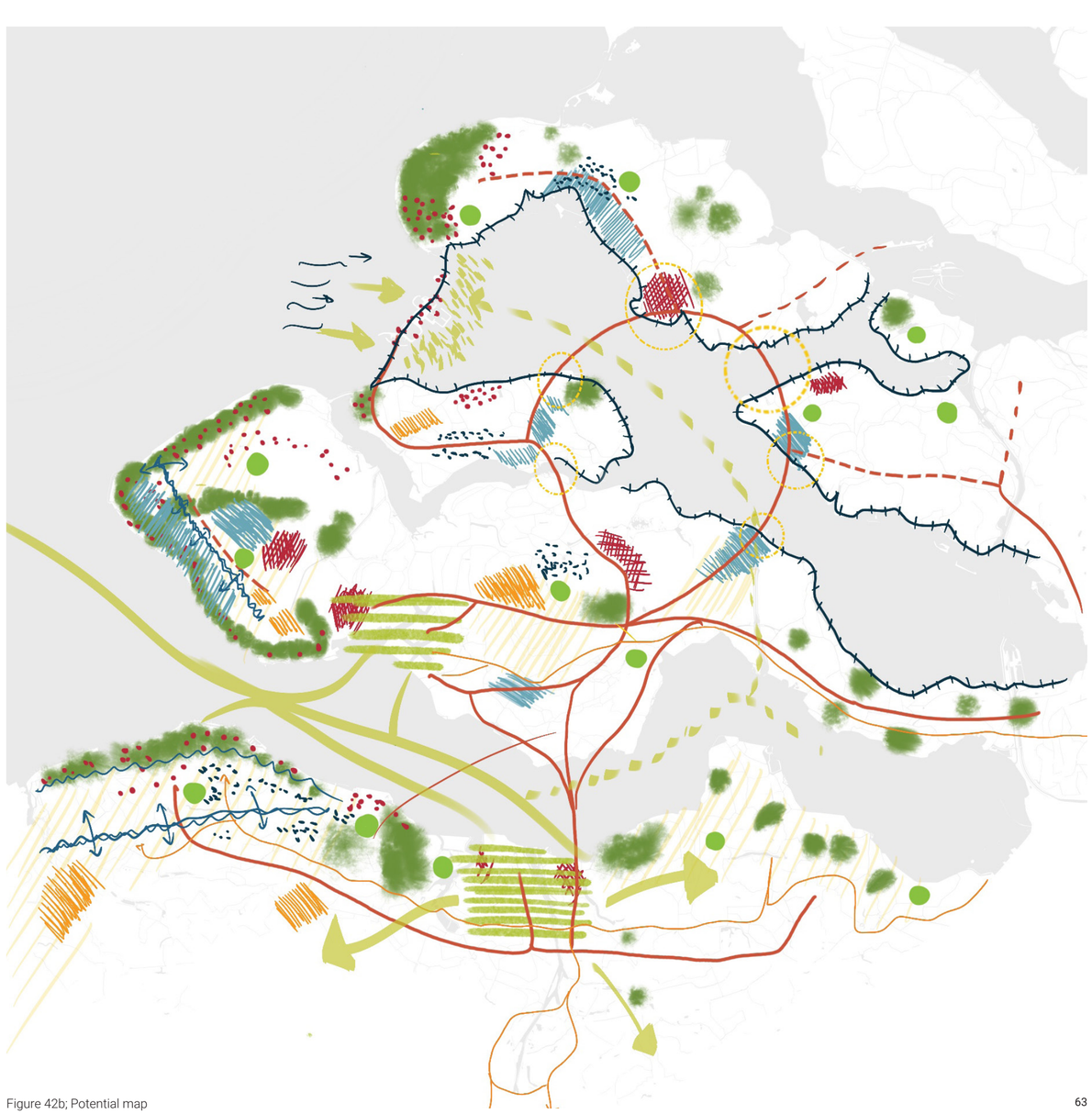


Figure 42b; Potential map

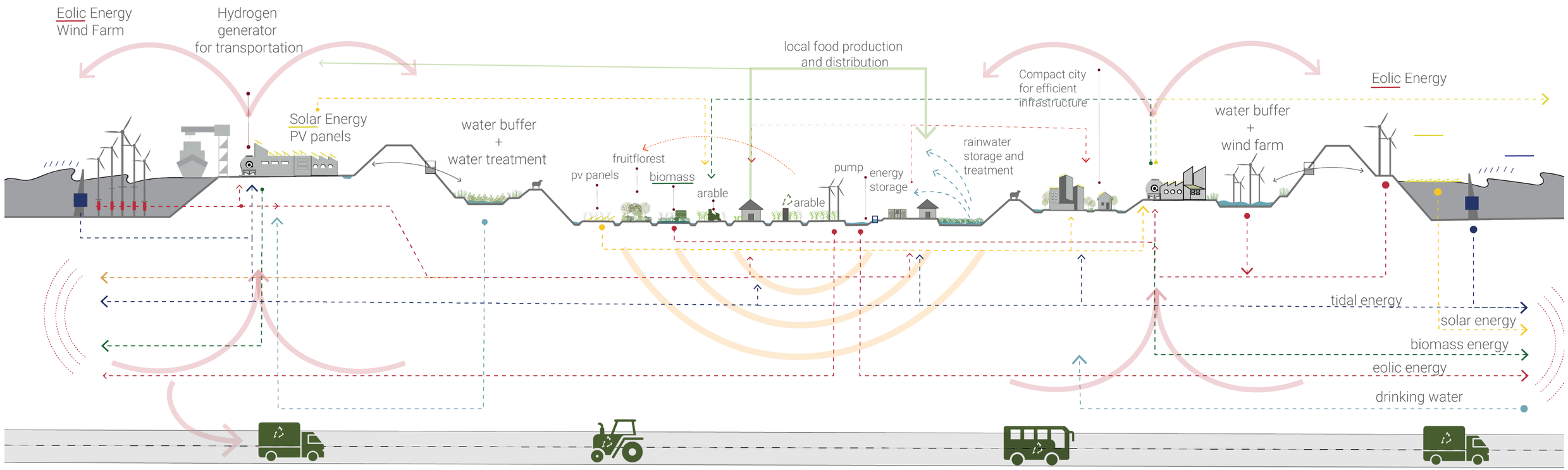


Figure 43; Systematic Interactions of problems and opportunities

In this chapter, based on the main aspirations related to water, energy, and agriculture, a scenario for the future of Zeeland was outlined separately. The analysis of these three scenarios made it evident that, in each of them, addressing a separate and exponential theme, the solutions predicted significant losses for the other. The conclusion discussed, then, is that the ideal scenario, most beneficial for all themes and thus for the community of Zeeland in general, is the scenario that integrates the three in a synergistic and complementary way, giving voice to all the aspirations and concerns necessary to guarantee water, energy, and agriculture security and therefore, farmers stability.

4. Vision

4.1 Scenarios
4.2 Objective
4.3 Synthesis

4. Vision
4.1 Scenarios

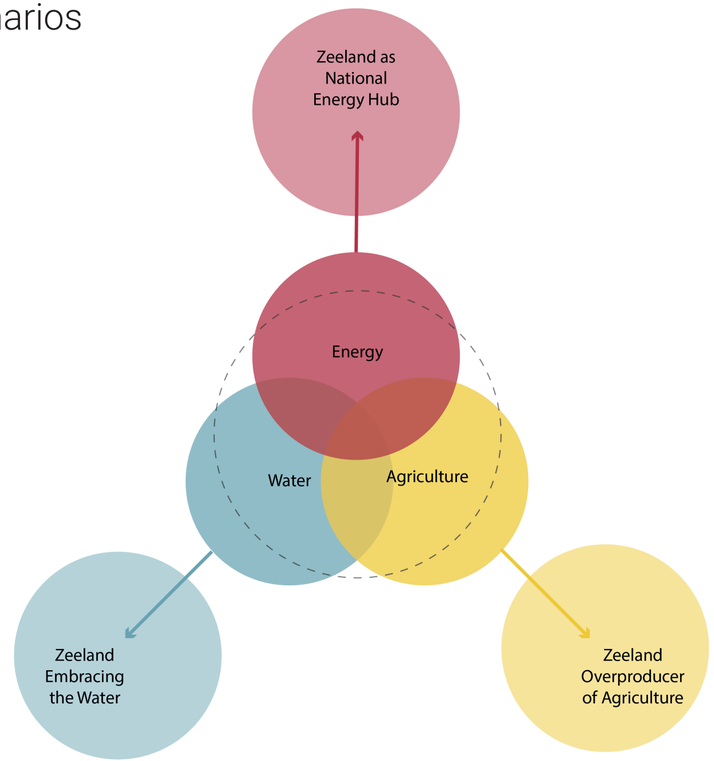


Figure 44; Introduction to extreme scenarios

Three extreme scenarios are developed to explore the needs of space of the three themes interacting within Zeelands landscape: energy, water and agriculture. In this scenario the context of large scale energy production is developed where water and agriculture intergrate within (figure.44a). It envisions the agricultural landscape as an energy production site where 70% of the landscapes primary landuse is intended for energy proudction. This allows Zeeland to become a national energy hub. The rain water is collected with strategically placed waterbasins next to the green houses. Off-shore windfarms also contribute to the energy production. Food is produced in greenhouses which are supplied with adjacent batteries. Due to the heavy energy focus additional food is imported from the neighbouring countries, Germany, Luxemburg or and Belgium. Biomass processing is encouraged but has not really been developed. All sources of energy are implemented ranging from solar, wind, hydrogen, tidal and kinetic to nuclear. This scenario positions the farmer with new business opportunties to produce and sell energy. It may come with long-term stability and certainty but simulatenously a loss of identity in landscape and practices

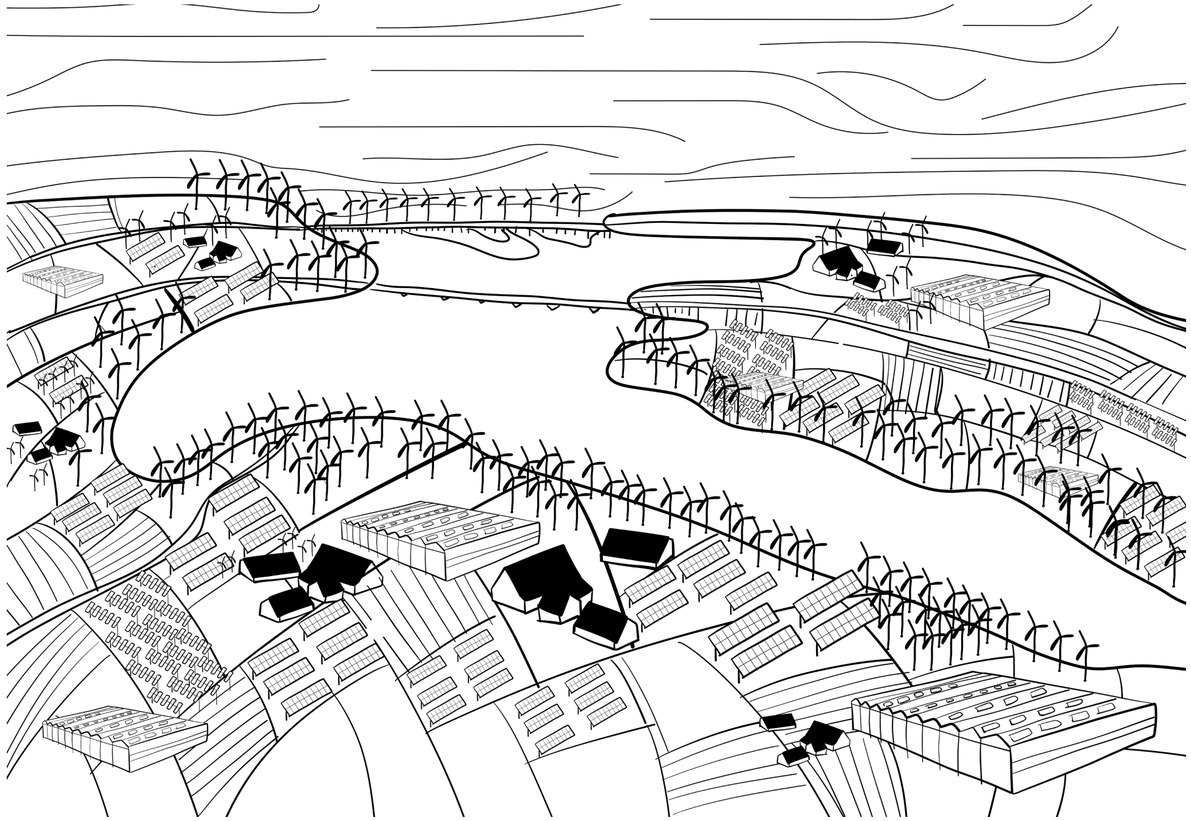


Figure 44a; National energy produce

4. Vision
4.1 Scenarios

Given the location of Zeeland with the North Sea and Schelde Delta as major sources of life and danger as was experienced during the Waternoodsramp in 1953 an extreme future could be imagined in which the water completely takes over (SOURCE). As a result of continous flooding and sea level rise of climate change. The little cities left can only survive by living on circular platforms surrounded by a dijk (Figure.44b).The wetlands have been fully inundated with water and occasionally act as buffer zone to the water. The hyper salinisation results from the seawater taking over the land increasing the need for large sweet water and rain water filtration systems and reservoirs. These surround the cities with an equal surface area from which the water is pumped up to the cities. Changing conditions also brought major changes in agricultural practices and crops to those that can also grow in changing condition such as seaweeds and other greens. We can notice a growth in floating farms and vertical agriculture that are not dependent to the soil conditions. And fishing is becoming even more popular. Regarding energy production solar panels on roofs and the water are implemented such as tidal energy adn wind turbines in a decentralised manner to cater to teh individual cities. A trend of hyper dense urbanisation is happening within the dijkes created. For the arable farmers a loss of land and identity may either result in adaptation moving.

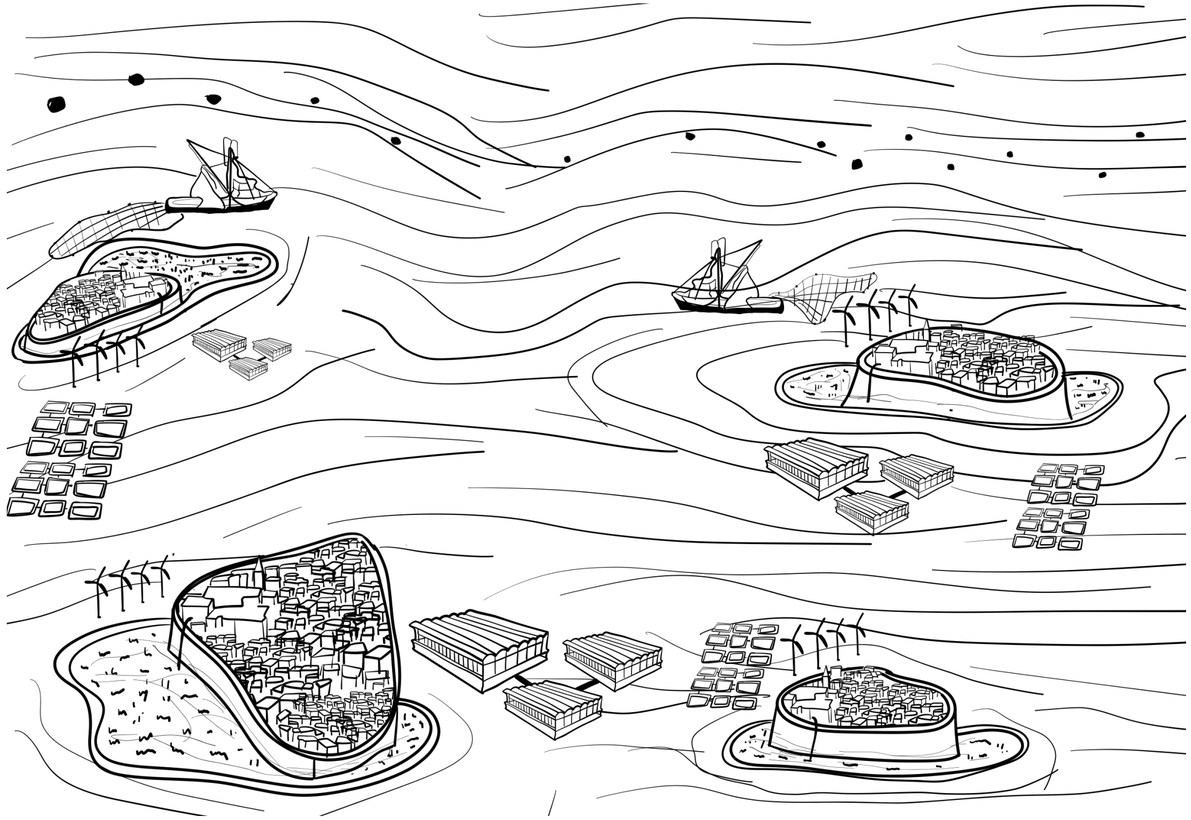


Figure 44b; Embracing the water

4. Vision
4.1 Scenarios

In this scenario, the Zeeland landscape is characterised by extreme agricultural production (Figure.44c) allowing Zeeland to become a national and internaitonal food producer. Soil salinisation is remains an on-going challenge that is tackled by working with large water buffers and decentralised water reservoirs and retention areas. Irrigation also makes use of hte water buffers and retention areas. Vertical agriculture is encourage to drive large-scale production in homogenous climate environments but is not the norm and are complemented with greenn houses. Machinery is driven by biogas that is produced collectively with biogas plants. Agricultural practices have become even more monofunctional in order to have the higest production yield and lowest cost. Chosen agricultural fields are complemented with agrivoltaics and solar grazing such that the local farmers can meet their own energy demands. Additioally, wind turbines can be found along the water front where the potentials for energy generation are highest wind potentials. High agricultural output is leading to a demand for more farmers with more job opportunities. Even so that current and future inhabitants may want to become farmers making the job more attractive. The agricultural identity of Zeeland is strengthened and the appreciation and pride developed. Nonetheless this scenario may have grave implication for the local ecosystem, the soil quality and lonegvitiy of food production.

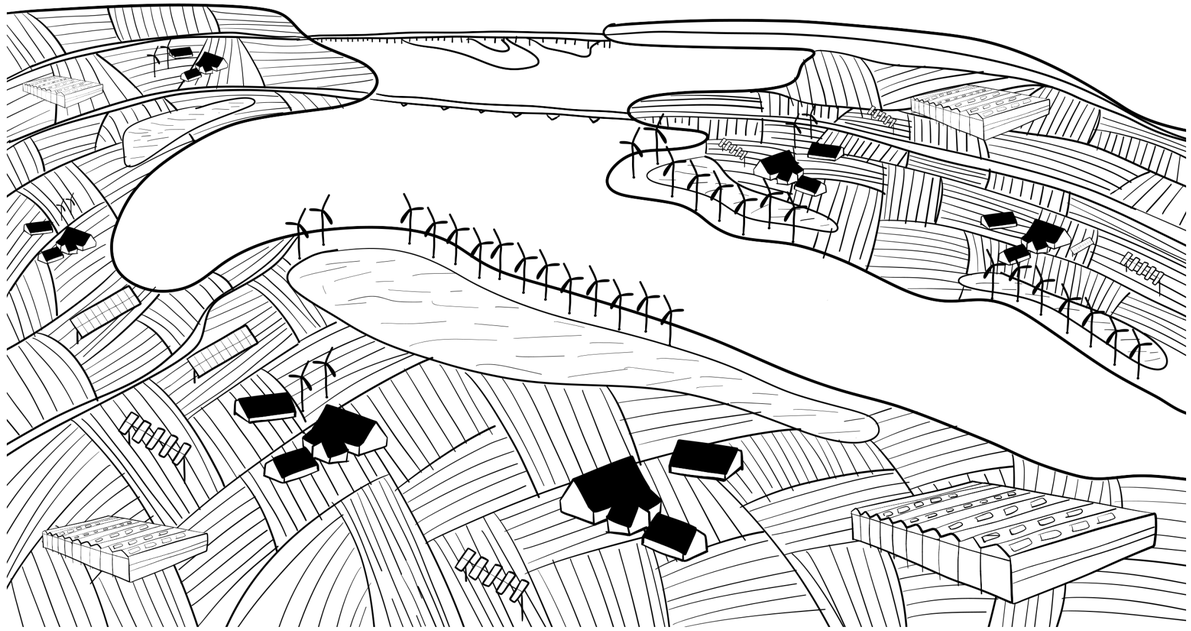


Figure 44c; Agriculture over production

4. Vision
4.1 Scenarios

Evaluating the three extreme scenarios on the three themes of agriculture, water and energy the priorities and intersections between these can be determined. In the scenario of Zeeland as a National Energy producer (Figure.44a.) the farmer is positioned as not only a consumer but also an energy producer. New opportunities bring stability and security but leading the landscape to suffer under the threats and exploitation. Letting the water take over the landscape (Figure.44b.) may increase the threats of water salinisation and availability of sweet water. In this scenario the possibilities for growth become quite limited. And in the Agricultural overproduction scenario (Figure.44c) the landscape suffers from nutrient depletion and raises questions on the temporal feasibility of its on practices.

Ultimately, It is understood that separate scenarios within a single system are not beneficial either for the system itself (in the long term) or for the other interconnected systems. Therefore, a combination of the three scenarios non-negotiables needs and wishes, highlights that a co-existence between the three themes can be achieved through careful planning, management and visioning (figure.45). It remains important to make space for the water organically. A diverisfication of the agricultural landscape and practices allows for different crops to be produced in the changing conditions. Energy production becomes more central to the area and is strategically placed in areas of high wind and sun potential and in close vicinity to farms in regards to biogas plants, in a decentralized manner. And appropriate spaces for water buffers, as well as the more sustainable and responsible use of drinking water for agriculture. Only through co-existence could a environmentally supportable development be achieved.

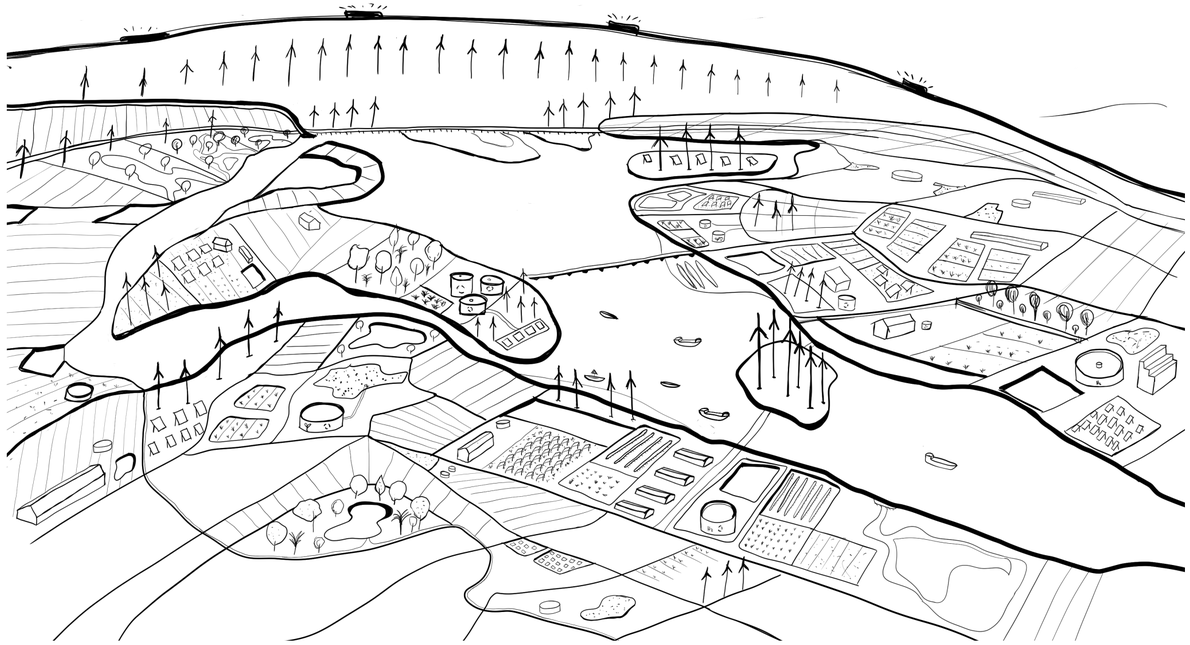


Figure 45; Scenario for Zeeland Oosterschelde

4. Vision
4.2 Objective

Our objective of the vision is to shift the position of the farmer within the agriculture and energy transition. The farmer is not only solely an energy consumer for the production of crops but is also becoming a producer of the energy they use (figure 46). Nowadays, farmers use a lot of energy for the agricultural process, such as machinery, irrigation, and the transport of food. All this makes the farmer dependent on external energy systems as it is now.

At the same time, from the analysis, Zeeland has great potential for renewable energy production. This can ensure that farmers take a more active and also leading role to make this shift more possible. This shift is even more important when seen within the context of the polycrisis. Different challenges in agriculture, energy and water are putting more and more pressure on the agricultural system.

For our dot on the horizon to battle these problems, farmers can integrate renewable energy production with agricultural practices. This can contribute to a more decentralised and sustainable energy system. This also reduces the dependency farmers currently rely on so heavily, while their own security, stability and resilience will be strengthened in the future. To have this as an integrated system, it can become more adaptive and better connected, and most importantly, the systems can reinforce each other.

Everything together, the land will change and become multifunctional. Farmers will not only consume energy anymore but also produce it on-site. The key is that we take the role of the farmer with us and that the identity and future of the farmer remain secure.

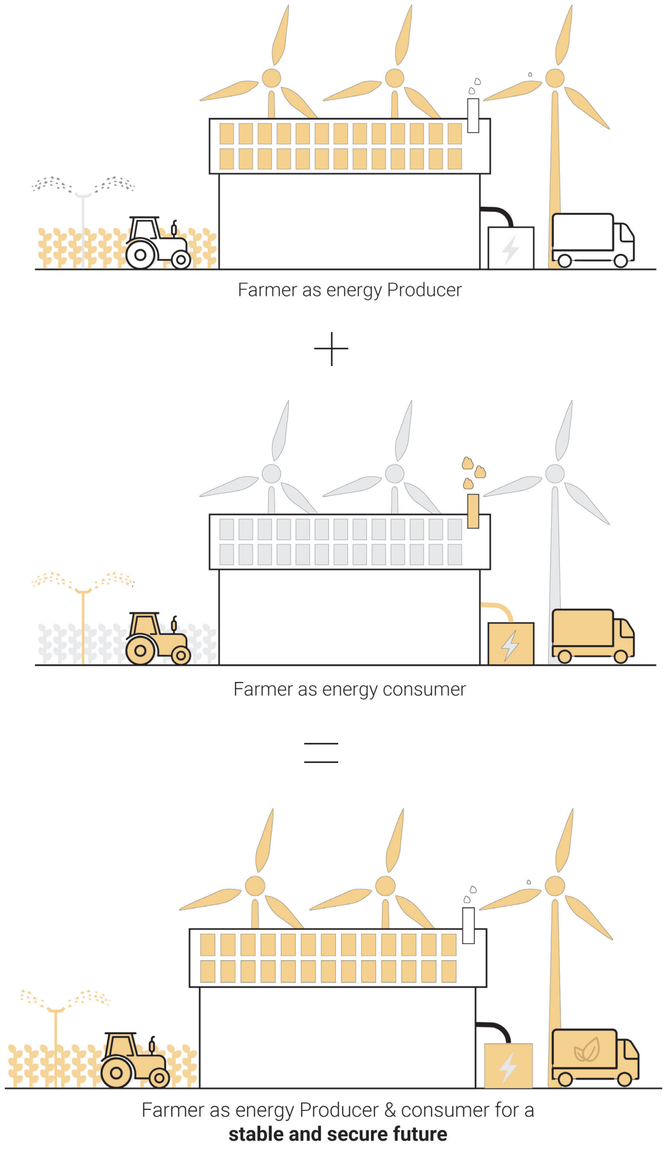


Figure 46; Farmer as energy producer and consumer

4.2.1 Rethinking Agricultural Process
4.2.2 Decentralized Energy Production

The need to rethink the agricultural process stems from the negative implications the current agricultural methods have on the local ecosystem and soil quality (Barros-Rodríguez et al., 2021). Monocultural food production, increasing nitrogen emissions and nutrient depletion are characterising Zeelands agricultural landscape (Bellarby et al, 2008; Van Apeldoorn, 2025). Large scale agricultural production is notably harmful for the environment when considering its continous impact over time. Changes to the agricultural system are often contested and considered controversial as the agricultural industry is closely linked ot the national economy (Ministerie van Economische Zaken, 2011) This has in the past lead to rushed decisions, and mismanagement resulting in farmers protests such as in 2019 (Tullis, 2023). Additionally, the extent of the existing agricultural process and value chain, with its distances, and multiple stages that account for loss of energy,w ater and other resources (see Figure.39). The agricultural system is also heavily impacted by climate change where an increased risk in climate events is driving soil salinisation and drought (Barros-Rodríguez et al., 2021).

Reimagining the agricultural process into becoming more sustainable can also mean to be producing on a smaller scale for local and regional scales to reduce distances and emissions (Figure.47a). Additionally, operating on smaller scale will allow the farmers of Zeeland to become the main driver of their processes and become independent from the tensions from the agricultural and food market ultimately resulting in more stability and security for the farmers.

Upon shifting the agricultural process to a lower-impact practice (Figure.47a) a change in the current energy productions system also needs to be considered. Figure.47b., illustrates the interactions between the agricultural landscape and a potentially growing energy landscape. Considering this interaction on the local and collective scale the vast surface area of agricultural land poses great possibilities for energy production and generation. These include bioenergy production, solar energy production and wind energy production. Despite all of them being feasible in Zeeland especially solar and wind energy production have greater potentials in specific areas (Figure.37b, p.55). Biogas is a renewable energy source that requires a lot of input, due to which its realisation may need to be encouraged through the use and investment on a collective scale. Focusing on decentralising the energy production allow the farmers to take control and agency over their own practice and process. It may relief the pressures associated from the policies but remains in line with some of the proposed trajectories (RES Zeeland, 2024; Figure.33 p.47). This includes the benefits of the production and management of energy close to the place of consumption and the long awaited reduction of grid congestion on Zeelands' regional electricity grid (NOS Nieuws, 2025; TenneT, 2025). Additionally, a decentralised energy system also brings affordability, reliability and lower start-up costs for investments making it attractive to Zeelands farming community (Ha & Kumar, 2021). Finally, the goal aims to aid in developing stability and security in the agricultural processes for the farmers of Zeeland and safeguard the supply of energy for irrigation, harvesting and processing and more.

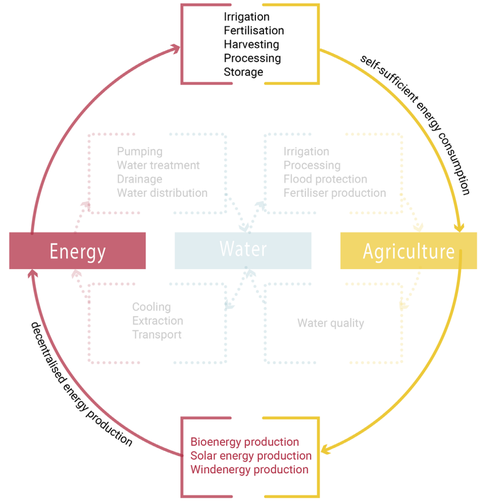


Figure 47a; Consumer - Agricultural cycle

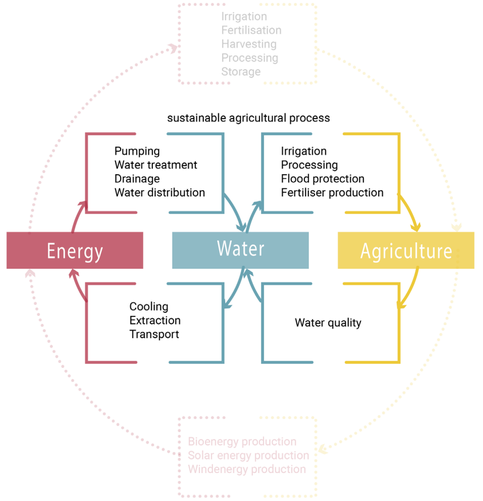


Figure 47b; Producer - energy production potential

4. Vision
4.3 Synthesis

VISION STATEMENT

The existing agricultural practices in Zeeland intensify the polycrisis currently unfolding around salinization, nitrogen emissions, and water availability issues. These pressures are further compounded by climate change, which brings imminent risks of severe flooding and drought, as well as rising energy costs and growing scarcity of water and/or energy. Therefore, tensions are emerging between competing spatial and social demands: the need to accelerate the energy transition while preserving Zeeland's agricultural landscape identity and its rural communities.

This project commits to prioritizing a sustainable agricultural system model of production and distribution, while dealing with the polycrisis related to food security, energy security, and water security (NEXUS, n.d.) such as the long-term stability of these systems. The scope is to support the farmers to achieve security and sustainability within their agricultural practices. Within this framework, the project proposes to diversify the spatial interactions between water, energy, and food production systems, stimulating their coexistence and mutual reinforcement. This approach recognizes that governance strategies and community initiatives must work together to guide this transition.

We aim to see farmers as consumers such as producers of their own energy. By integrating decentralized renewable energy production, diversifying crop systems, and adopting water-adaptive farming practices aligned with Zeeland's delta infrastructure, agricultural landscapes can then into multifunctional territories, in local and regional levels. This will bring security and therefore, the stability wished by farmers regarding the future.

In this way, Zeeland can strengthen its role in the national energy transition without sacrificing its agricultural identity or long-term resilience, but improving its extensions and ranges. Progressive farmers play a central role in this transformation. Their initiatives and aim to adapt production methods, diversify activities, and participate in new energy systems will determine the viability of the region's rural economy, while promoting its income stability and diversification.

Ultimately, the vision aims to achieve a spatial synergy between food security, renewable energy production, and water security. The combination of these three aspects should also guarantee the cultural identity of the Zeeland landscape as a calm and nature-friendly environment.

In this scenario, the main wishes of farmers, stability and security, can be achieved through the new opportunities that energy production offers. At the same time, Zeeland farmers would not only produce sustainable food and renewable energy but also use renewable energy within their own food production processes, strengthening the region as a stable and secure environment for the farmers practices and therefore, for everything that relates to it.

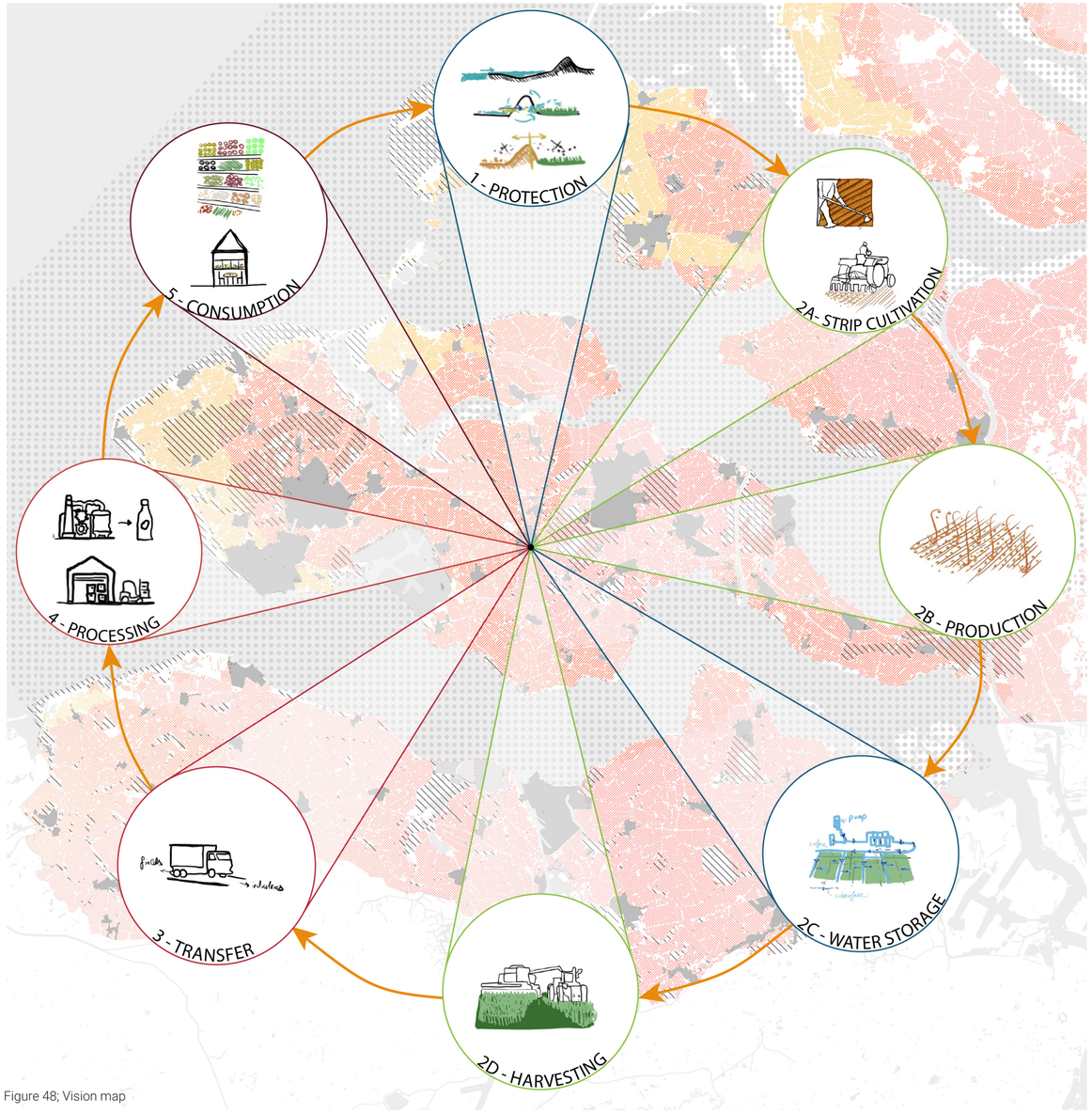


Figure 48; Vision map

Figure 49: Integration of agriculture and renewable energy through strip cropping and solar farming

Within this chapter, the project aims to develop the strategic following three project pillars. First, introduce the demands of the stakeholders most affected by the project. Following by the definition of the direct strategies and the intervention strategies, their intersections and roles. Finally, define the intervention locations and their typologies, with the pilot project, highlighting the joint action of these strategies and the guiding concepts of the envisioned project.

5. Strategy

5.1 Stakeholder arena

5.2 Strategy action toolbox

5.3 Spatialisation

5. Strategy
5.1 Stakeholders
5.1.1 Stakeholder arena

Figure 50; Stakeholders

With community and the political initiatives in mind, such as their potential occurrences, both in the space and society of Zeeland, we have outlined a common understanding, an “arena” among stakeholdersregarding the transition to renewable energy sources on agricultural land in Zeeland, as seen in the figure 51. The most affected stakeholders, with less power to act and greater interest, are non-humans and peri-urban residents. With less power and interest towards a change, the conservative farmers. Moreover, the most decisive stakeholders in this arena, along with the progressive farmers themselves, in a proposed project scenario, are the province of Zeeland and the renewable energy companies in the region. In a brief analysis of power and interests among stakeholders, it is noted that a relevant conflict lies in aligning expectations for energy production with the needs and limitations of non-human resources. The main synergies, however, are in the interest of sustainable, fair, and resilient progress for all parties.

The project’s strategies are designed to turn the stakeholder community’s shared vision into reality. This is since, when a project encompasses all, or as many as possible, of the interested parties, it not only gains more resources to act, but also greater acceptance and participation. In this way, the project, along with its concepts, principles, and ideals, becomes more effective, particularly within the public sector and its institutions. Moreover, this can be highly significant in terms of leadership and impact. Each of these stakeholders would be more actively involved in different actions, contributing to the best collective scenario for energy, nature, society, and agriculture in Zeeland.

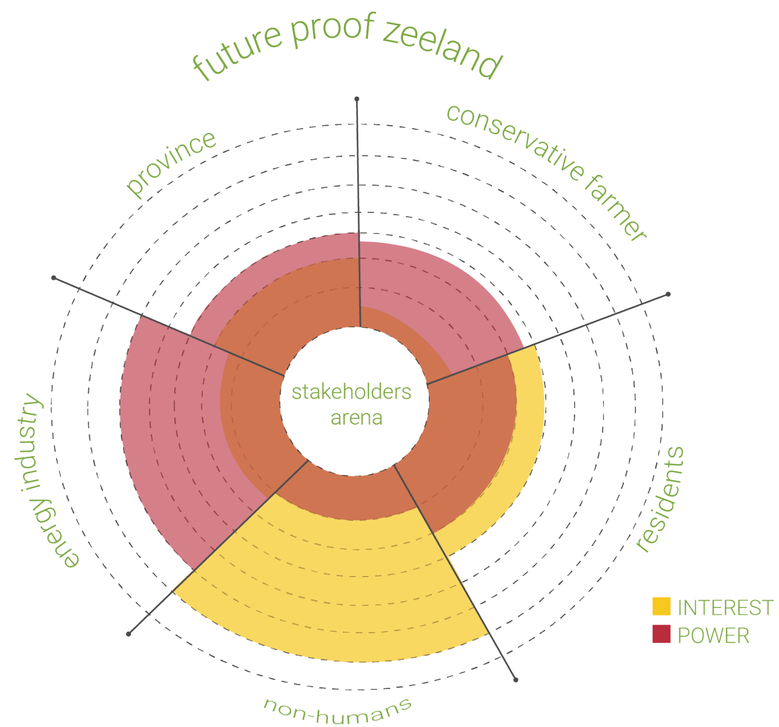


Figure 51; Stakeholder arena diagram

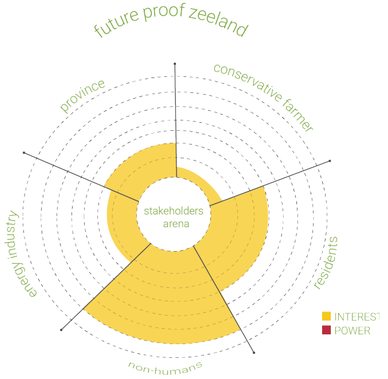


Figure 51a; Interest stakeholder diagram

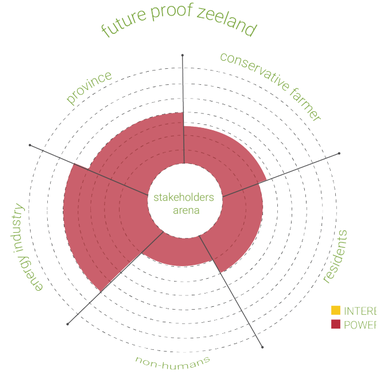


Figure 51b; Power stakeholder diagram

5. Strategy
5.1 Stakeholders
5.1.2 Goals on common ground

From figure 52, for residents, the preservation of the landscape it is non-negotiable; complementarily, for non-humans, this natural landscape must not only be preserved but also actively supported and respected. For conservative farmers, their identity is also strongly tied to the landscape of vast agricultural polders, which is equally important as a defining element. On the other side, we have the province's non-negotiables, which relate to the resilient and productive development of Zeeland. Meanwhile, for the energy companies currently producing renewable energy in Zeeland, the immediate priority is productive decentralization in order to expand their operations.

Residents

The primary concerns of peri-urban residents in Zeeland revolve around the gradual loss of the polder landscape's identity and the surrounding natural environment, both of which have historically shaped their urban life. At the same time, their aspirations center on remaining in a province that is it not valued only for its agricultural production, but that can offer also, sufficiently developed public amenities, ensuring they do not feel compelled to migrate to access essential services and op-

Non-humans

The position of nature in Zeeland's vision it is a positive, if biodiversity, soil health, and freshwater systems are treated as non-negotiable preconditions. Renewable energy production on agricultural land can conflict with nature's interests, as wind turbines and PV panels may affect ecosystems and should be placed in less sensitive areas. It is acceptable when robust, integrated solutions combine energy production with agriculture to ensure ecological improvements.

Province

Zeeland aims to lead the Netherlands as a cleaner, greener, and stronger region while balancing energy demand and biodiversity. It focuses on sustainable transitions using flexible energy use, storage, and green heat to decarbonize sectors. By 2050, it envisions a nature-inclusive, climate-resilient delta with balanced ecosystems and safe living conditions. Agriculture remains key, ensuring food security through innovation, resilient crops, and global food leadership.

Conservative Farmer

Farmers are not unwilling to change, but the vision is too far removed from everyday practice. They ask for clear and stable policies, realistic conditions, and a transition that supports both their work and, mainly their identity. Only then can change become achievable while maintaining long-term stability and security, for what is more important for them, their farm sense.

Energy Company

Zeeland offers strong potential for renewable energy growth, driven by regional initiatives and diverse energy companies. Decentralisation is reshaping strategies, creating both opportunities and tensions around competition and stability. Zeeuwind can act as a key partner by fostering collaboration and pilot projects. Grid operators remain cautious but are essential for implementation. Strong partnerships will be vital for success.

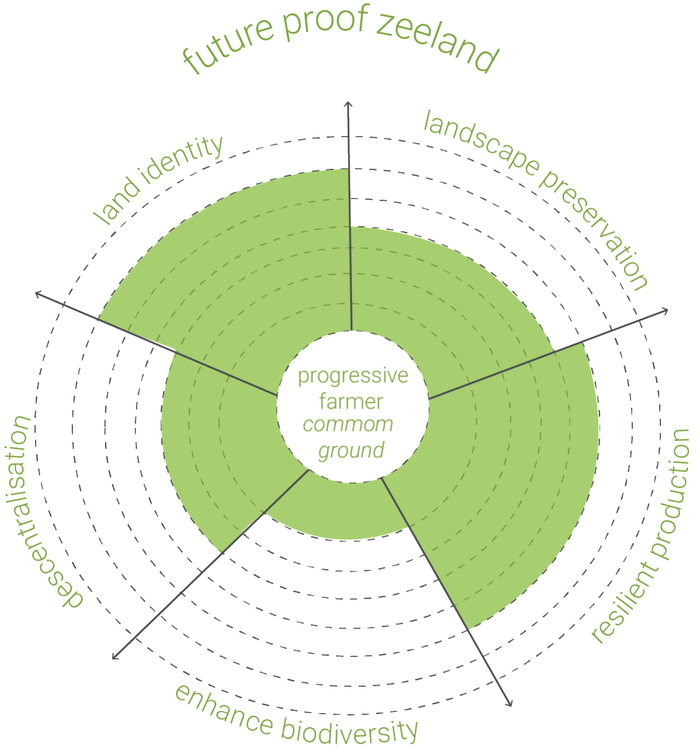


Figure 52; Stakeholders and Progressive Farmers common ground

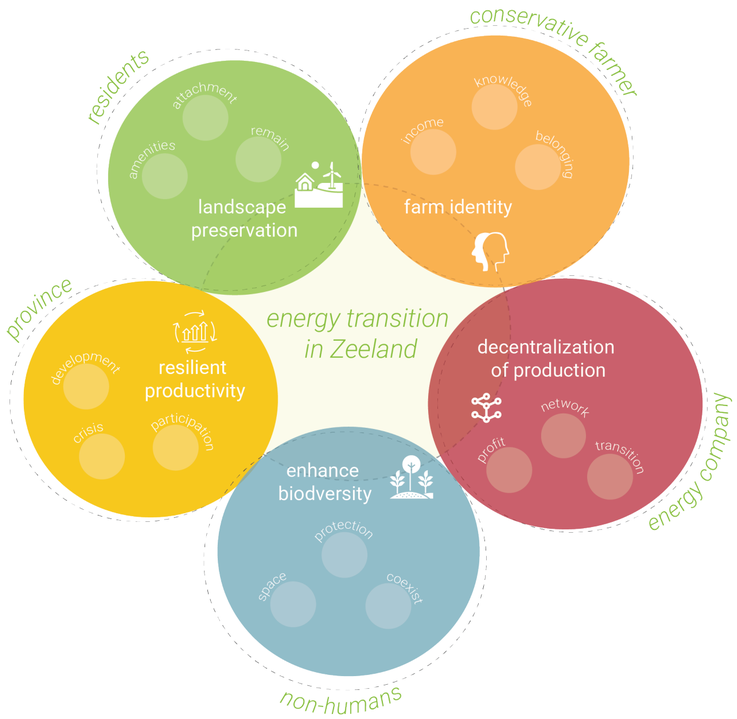


Figure 53; Stakeholders Common Ground Interactions

With the main aspirations, concerns, and non-negotiable principles of each stakeholder identified, these were analyzed alongside those of the progressive farmer (discussed in Chapter 3.1 of this report). The greatest alignment of interests lies in resilient production, which the Province of Zeeland has already been addressing. Although there are disagreements on how to achieve these goals, it is important that a common ground in terms of scope has already been established. There is also strong agreement regarding landscape identity and preservation, since, much like conservative farmers, the individual identity of Zeeland's residents is closely tied to their collective integration within the region's prominent horizontal agricultural landscape.

The correlation remains weaker, however, with biodiversity enhancement, as well as with the concept of decentralization proposed by energy companies. This is mainly due to a lack of alignment in expectations and coordinated actions. Bridging these convergences and divergences is an essential step toward achieving strategies that are both effective (delivering strong and expected results) and comprehensive (ensuring that these results benefit all stakeholders across different dimensions).

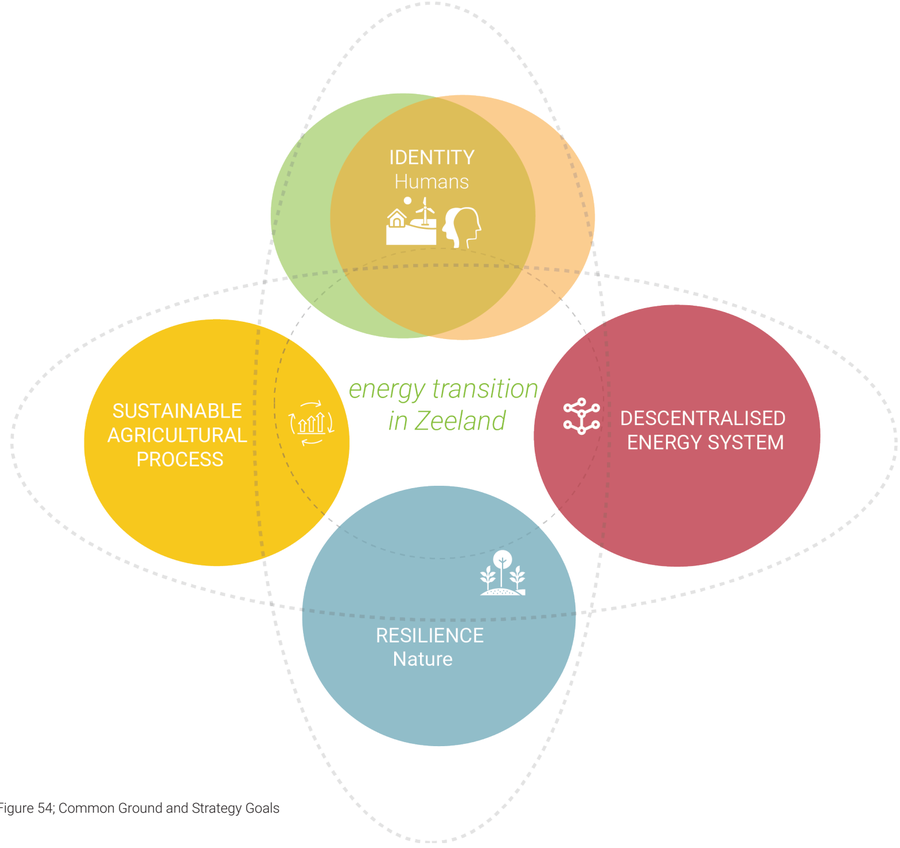


Figure 54; Common Ground and Strategy Goals

In figure 54, the project outlined the structure and scope of its strategies. With the vision of making Zeeland's agricultural system more sustainable, the province's ambitions for increased and resilient production can be achieved. At the same time, there is a need to decentralize and expand renewable energy production; when developed in a way that ensures autonomy not only for progressive farmers but also for Zeeland's residents more broadly, this can align effectively and grow in synergy with energy companies. Finally, understood as preconditions, is the commitment to protect nature and non-human life, as well as to safeguard the region's landscape identity. These last two form the foundational framework of Zeeland's vision, meaning that no objective is pursued without first addressing the needs of nature, the landscape, and their protection and identity.

By adapting the project strategies to the concerns and wishes of the stakeholders involved, the vision for this project becomes viable. Through practical actions, whether directional or intervention strategies, a just and resilient energy transition is sought in a way that encompasses the stakeholders directly related to this energy transition in Zealand. Figure 55 illustrates how these ideas interconnect. It presents an integrated vision to promote farmer security and stability, based on four interconnected pillars: (1) protecting the resilience of nature and (2) safeguarding the region's identity as fundamental conditions of the territory; from this, (3) a sustainable agricultural process is developed, which balances the use of resources such as water and energy and increases biodiversity; in parallel, (4) a decentralized energy system is implemented, connecting local production, storage, and consumption. These elements reinforce each other to create a more self-sufficient, sustainable, and secure agricultural system in the long term.

preconditions setting boundaries to the region

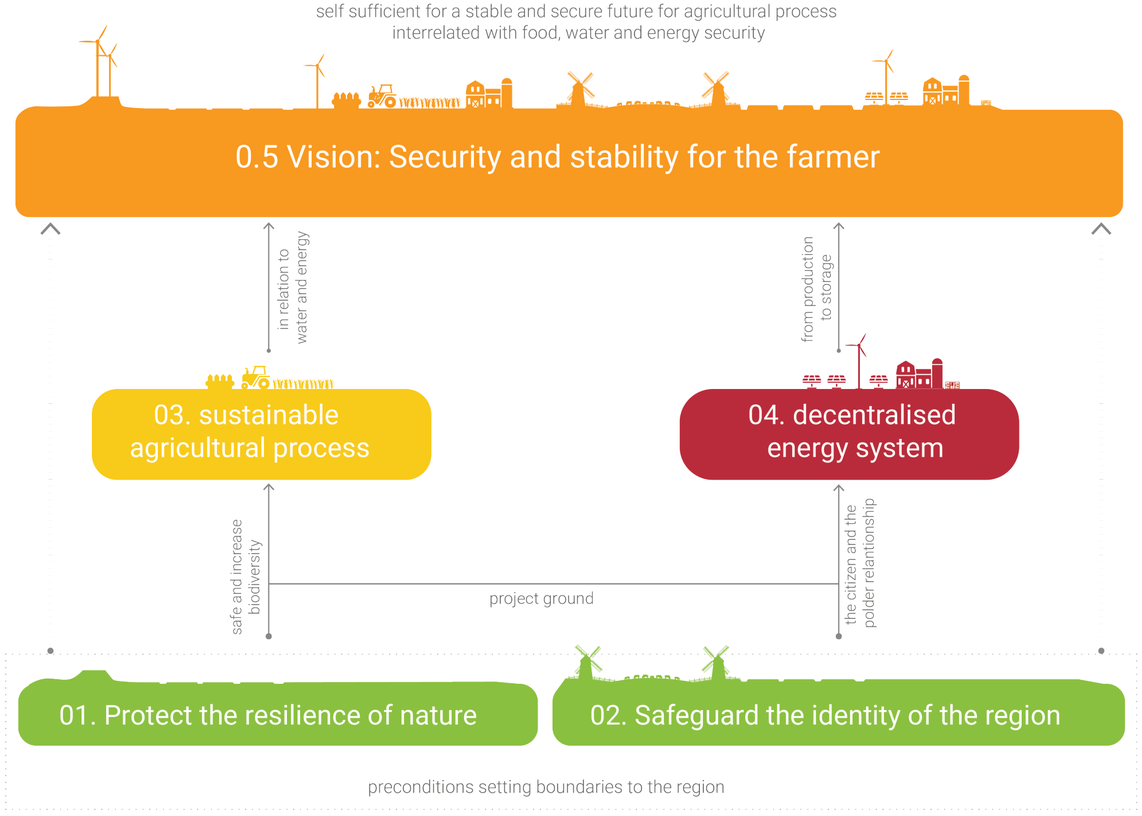


Figure 55; Diagram of the Strategic Pathway from Strategy to Vision

5. Strategy
5.2.1 Action Toolbox

The flow diagram (figure 56) aims to illustrates a strategic structure-organized hierarchically into four main levels: Preconditions, Actions, Goals, and Guidelines. The process begins at the top with the fundamental values of Identity and Resilience, which guide, as a ground, the project technical guidelines. These guidelines converge on two central objectives, interconnect with each other: Decentralized Energy and Sustainable Agriculture Process. These, in turn, branch out into various practical actions, from different scales, stakeholders and instances, across Zeeland, to consolidate a final integrated Strategy.

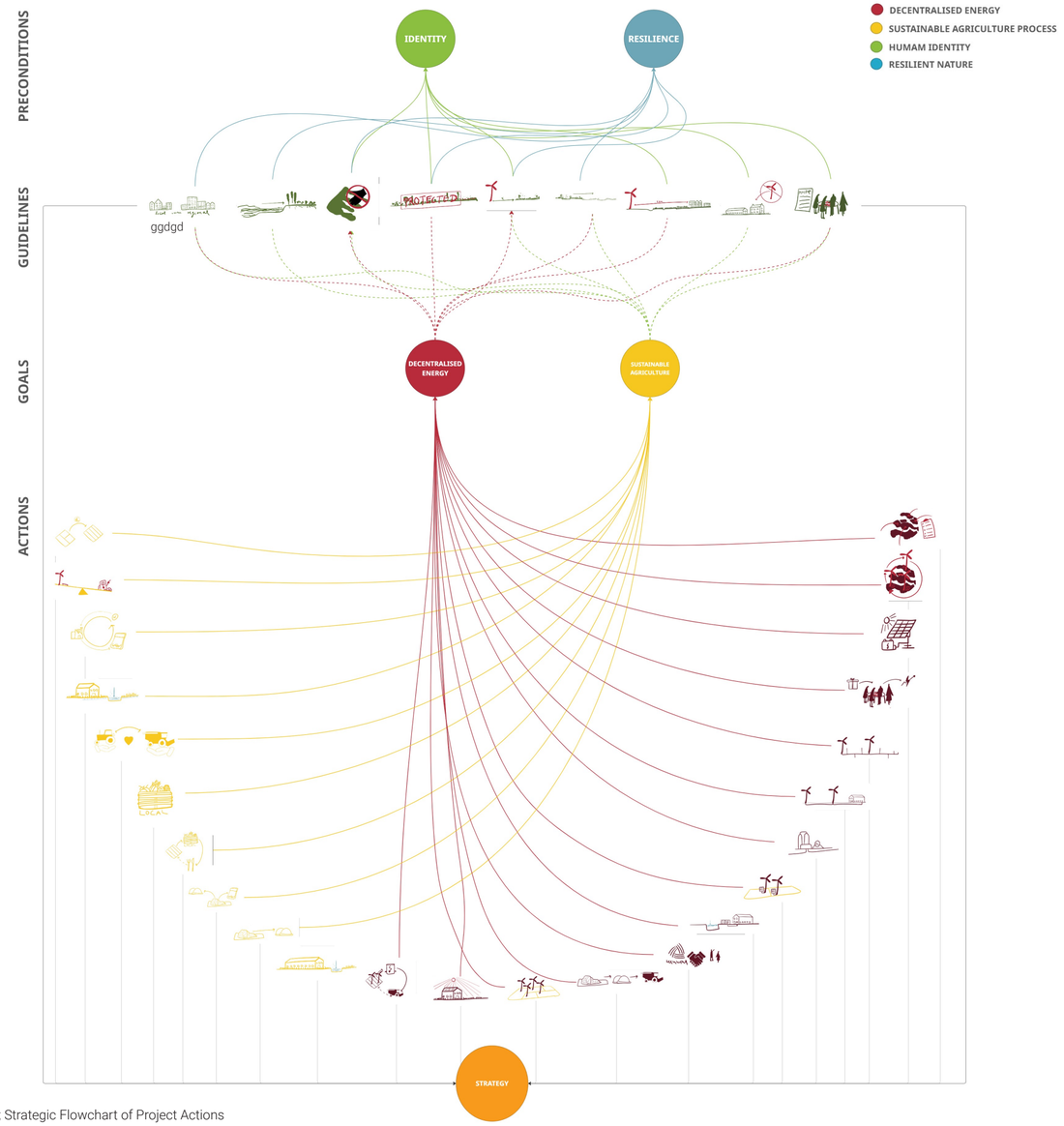


Figure 56; Strategic Flowchart of Project Actions

5. Strategy
5.2.1 Action Toolbox

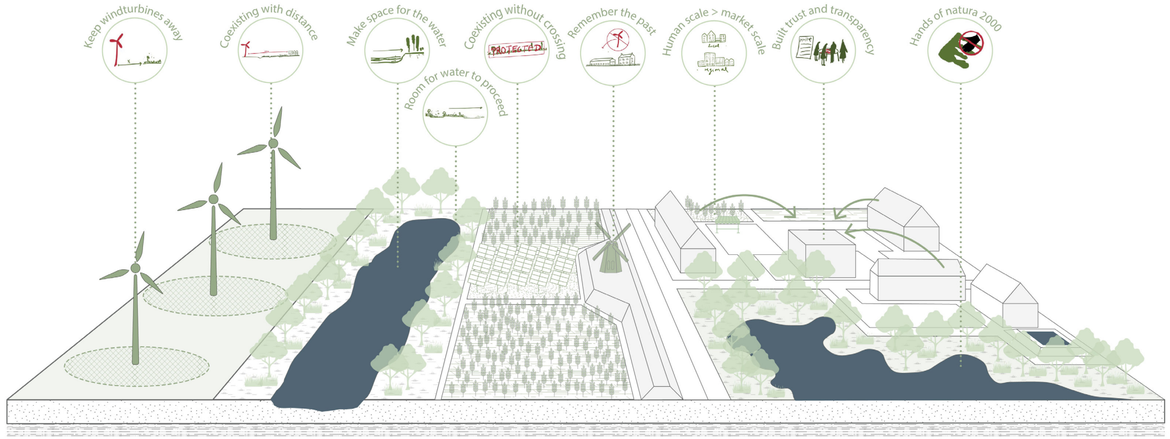


Figure 57; Preconditions diagram

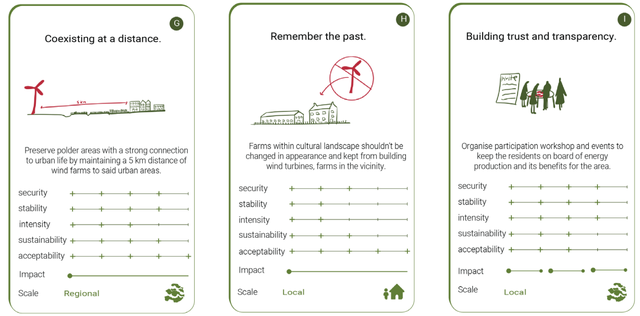


Figure 58; Strategy Action cards - Resilience

Figure 59; Strategy Action cards - Regulations

5. Strategy
5.2.1 Action Toolbox

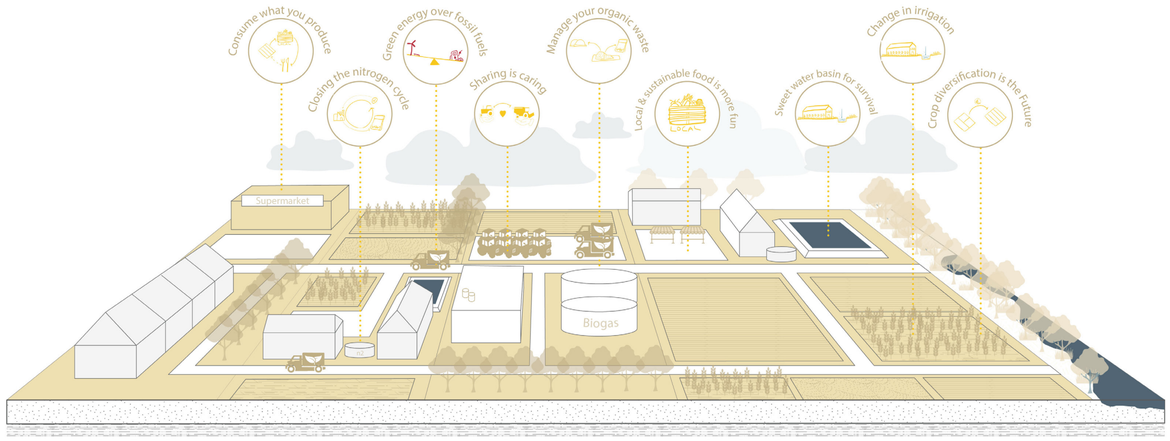


Figure 60; Sustainable agricultural process diagram

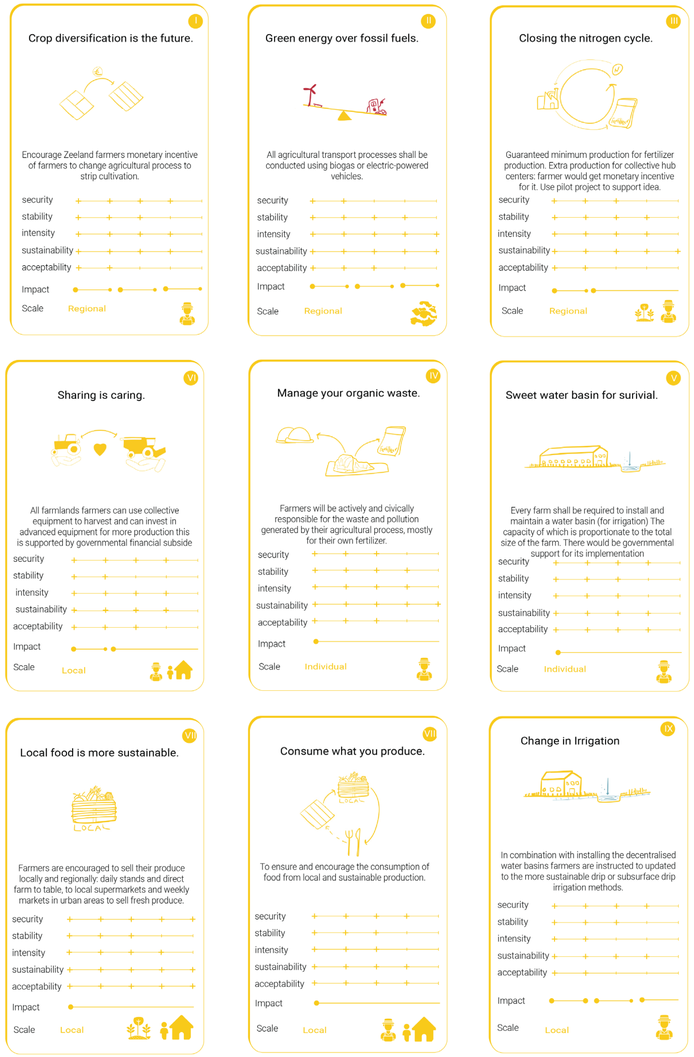


Figure 61; Strategy Action cards - Goals / Agricultural Process

5. Strategy
5.2.1 Action Toolbox

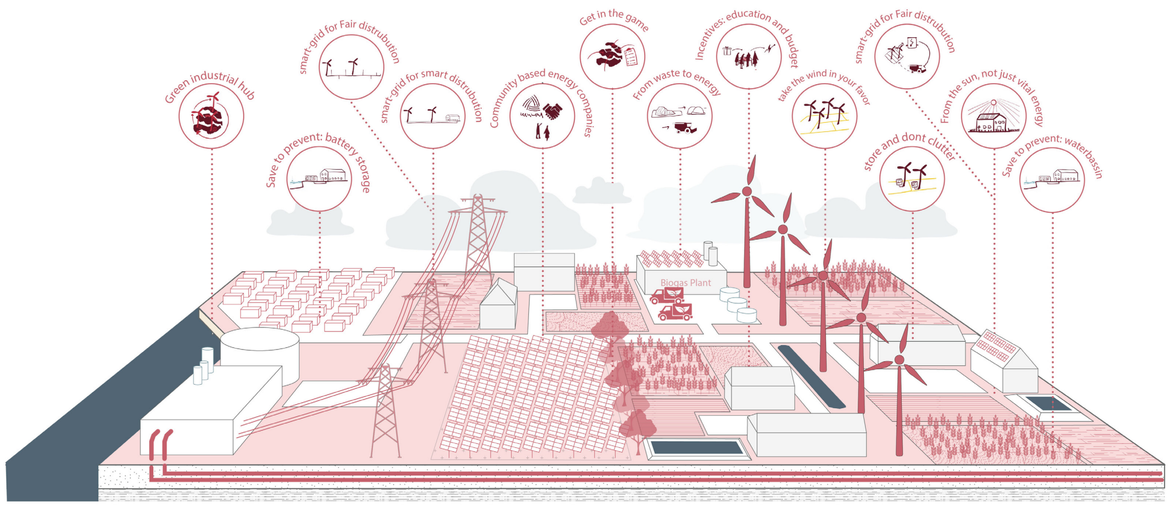


Figure 62; Decentralized energy diagram

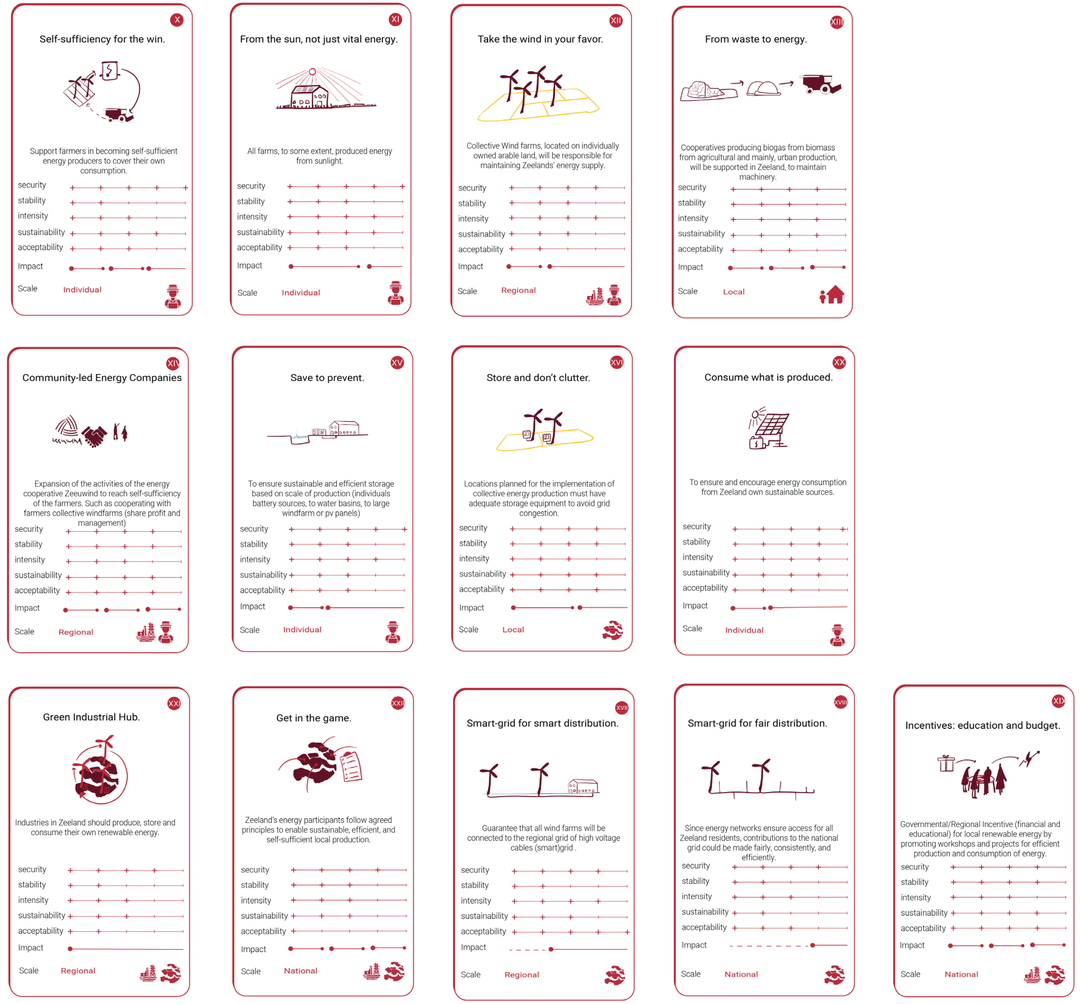


Figure 63; Strategy Action cards - Goals / Decentralized Energy

The table in figure 64, presents a comparison between landscapes whose interrelationships connect and complement the agricultural landscape in Zeeland, namely the protected, urban, and industrial landscapes. It analyses how these landscapes will be driven to function in the five energy pillars: production, circulation, storage, consumption, and finally, emissions.

In agricultural areas, the integration between food production and renewable energy production stands out, such as solar panels, biomass, and in some cases, wind turbines. The storage of the energy produced is done locally, as its consumption, in an energy circularity concept. Emissions will be drastically reduced using biogas instead of fossil fuels for automobiles and refineries, for example. In protected areas, the focus is on low-impact sources, mainly solar energy production, over rainwater buffers, with strategic location and the least possible damage to the environment, of underground transmission networks. In urban areas, there is an emphasis on energy efficiency through production by PV panels, collection and treatment of organic waste into biogas, and thus, renewable electric mobility. Finally, in industrial areas, the table points to the large-scale production of renewable energy, mainly for self-use. As a consequence, there is a drastic reduction in CO2 emissions, complementing these processes in other landscapes. In this landscape, however, there is also an expansion of responsibility regarding the treatment, storage, and direction of energy to the grid.

Taken together, the table highlights the scope to decentralize, optimize, and make general demands fairer and more coherent, in the scenario of the energy transition in Zeeland. Do this while optimizing, in relation to productive potential, socio-economic demands and community demands, the use of resources

Ultimately, in figure 65 The proposed system transforms this into a circular and integrated process, where farmers become both producers and consumers of energy, and resources are increasingly reused, creating a more stable, self-sufficient, and resilient agricultural system.

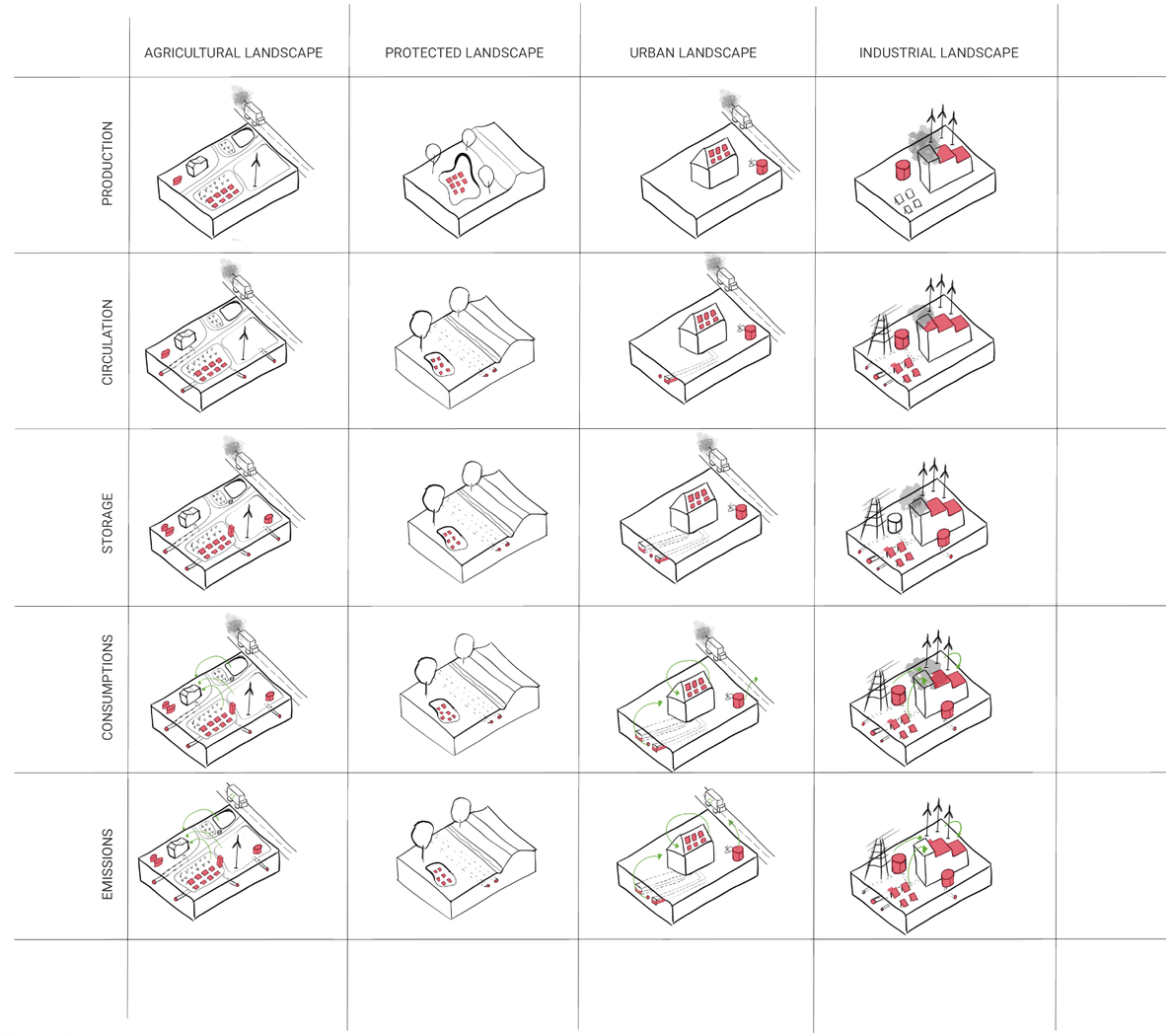


Figure 64; Potential table

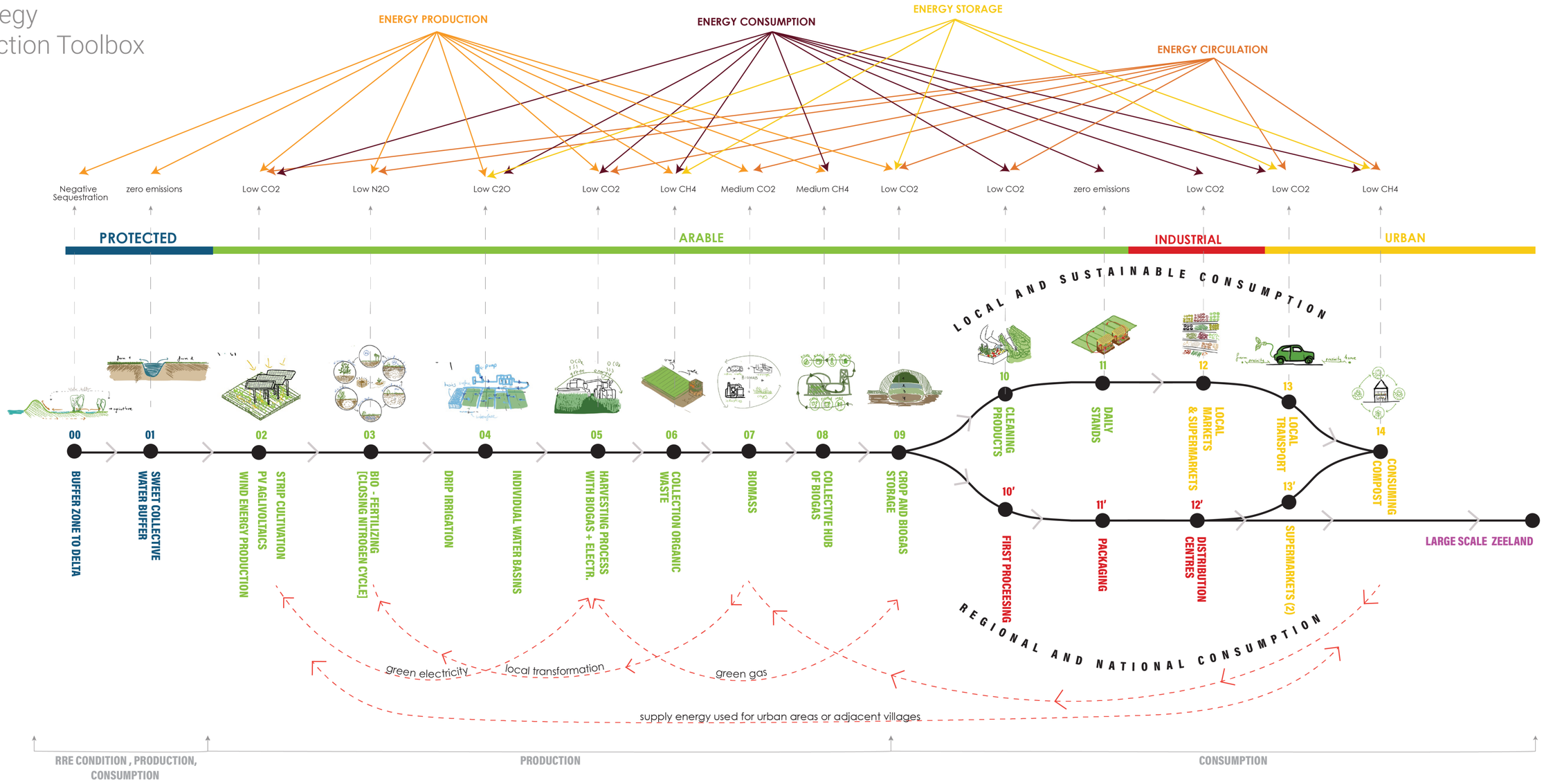


Figure 65; New agricultural value chain

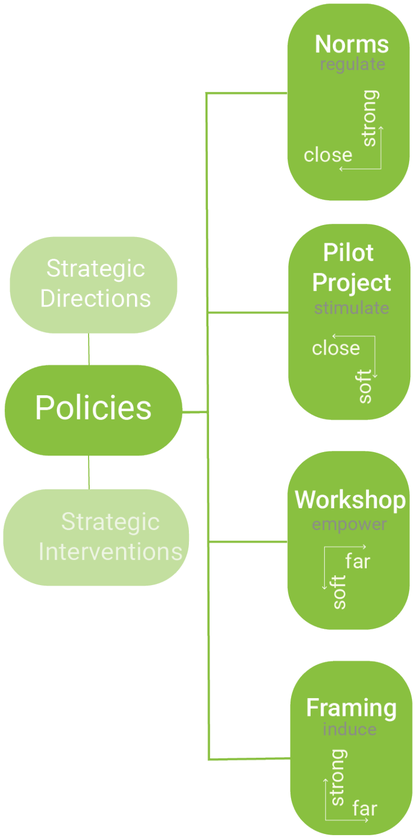
5. Strategy
5.2 Strategy Action Toolbox
5.2.2 Timeline & Steering

Figure 66; Matrix of Policy and strategic interventions

This matrix organizes the project's strategic actions across four complementary approaches: framing, stimulating, regulating, and empowering. Each playing a distinct role in guiding the transition toward a self-sufficient and resilient agricultural system. Framing establishes the long-term vision and shared narrative, ensuring that all interventions align with core values such as landscape preservation, resource balance, and integrated food–water–energy systems. Stimulating focuses on activating change through incentives, pilot projects, and innovation, encouraging stakeholders to adopt new practices and experiment with sustainable solutions. Regulating provides the necessary structure and safeguards, setting boundaries and policies that protect environmental limits while steering development toward collective goals. Empowering, in turn, enables stakeholders, farmers, residents, and organizations, to actively participate, build capacity, and take ownership of the transition. Together, these approaches are essential because they balance direction with flexibility, control with participation, and vision with action. For the project's strategy, this means creating a coherent yet adaptive pathway where policies and interventions not only guide but also support a systemic transformation toward a stable and secure future.

Figure 67; Strategic timeline

The timeline in figure.67 ties the actions together within the strategy. Regulations set the base for the strategy to unfold. These set the ground conditions and preconditions. They act as protection to the ecosystem and identity of the landscape of Zeeland. They all fall under the paradigm shift of ultimately transitioning from a market scale production and consumption to human scale (A). Important regulations include the distances that need to be kept of new energy infrastructure to the existing natural areas (D,E,G) and the regulation that grants special protection to Natura 2000 (C). Overall, the timeline follows phasing through the scales of impact of the actions that range from setting the stage acting on the smaller and collective scales to the larger scale with impacts beyond the borders of Zeeland. The actions are temporality interconnected but are associated to either of the two main goals of the project: development of a sustainable agricultural system and the creation of a decentralised energy system in Zeeland. The actions are attributed within four strategic actions which end is marked with a milestone: what you produce (VIII) resulting in the farmer becoming a local producer, Self-sufficiency for the win (X) and Consume what is produced (XX) where the farmer becomes a regional producer and lastly the integration at the larger scale grid with Smart-grid for fair distribution (XVIII) with impact and production on the national scale. The individual actions that contribute to the strategic actions start with pilot projects that aim to gain the trust of the stakeholders and test their overall feasibility and scalability through tactical actions such as incentives, monetary support and workshops. The length and amount of pilot projects is determined by the complexity of the intervention and the support of the local stakeholders. Upon a successful implementation the impact of the action continues and together fulfils the intention of the strategy and objective of the project.



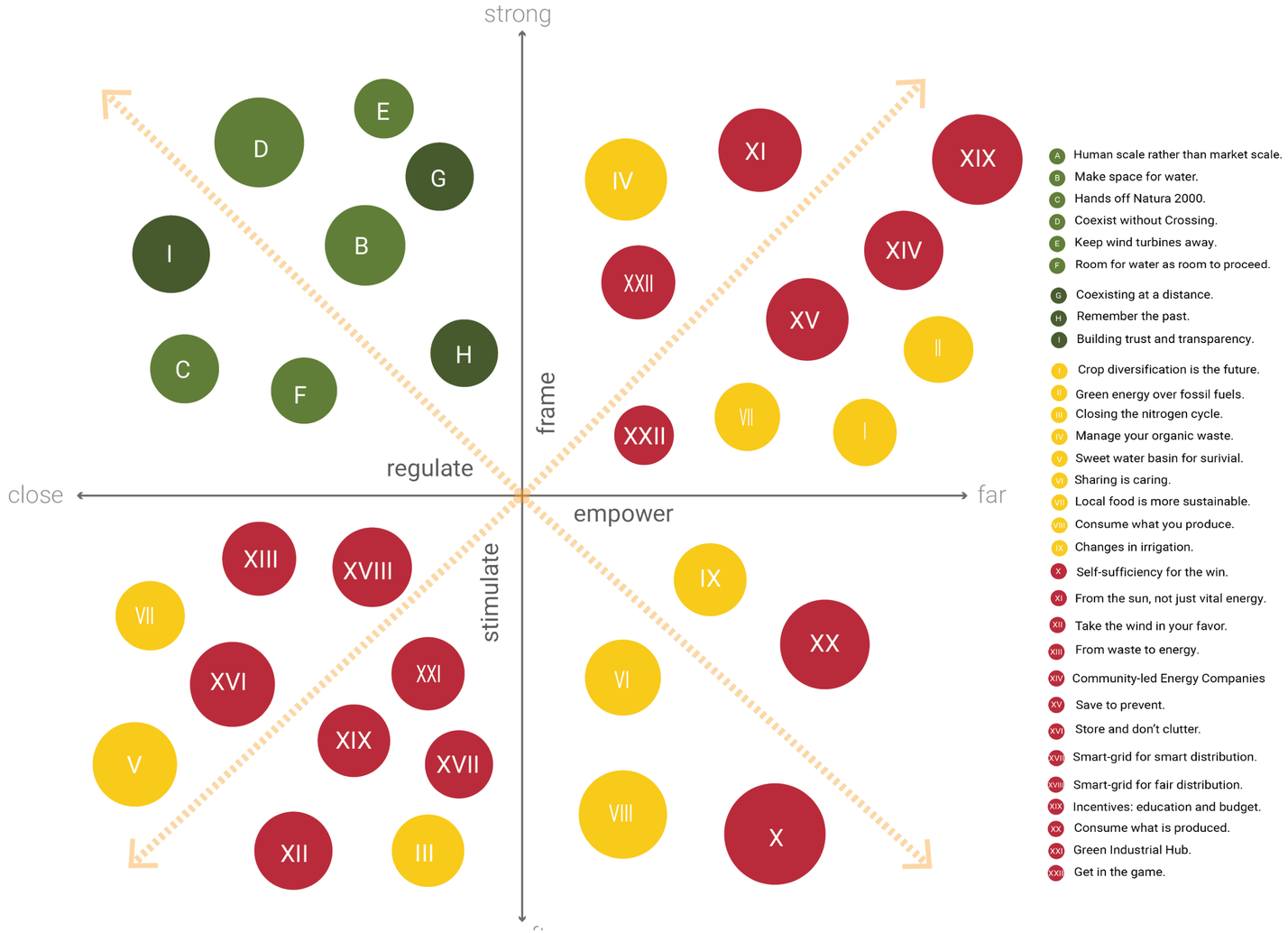


Figure 66; Matrix of Policy and strategic interventions

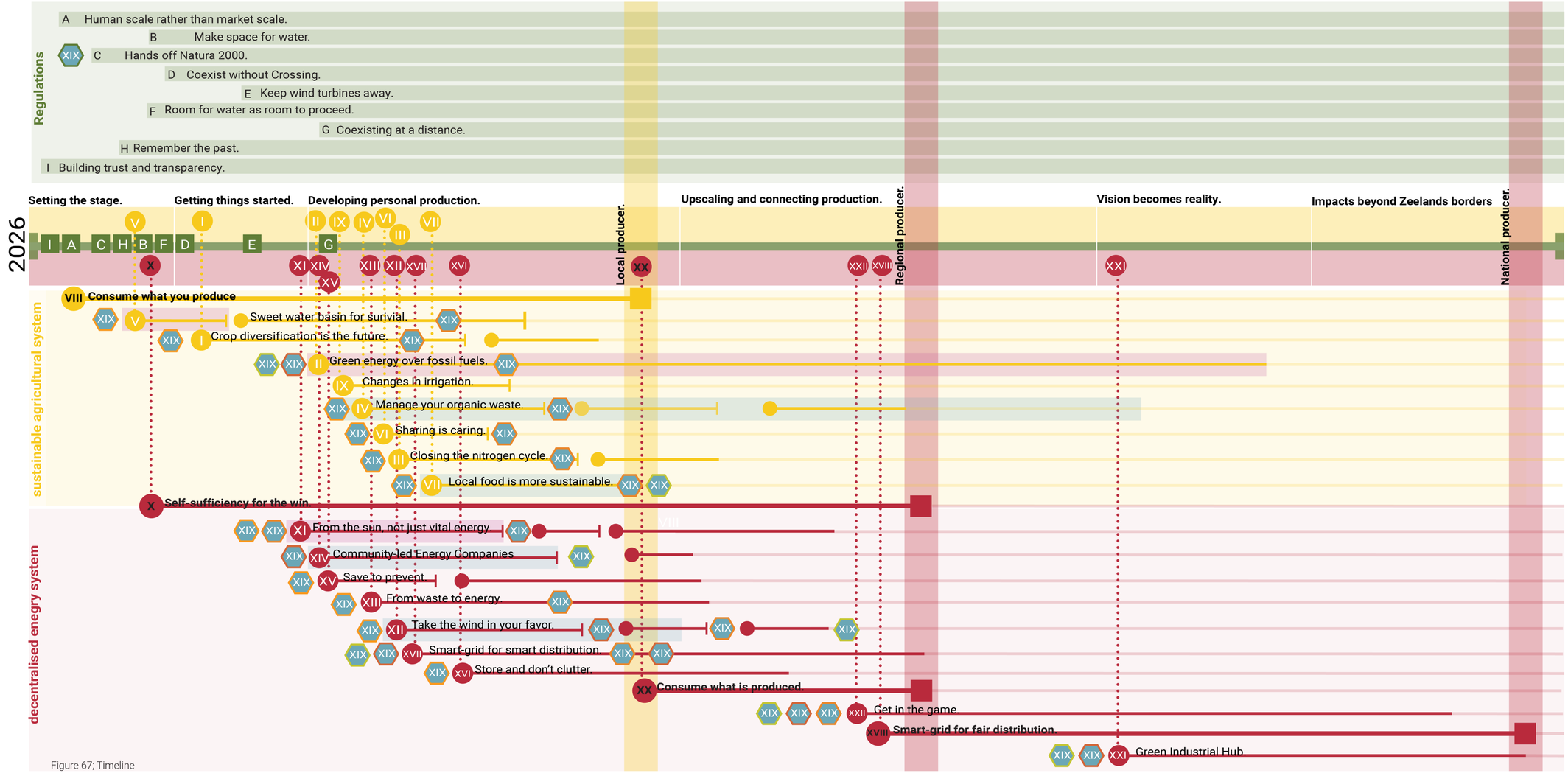


Figure 67; Timeline

5. Strategy
5.3 Spatialization

To further elaborate on the timeline, the scales of the three goals can be defined through spatial representation and localisation in maps, diagrams, and visualisations. Categorizing the types of energy production will lead to defining the scales of intervention. Figure 68 illustrates the spatial and technical trade-offs between wind, biogas, and solar energy production within the Dutch agricultural landscape, specifically reflecting the regional dynamics of Zeeland. Through this spatial claims and projected energy output, the three types of renewable energy production can be allocated to the different scales. With integrated PV-panels on agricultural land, windfarms by cooperatives, and biogas facilities embedded in a network.

Wind energy, highlighted as a primary driver for the Netherlands' energy transition, involves substantial land-use considerations where a 300-hectare farm can generate approximately 147 MW annually (Maqbool et al., 2023), a scale consistent with the infrastructure planning and visual impact assessments noted by Zeeuwind and the Project WINDFARM Perception study. Biogas production offers a circular alternative by utilizing biomass from agricultural land, where converting annual crops to perennial varieties can optimize biomass yield while sequestering soil carbon (Chen et al., 2022); however, this requires significant logistical coordination, such as transporting 11 tons of biomass per hectare to processing centres (Cambi, 2023). Only for fertilizer in a farm of 1hec, would be necessary approximately 90% of this value. Meanwhile, PV panels provide high-density output, though their integration is often constrained by the increasing challenge of grid congestion, a critical bottleneck for Dutch entrepreneurs addressed by the Netherlands Enterprise Agency (RVO). As offshore wind capacity continues to expand toward 15 MW per turbine to meet national targets (Ministry of Climate Policy and Green Growth, 2024), onshore projects in regions like Zeeland must balance energy output with the protection of freshwater resources (Deltares, 2024) and the strengthening of high-voltage transmission networks led by TenneT.

The diagram underscores that the most suitable solution for individual energy production on farms on the local scale is solar panels. These panels can be integrated into the agricultural landscape by using agri-pv panels, and produce enough energy for farms to be self-sufficient. On a larger regional scale, windfarms on agricultural land in collaboration with energy cooperatives, can produce energy to sustain the urban centres. Biogas production by biomass treatment also happens on the regional scale.

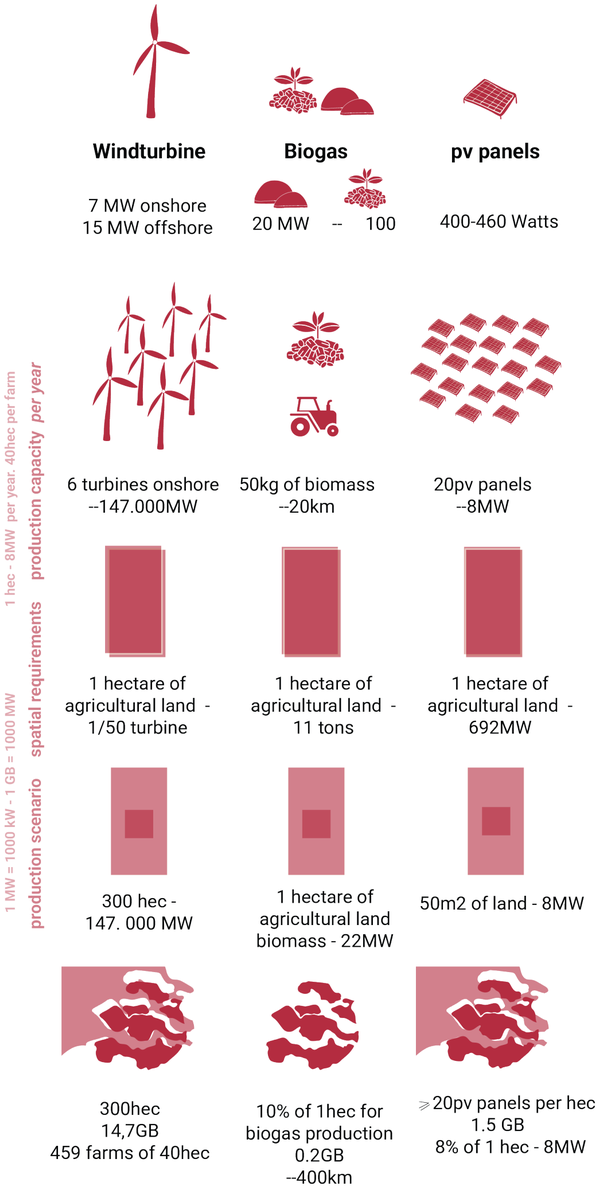


Figure 68; Energy uses and range diagram

5. Strategy
5.3 Spatialization

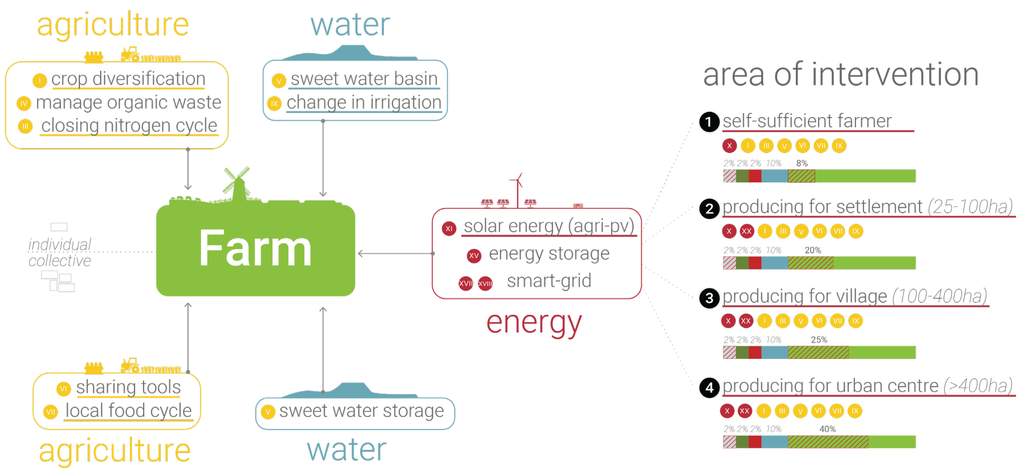


Figure 69; Diagram Local Scale

The objective at the local scale is to achieve self-sufficiency for farmers and nearby settlements through decentralized energy production, mainly by integrating solar panels within agricultural landscapes. Farmers play a key role in this transition. By enabling them to contribute to the local energy demand of surrounding communities, their economic and environmental resilience can be strengthened. At the same time, transitioning to more sustainable agricultural process will help reduce external pressure on the farmers, from government bodies and environmental organizations.

For the agricultural practices this means crop diversification and strip cultivation (I), and the use of biomass compost converted into fertilizer (III, IV). Local markets on collective farms or in settlements help strengthen short value chains between producers and consumers (VII, VIII). On the intersection of agriculture and water, the focus is on individual rainwater basins for sweet water collection (V) to use for on-farm irrigation (IX), and collective freshwater buffers underground, in areas where there is no salinization. Energy production on this local scale happens through agrivoltaics systems on farmland (XI), using agri-pv panels. Allowing both self-sufficient energy use for farmers and energy sharing with nearby settlements. The proximity to the different sizes of settlements shape the distribution of energy production on farms, resulting in four types: 1- self-sufficient farmer, 2- producing farmer for settlement under 100ha, 3- producing farmer for village (100-400ha), and 4- producing farmer for an urban centre over 400ha.

These four scales of energy production integrated in the agricultural landscape can be localised in the map. For each typology there will be one or multiple areas of intervention where pilot projects of integrated energy production in combination with pilot projects for a sustainable agriculture cycle are displayed (1, 2, 3, 4). These pilots serve as examples to inform, inspire, and motivate farmers to participate and engage in this transition. By decentralizing both energy production and food cycles, the essence of the strategy is established, to let farmers reach the goal of being stable and secure in the future. To engage other important stakeholders in the region, as governmental bodies and energy companies, this decentralised network needs to be embedded in a larger scale, so the initiatives can further expand.

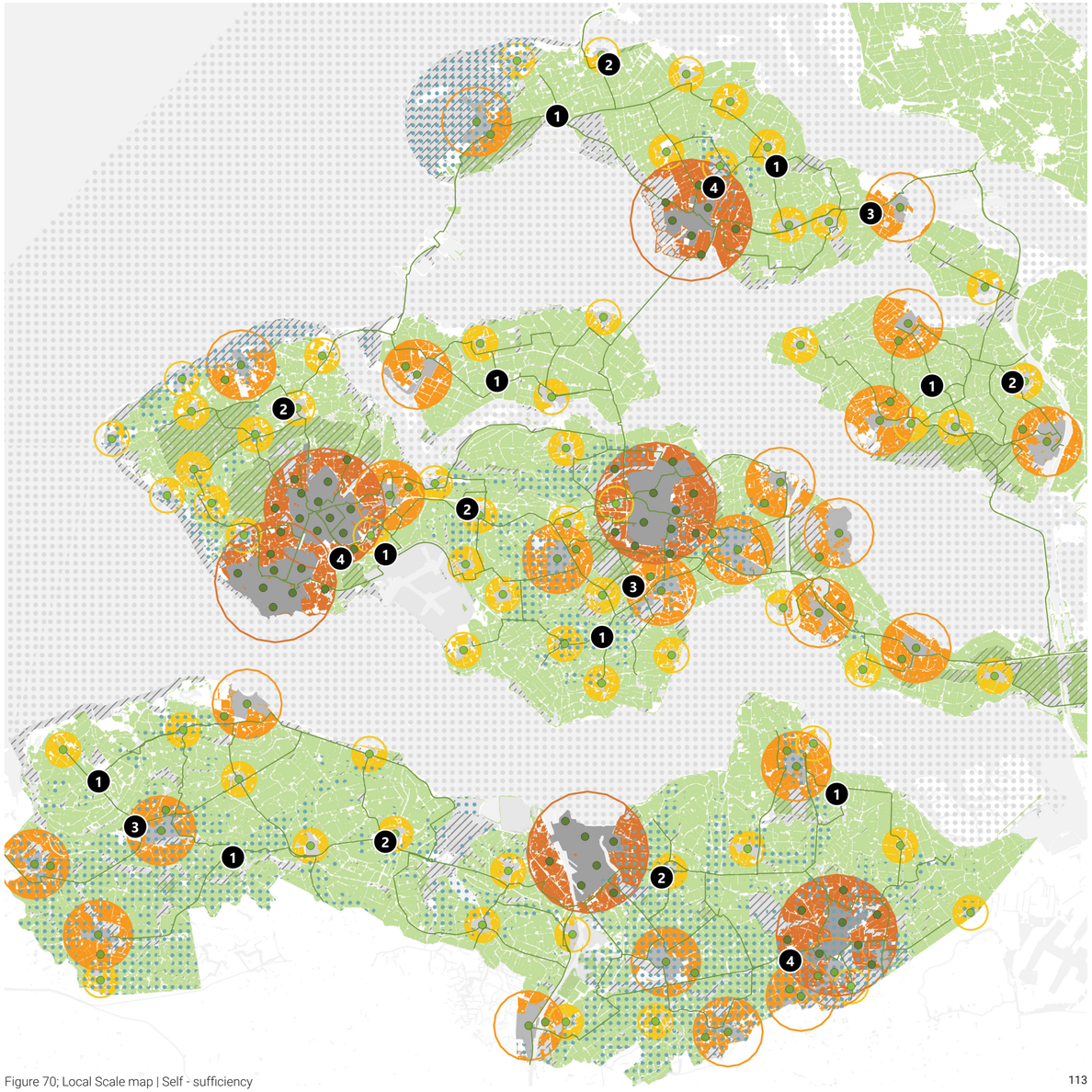


Figure 70; Local Scale map | Self - sufficiency

5. Strategy
5.3 Spatialization

Figure 71; Zeeland Farm Experimentation Layout - Local Scale

Four levels of energy production can be distinguished within agricultural areas (diagram 5.3.local diagram). These include: (1) the selfsufficient farmer, (2) the producing farmer for small settlements under 100 hectares, (3) the producing farmer for villages between 100 and 400 hectares, and (4) the producing farmer for urban centres exceeding 400 hectares. Each level represents a different degree of integration between agricultural production and photovoltaic energy generation (agripv) and can be seen as an area of intervention.

These areas of intervention illustrate how renewable energy production can become embedded within existing farm structures, creating a gradient from individual selfsufficiency towards collective contribution to nearby settlements and urban networks. Within these scales, various pilot projects can be developed, combining crop production with solar energy systems, shared storage solutions, and cooperative management models, to strengthen both the local energy balance and the resilience of the agricultural cycle.

The spatial organisation of these scales is visualised in figure 71, indicating the general distribution of functions across farms. Their application in practice is further illustrated in figure 72, which gives an impression of how agripv systems can be integrated into real agricultural landscapes, together with the other actions in the form of pilot projects for a sustainable agricultural cycle

Figure 72; Pilot Project Study Case- Bird eye

5. Strategy
5.3 Spatialization

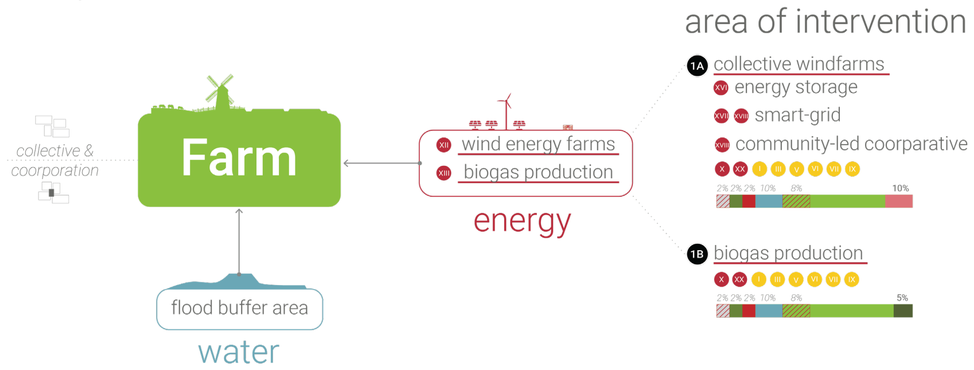


Figure 73; diagram regional scale

At the regional scale, the goal is for the entire province of Zeeland to achieve self-sufficiency in both energy production and consumption. This will be realized through the expansion of the Zeeuwind program and improvement of the regional energy grid. To also supply the growing energy demand of the main urban centers, additional renewable energy sources must be integrated into the regional system. Zeeuwind already contributes substantially to both regional and national energy demand, laying a strong foundation for this transition.

While food consumption remains largely localized, regional agriculture continues to play a role in resource sharing and biomass generation. Water management focuses on large-scale flood protection by the creation of regional water buffers to secure safety in changing climatic conditions. Energy production is scaled up through the Zeeuwind initiative and new expansions of both the grid (XVII, XVIII) and new windfarms (XII). Driven by collaborations between farmers, energy cooperatives, and private companies (XVIII). Biogas processing hubs (XIII) form another important layer—collecting biomass from both urban sources and farms to generate biogas for mobility and heating applications.

Currently, Zeewind produces enough energy to power approximately 400,000 homes (Zeewind, 2026). However, the voltage of the energy produced by wind turbines is low, and for transmission to homes or industries, a medium voltage is necessary (Wind Energy The Facts, n.d.). According to the International Energy Agency (n.d.), electricity is transformed to higher voltage levels in substations for transmission. These, however, are concentrated only near the national energy grid (Netherlands, 2025). It is assumed, therefore, that even with this high domestic production, Zeeland still suffers from constant and increasing energy shortages (Zeeland 2050, 2025), because this energy is directed to the national grid, and from there, to the regional grid. Therefore, the project foresees the immediate extension of Zeeland's high-voltage grid, as well as the extension of its network of energy transformation and distribution stations. This extension, in addition to helping decongest the national grid, would also, and most importantly, boost regional autonomy and guarantee its self-sufficiency on all scales. Beyond the extension, the final strategy for this regional autonomy is the creation of more wind farms, positioned to ensure balanced spatial reach across the entire area, resulting in the region of Zeeland becoming energy self-sufficient

On the regional level, energy production through wind farms (1A), developed in collaboration of farmers and energy companies, meets the needs of larger urban centres while respecting cultural landscape restrictions identified earlier. In addition biomass waste is converted into biogas (1B), used for sustainable agricultural mobility. Bridging to the national scale, Zeeland's regional generation capacity acts as a contributor to the national energy grid, embedding the province into the broader renewable energy system envisioned by the national government (Rijk).

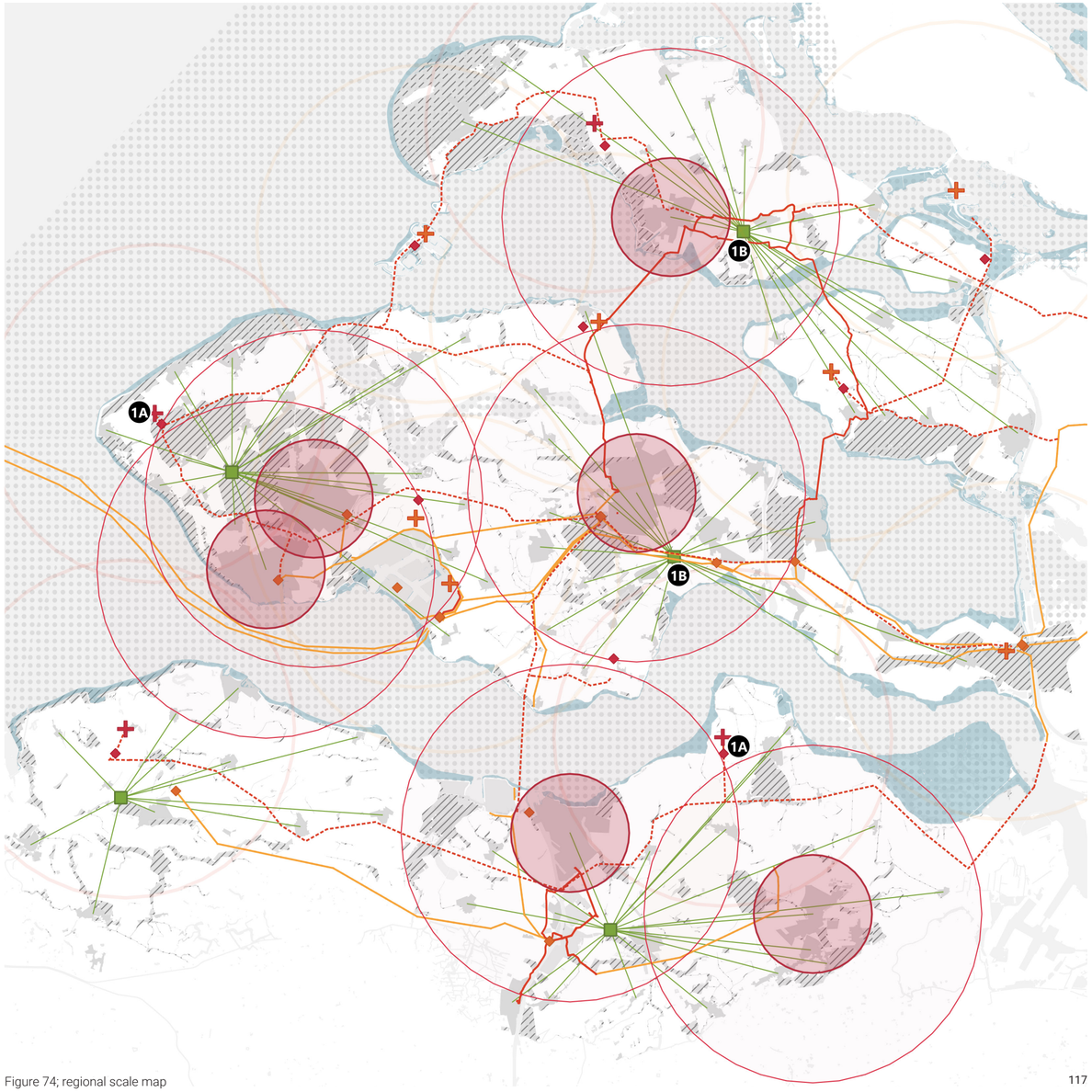
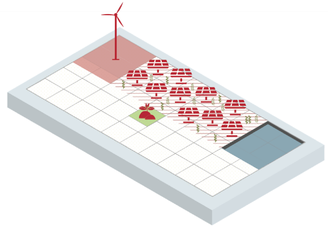
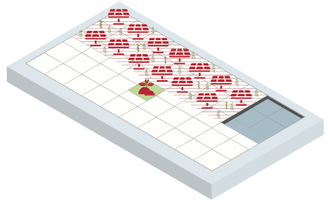


Figure 74; regional scale map



1A collective windfarms
XVI energy storage
XVII XVIII smart-grid
XVIII community-led coorparative
X XX I III V VI VII IX
2% 2% 2% 10% 8% 10%



4 producing for urban centre *(>400ha)*
X XX I III V VI VII IX
2% 2% 2% 10% 40%

As elaborated in the regional scale diagram figure 75b, two main types of areas of intervention can be identified: collective wind farms (1A) and biogas production facilities (1B). Both typologies are strategically localised in the regional strategy map (figure 5.3, regional map), indicating their spatial relationship within Zeeland's broader landscape. Within these intervention areas, various pilot projects can be initiated to stimulate a more sustainable agricultural cycle and implement the decentralized energy system. Such projects may range from crop diversification, improved irrigation practices, and shared infrastructure to energy-oriented initiatives including wind farm development (1A), energy storage, and biogas processing units (1B).

These typologies are further illustrated in figure 75a, which visualizes the general distribution of functions across typical farm layouts. The spatial integration of these pilot projects is then exemplified in Diagram 5.3 (bird's-eye view), providing a tangible representation of how such an intervention area may appear in its actual

Figure 75b; Pilot Project Study Case- Bird eye

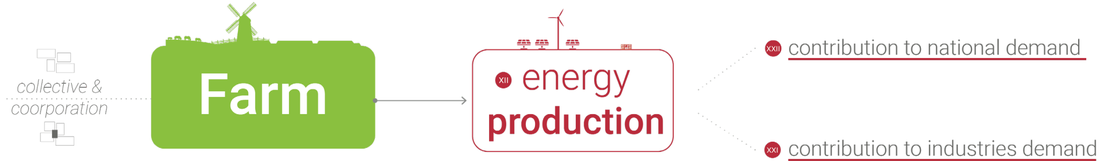


Figure 76; diagram national scale

On the largest scale, the goal is to contribute to the national demand by delivering extra produced energy on the national grid. This is not interacting to much with the vision of the farmers anymore, but creating broader support from the other stakeholders involved in this transition for the community (farmers) and the region of Zeeland. The regional role thus shifts from regional self-sufficiency towards active participation in the national energy network, serving as a contributor to the collective transition as proposed by the Dutch government (n.d.).

This national scale does not involve direct spatial intervention on the themes of water or agriculture. However these sectors remain indirectly connected with the energy production, through land use and infrastructural dependencies. Agricultural land provides space for production of renewable energy, both agri-pv panels and larger scale windfarms. The integration of energy production and agricultural landscapes automatically affects and includes water. Surplus energy that is produced by wind farms, operated by energy cooperatives and farmers on the regional level, can be delivered to the national grid once the regional demands are met. To enable this contribution to the national demand, expansions and upgrades on of both regional and national (high voltage) grid infrastructures are required (RVO, 2026). The broader national context is displayed on the next page, where other regions with the same characteristics are identified.

To conclude the national scale, energy production of windfarms on agricultural land, can contribute to the national net. This strengthens Zeeland's role within the national transition and highlights the interdependence of regional and national strategies. On this scale there are no concrete areas of intervention, only the way it the Zeeland decentralised system is embedded in and scale able on the national scale. This understanding forms a bridge to the next step, in which all scales come together in the synthesis map and spatialising in the systematic section how all scales interreact.

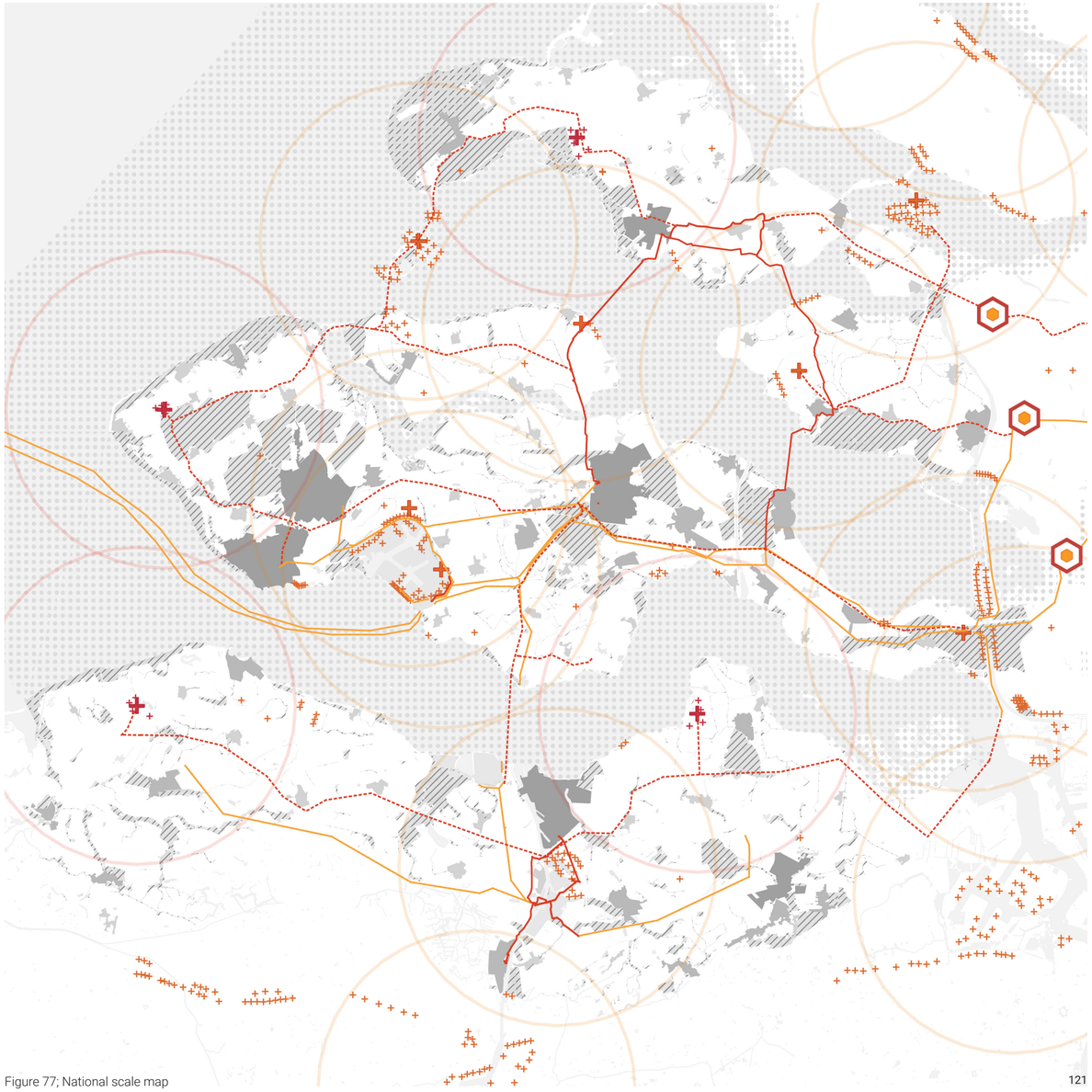


Figure 77; National scale map

Positioning Zeeland in the broader perspective of the Netherlands shows how wind energy production on arable land can be integrated into the national context of production and consumption of energy (figure 5.3 xxx). There are other regions in the Netherlands that share the spatial identity and potential for wind production on agricultural land. These areas are displayed in red, including Flevoland that is already producing wind energy, and regions of Friesland and Groningen.

This repetition across the country illustrates how the decentralized system developed in Zeeland can connected to a wider national network. Scalability therefore lies not in specific spatial interventions, but in the replication of structures and synergies between agriculture and energy production that contribute collectively to the national transition

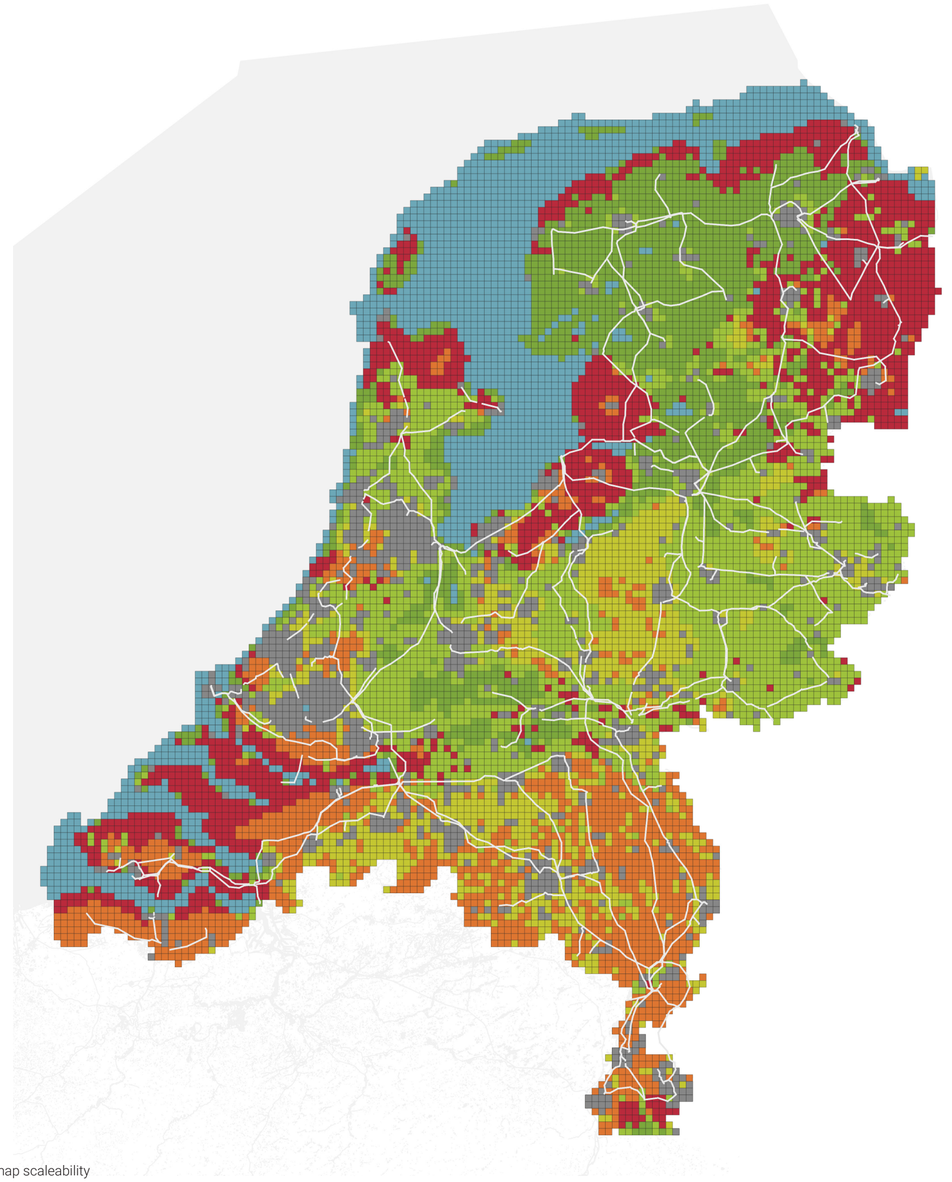
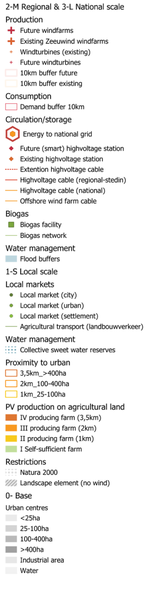


Figure 78; Grid map scaleability

As stated, by overlapping the different scales, a coherent strategy or synthesis map is formed. This shows the interrelation between the themes, goals and scales. This synthesis map relates to the systemic section where the actions are spatially located.

Within agricultural areas and its practices, these transformations span multiple scales, stakeholders, and themes. in terms of water management, every farm will have its own water basin for irrigation, whose collected and treated water will be directed to irrigation reducing reliance on potable water, which is currently under critical pressure (PosadMaxwan, 2023). Production will shift to meet the needs of nearby urban centres rather than global markets, promoting a move away from profit-driven, large-scale systems toward a more responsive, human-centered approach. This will result in more direct, efficient supply chains with less waste, partially compensating for agricultural land allocated to other uses, and encouraging more diverse production adapted to local conditions. Energy production and consumption, one of the most contested issues, will prioritize self-sufficiency first at the farm level, then locally, and finally regionally, with national supply as a consequence of internal surplus. Farms will use agri-PV panels for their own needs, supported by the regional grid, with excess energy supplied to nearby urban areas.

All farms will manage and process their own organic waste into fertilizers, supported by tools developed under the AMFER initiative (see Chapter 3.1). Diversification and land exchange will be common, in order to stimulate sustainable productive efficiency. Some land, according to proximity and potential analysis, will host wind farms, and their management will be collective. Since the organic matter produced on the farms will be fully used for managing their own fertilization, the organic material produced in urban centers will be directed to new industrial implementations for energy collection, treatment, and distribution, and there transformed into biogas.



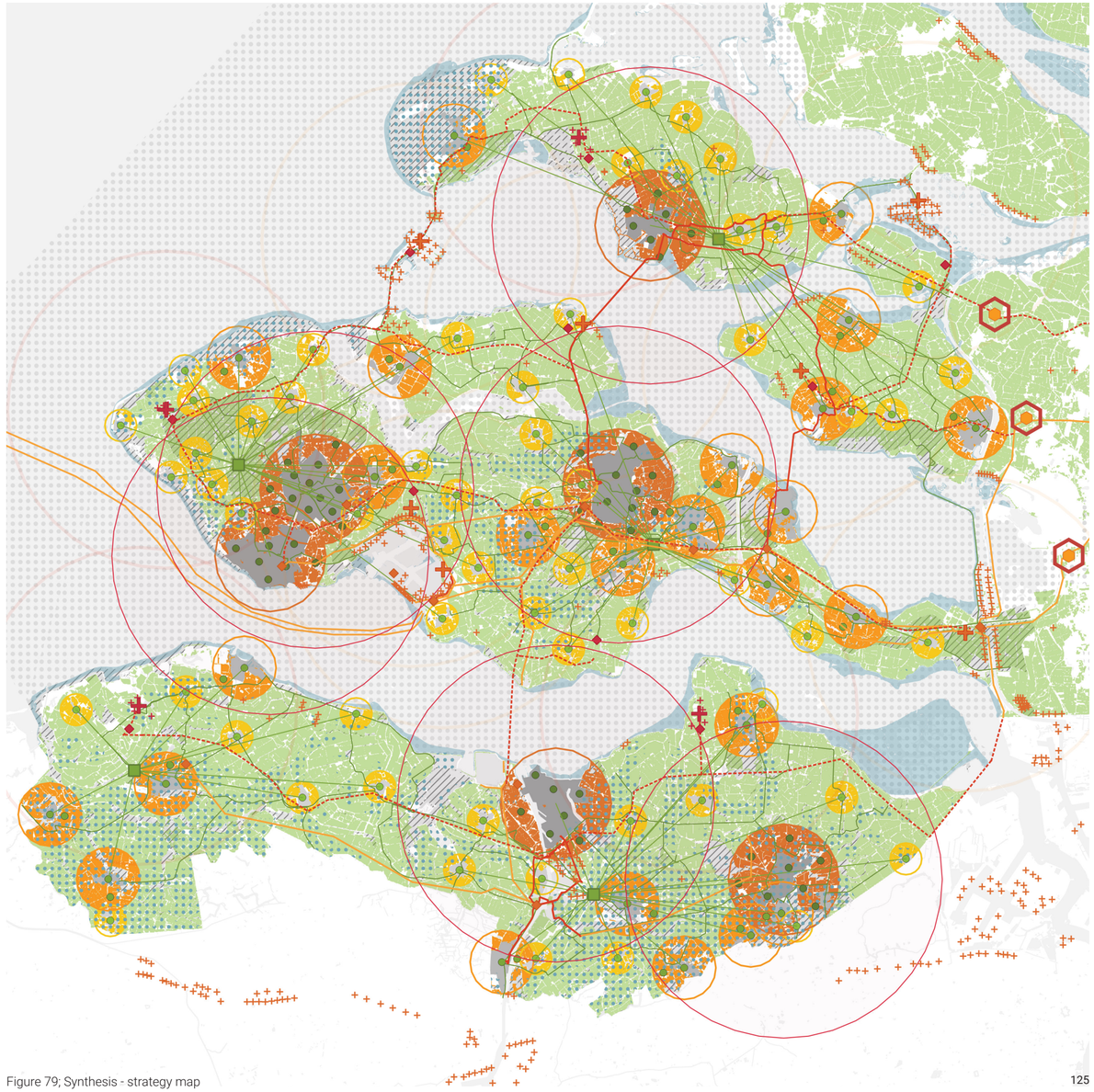
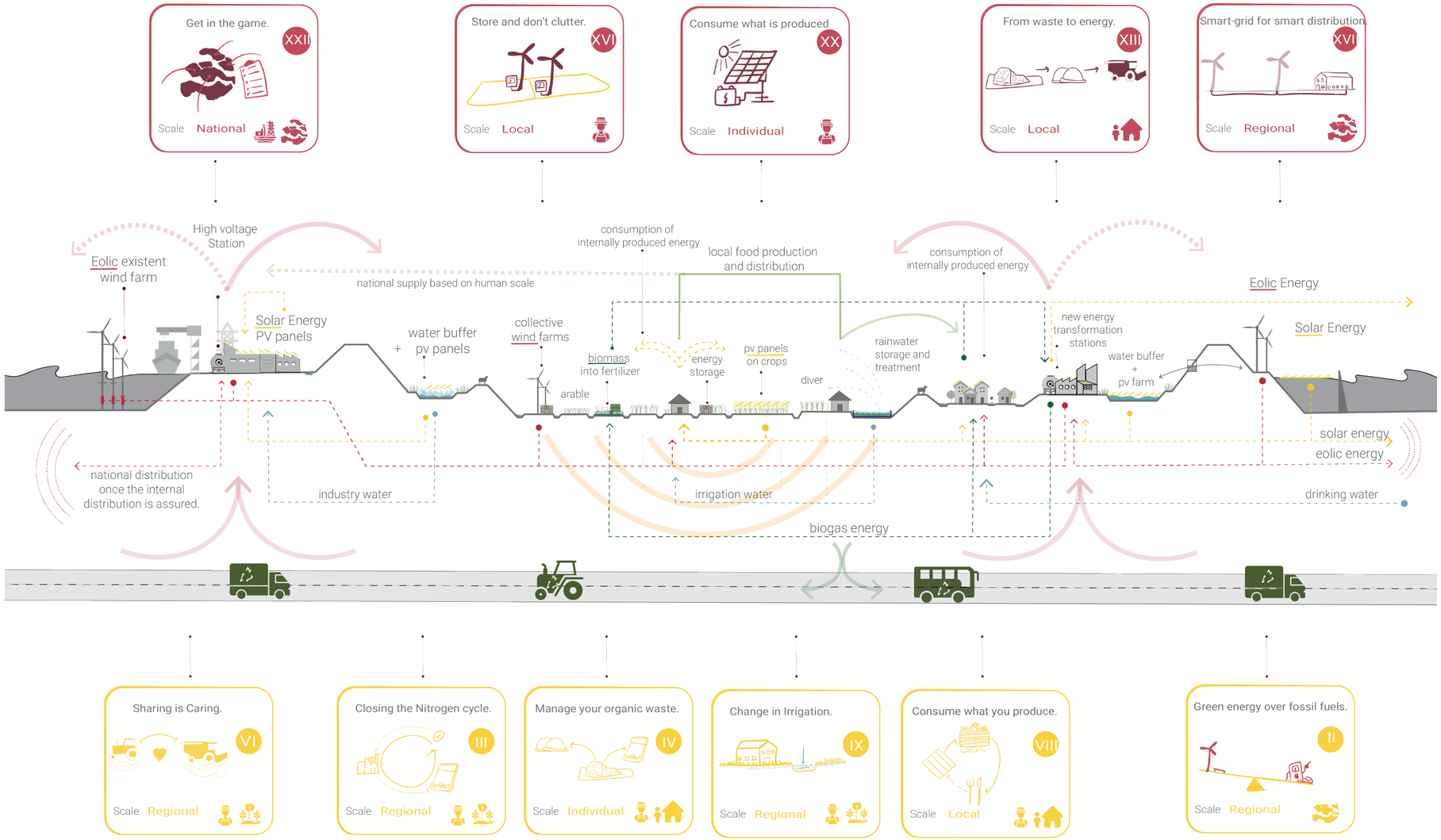


Figure 79; Synthesis - strategy map



The main scope of this energy source is for use in regional transportation, which will cease to emit pollutants. Energy storage is also implemented in all productive spheres. Each farmer will have their own reserve, and this has a scale corresponding to their productive capacity. This, in addition to being important for times of crisis and low energy capacity, is also important for decongesting the regional grid, which this project will also expand. Beyond the existing industries that complement the execution of the agricultural process in Zeeland, which are now responsible for their own energy production, and this energy needs to be renewable, the industries created for the collection, treatment, and distribution of energy will also follow the same principles. The projected national demand for energy and food in Zeeland will only be met after guaranteeing domestic demand.

This set of actions aims to directly address the problems related to the excessive release of nitrogen into the atmosphere, the water crisis from drought to floods, as well as subsidizing land by reducing pressure on congested and monopolistic infrastructure, and finally, energy with sources spread throughout Zeeland for the production of solar, wind, and biogas energy.

Figure 80; Synthesis Strategic Sistematic Section

Ultimately, in figure 81, the vision for Zeeland, is achieved through the proposed strategies across different timeframes, introduces transformations across all landscapes, which together actively sustain the province's agricultural system.

Within the agricultural sector, landscape diversification, as well as diversification of production methods and thus consumption, energy, water, and food, will be a guiding principle. Solar panels will be seen on crops, at different scales, across the horizon, as will rainwater harvesting basins, this last one, it spurred a change in existing irrigation process. Similarly, biomass collection will be the individual responsibility of everyone, making the environment less polluted and the nitrogen crisis more controlled. Finally, collective wind farms will be scattered across the general landscape, serving as a reminder of the energy security and internal sovereignty of Zeeland's renewable energy production, distribution, and consumption network.

Urban areas will feature local hubs for fresh food supplied by nearby farms and will benefit from improved grid infrastructure and decentralized energy systems. Additionally, they also have biogas production centres, using urban organic waste and improving the general energy resources. Meanwhile, governmental incentives for residential solar energy use, make them possible all around the province.

Industries will process locally generated energy and biomass, contributing to a circular energy system, while relying on their own renewable sources and local rainwater collection systems to reduce pressure on potable water and mitigate flooding. Ports, consequently, will regulate external demand more strictly, ensuring that exports only occur after internal needs are met, and will integrate nearby solar and wind energy production.

In environmental and cultural preservation areas, the project Protected landscape, interventions will be minimal and focused on protection and enhancement of biodiversity, needed space, and heritage, while reinforcing regimentations and importance.

By addressing each system individually while maintaining their interconnections, these strategies aim not only to provide stability and security for farmers, but also to ensure long-term resilience and sustainability for Zeeland as a whole.

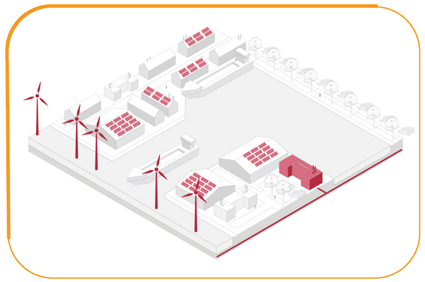


Figure 81a; Project Envisioned Industrial Landscape

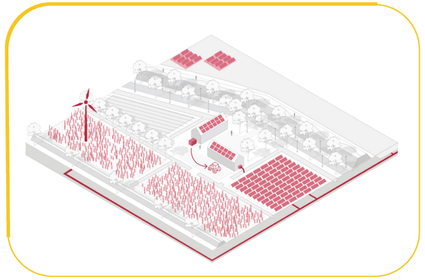


Figure 81b; Project Envisioned Arable Landscape

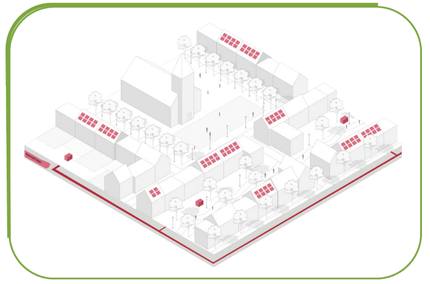


Figure 81c; Project Envisioned Urban Landscape

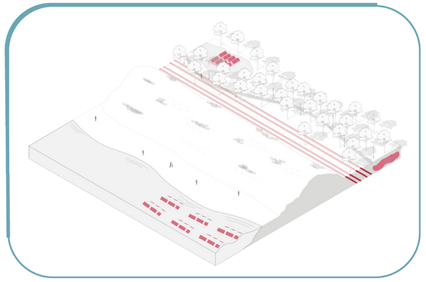


Figure 81d; Project Envisioned Protected Landscape

protected -natura
port-industry
agriculture
urban

6. Epilogue

6.1 Evaluation
6.2 Reflection
6.3 Conclusion

6. Epilogue
6.1 Conclusion

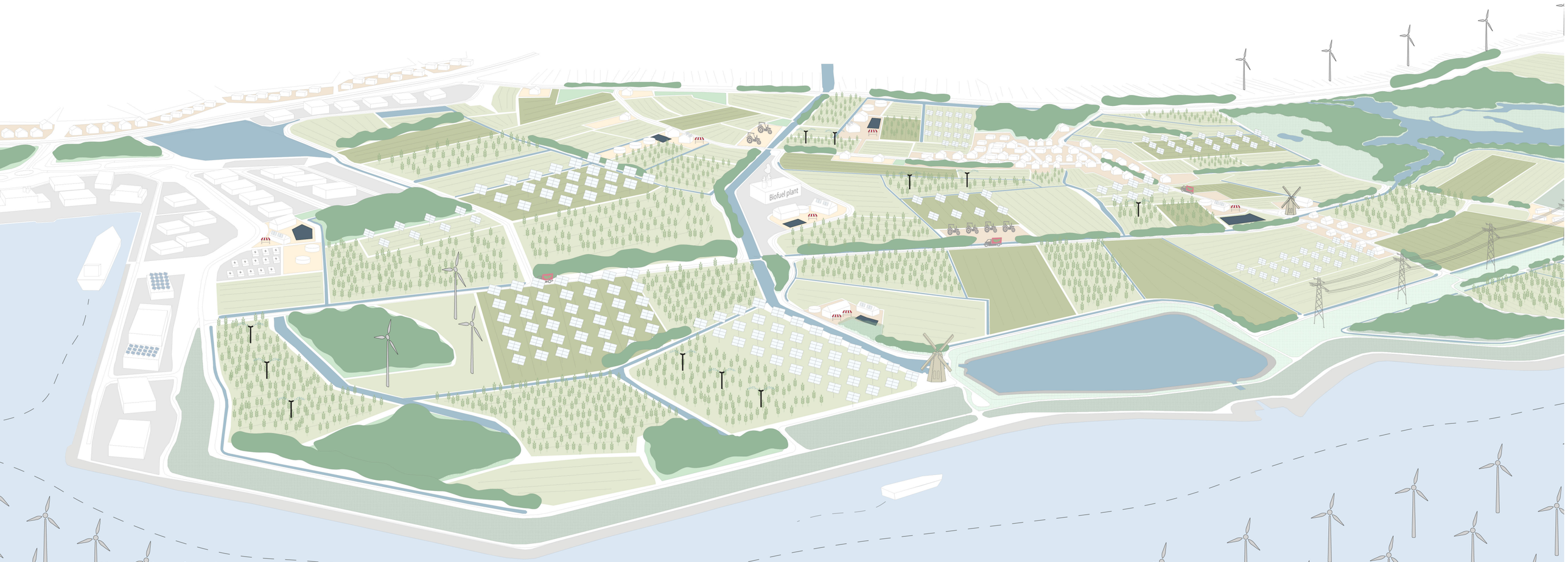
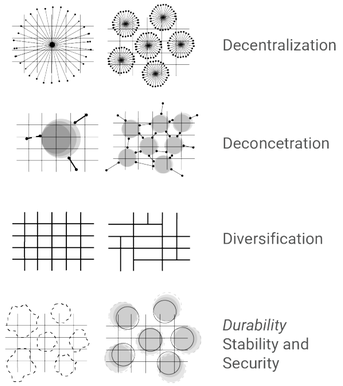


Figure 82; Future landscape of Zeeland

6. Epilogue
6.1 Conclusion

This project aimed, through directional and interventional strategies, address the complex challenges of the energy transition, from fossil fuels to renewable sources such as wind, solar, and biogas, while also responding to climate crises, such as droughts and floods. Simultaneously and in an interconnected way, the need to adapt current agricultural practices was considered, addressing issues related to uncontrolled production and consumption, as a structuring guide for the established vision. This aspiration was linked to energy decentralization in the pursuit of self-sufficiency and circularity at different scales. Similarly, water security was considered, both within the scope of promoting, managing, and implementing agricultural practices in Zeeland, as a sustainable agricultural process.
In this regard, the project research question: How can progressive farmers in rural Zeeland act as drivers of the energy transition while safeguarding their emotional, economic and productive stability and security and contributing to a future-proof rural system at the intersection of energy, water, and food security, while mediating between top-down policy frameworks and bottom-up practices? was answered in parts, through different actions that navigate between regulations, incentives, and projects, in a strategic, synergistic, and deliberative manner.
The regulations ensure that the project's agricultural and energy practices respect the limits and demands of nature and landscape. Besides being fundamental for sustainable development, this is equally essential for the farmer's quality of life. Governmental or institutional incentives, whether financial or educational, are essential for didactic assistance in the mindset shift proposed by the project: from market- production focused to human-based. It aims to encourage the local exchange of food and energy, based on the fundamental principles of the circular economy, together with individual responsibility regarding production and management of agricultural or urban waste.

Finally, the pilot projects, spread throughout Zeeland, encompass, at different scales, the desired vision for self-sufficiency. At the project's local scale, the focus is on maintaining a sustainable existence. The farmer produced their own energy using solar panels, while some of his irrigation water from rainwater basins, together with natural fertilizer by managing their organic waste. At the regional level, the extra food and energy produced is first directed to the urban outskirts, then to the province. Some pilot projects have been outlined at this scale, aiming for greater energy production, focusing on collective wind farms, along with the expansion of the transmission network. At the national level, in addition to decongesting the grid through provincial self-sufficiency, cooperative agreements will be essential in negotiating the supply and demand of products in Zeeland. These will guarantee the province's sovereignty and self-sufficiency.
These sets of actions were developed in order to meet the criteria of safety and stability for the farmer and the environment, the intensity of their impact on urban life, the probability of acceptance, and finally, the basic criteria of sustainability (United Nations, 2015).
Therefrom, the immediate result will be decentralization, spreading responsibilities and possibilities, and concomitantly, the deconcentration of maintenance and management, mainly from the production to the consumption process, both agricultural and energy-related. With these new forms, demands, and principles, the landscape will be diversified, with new activities and purposes. This will direct the project towards the principles most desired by farmers: security and stability. With an inclusive, decentralized, and environmentally supportable process, its durability becomes more reinforced.



Determinately, the focus is on placing the agricultural process as the ground for design decisions. Once the agricultural process is set in motion, in a synergistic way with the demands related to food, water, and energy security, its development is strengthened. A whole new social and economic arrangement based on the value change of sustainable agriculture is achieved. The result is a collective form of progress: more flexible, more resilient, and capable of ensuring a stable and secure future, not only for farmers, but for Zeeland as a whole.

6. Epilogue
6.2 Evaluation

This chapter will evaluate the outcome of the strategy and the project, focussing on three key elements. First, it reviews the parameters of action that guided the strategy, reflecting the vision's objectives. Second, the alignment with the Sustainability Development Goals (SDG's), to identify the extent to which these global targets are addressed through the project. Finally, it assesses the dimensions of spatial and social justice within the evolving context of geopolitical uncertainty, noting how the strategy affects different societal groups other than the transitional community. 1- Parameters of action/ strategy

This part of the evaluation starts by looking at how the strategy performs in relation to the goals of the project and to reflect on these goals. In addition, we define our main parameters: security, stability, intensity, sustainability, and acceptability. It is important to look back on how our strategy effectively responds to the challenges we aim to address, not only for farmers, but also across different scales in Zeeland and from a wide range of stakeholders.

Security – for the farmer

To immediately get to the point, the strategy increases the security of farmers. Farmers are now less dependent on external energy and on different pressures from outside. With the polycrisis only getting bigger, it becomes more and more difficult for farmers. Zeeland faces rising energy costs, climate risks, and constantly changing policies. This creates even more uncertainty.

By becoming not only energy consumers but also producers, farmers gain more control over their own production systems and their way of life. They become less vulnerable and are better able to deal with the effects of the polycrisis. In addition, their economic position improves, and they are more involved in decision-making, giving them a more active role in the transition. Overall, the strategy provides them with the tools to achieve more security for the future.

Stability – for the ecosystem

With the strategy, we are moving away from an intensive monoculture agricultural process to a more balanced system. The current challenges such as salinization and nitrogen cause the ecosystem to be under pressure. By applying our toolbox, for example crop diversification, water-adaptive practices, and circular use, the ecological system becomes much more stable and also more resilient to the polycrisis, such as flooding and droughts.

Together, this ensures that the agricultural process is now much more fo-

Intensity – Local spatial impact

On the more local scale, the spatial intensity increases in a positive way. This is because, through combining multiple functions within the landscape, it now becomes multifunctional. The agricultural land is now a place where food production, energy production, and water management come together, which again creates opportunities for farmers to have a bigger impact at the local, regional, and indirectly also national scale.

But if we zoom in even more, food is now more produced and sold locally, which also strengthens the connection with the surrounding community. The quality of not only agricultural products but also energy security and stability increases, and the strategy therefore creates a positive impact at the local scale.

Sustainability – system and landscape

One of our goals we strive for is that with our strategy, sustainability is improved, not only in separate parts but as one integrated system. Water is being reused, energy is produced locally, and the use of fossil fuels is increasingly being replaced by biofuel and clean energy. This makes the agricultural system not only more circular, but also transforms the landscape of Zeeland for the better.

The strategy also connects the water, energy, and agricultural systems more closely. They are now working more together instead of competing for space. By working on different scales and using pilot projects, the strategy can have a long-term impact and help balance new developments.

Acceptability – stakeholders

The acceptability of the strategy is supported through different approaches, such as bottom-up incentives and workshops, but also top-down policy making. This all focuses on the different stakeholders in our project. In the middle of this are the progressive farmers, who are key to making our strategy come alive. Through different pilot projects and local initiatives, we can test the ideas and, in the end, adapt them in a realistic context. This helps to bridge the gap between the top-down and bottom-up approach, which is key in this project.

It is also important to leave room for collaboration between the different stakeholders, such as initiatives between energy companies and farmers. This can ensure that different interests are more aligned. By bringing every-

Since Russia's large-scale invasion of Ukraine in February 2022 and the oil and gas crisis resulting from the United States' attacks on Iran last month, geopolitical uncertainties have significantly affected the availability of energy worldwide (European Commission, 2022; IEA, 2024). Sources indicate that a blockage of the Strait of Hormuz could specifically affect energy prices in countries in the global north (Almeida, 2026). As a result of rising energy prices and geopolitical tensions, alliances are shifting, and political and economic dependencies are heightening.

Situating our project within this reality of increasing geopolitical uncertainty and energy availability, we understand that the transition to renewable energy is becoming more pressing than before. The only way to ensure the farmers' energy security is to break the cycle of investment and support for energy dictators and their political agendas. We have seen this occur when our dependencies shifted from Russian oil to US-imported energy (CBS, Statistics Netherlands, 2025). By localizing energy production within our own country's borders, we cannot only control our dependencies but also the local environmental impact. Our proposal for a decentralized and self-sufficient energy production and generation with a focus on available and affordable renewable energy sources may be inevitable in the future, not only for the farmers in Zeeland but also potentially necessary for bottom-up societal stability and security on a larger scale.

Figure 83; Sustainable goals

Evaluating the strategy through the Sustainable Development Goals (United Nations, 2015) (figure 83), builds a understanding of the sustainability of the project. These goals contribute to a world for peace and prosperity for the people and the planet (United Nations, 2015). The thematic approach of the project including agriculture, water and energy, already contributes to multiple sustainability development goals (figure 6.2xxx). In addition, other goals are included and can be seen as synergies of the project. The project focusses less on spatial and social justice goals, as will be evaluated after (6.2.3). The SDG's that are in the centre of the strategy are: (2) zero hunger, (7) affordable and clean energy, (11) sustainable cities and communities, (12) responsible consumption and production, and (15) life on land.

Starting with zero hunger, this goal aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture (United Nations, 2015). The project aims to let farmers take the lead in transforming the agricultural process to a sustainable, future proof system. This integrates partly the goal for clean water (6), where the project aims to safe sweet water and use it through innovative irrigation systems.

The next integrated goal is 7: affordable and clean energy, where the project will ensure access to affordable, reliable, sustainable and modern energy for all (United Nations, 2015). By integrating energy production in the agricultural landscape of Zeeland, first the farmers themselves, and later the whole region will become self-sufficient. In addition, through the decentralised structure of this energy production and consumption, there is less pressure on net congestion and it will be a reliable and sustainable source of energy.

The goal that summarizes the whole project is goal 12: responsible consumption and production. By transitioning towards a sustainable agricultural process with local consumption, and the implementation of the decentralised energy system, the project ensures sustainable consumption and production patterns.

In conclusion, SDG 12 can be seen as the essence of the project, where all other goals come together and integrate. This shift towards responsible consumption and production of energy and food is needed in the contemporary context of the Zeeland region, and ultimately in the whole Netherlands. Farmers can be the key players to enable this shift, to ensure their own goals of stability and security.

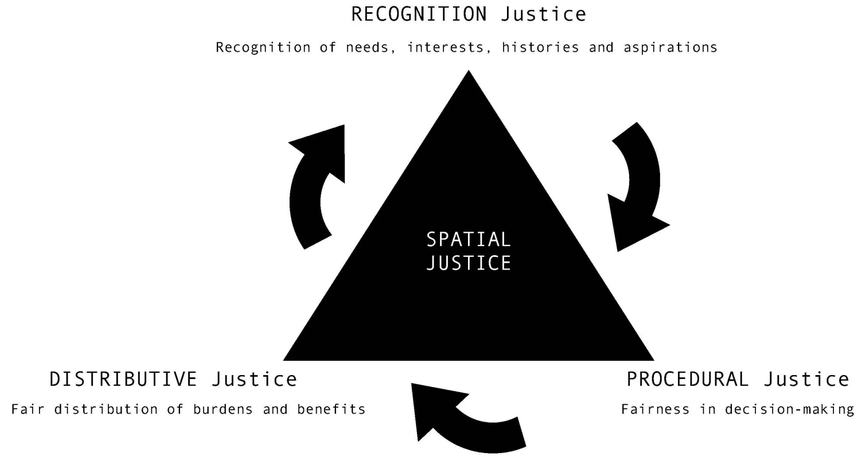


Figure 84; Spatial Justices diagram

Conceptualizing spatial justice as an interrelation between three dimensions: recognition justice, procedural justice, and distributive justice (Rocco, 2025). Rocco (2025) defined these dimensions as follows: Recognition justice refers to the "Recognition of needs, interests, histories and aspirations", procedural justice can be evaluated on the basis of the "inclusion and fairness of the decision-making process," and distributive justice is defined as "the fair distribution of burdens and benefits". The strategy will be further evaluated through these three dimensions to determine its contributions to spatial justice in Zeeland.

The project's framework, with a strong focus on the perspective of a transition community, allowed us to explore the needs and interests of our chosen community. These formed the basis of the vision and strategy, achieving security and stability for farmers in Zeeland. Due to the focus on the specific transition community, other stakeholders and vulnerable groups in Zeeland were not directly considered and given a voice within the project. Although ultimately recognition is only the first step in the process and requires further depth and development.

Our project aims to include and consider a yet-underrepresented perspective in the energy transition. Top-down policies and regulations impose pressures and expectations on farmers to comply with national and regional energy and climate goals. The community demonstrates a lot of resilience, motivations and frustrations as their efforts are not adequately addressed. By putting the farmers at the centre of the agriculture and energy production with interventions and solutions at different scales, they can develop their agency in a transition that will be inevitable for all of us.

The strategy localizes the benefits and burdens of the energy transition closer to the producers and consumers. As the farmer transitions from being solely an energy consumer to an energy producer in a self-sufficient and decentralised system, the benefits and burdens become shared and collective. A major change is the management and transparency of processes that arises in such a system. The famers and local community will be able contribute and have a say in the energy generation and produce for their own consumption.

Evaluating the project through these three lenses highlighted that the project largely contributes to improving spatial justice for the progressive farmers in an ideal situation but neglects other vulnerable perspectives. While the effects of the of the vision and strategy may benefit a larger audience of stakeholders, the lack of consideration to potential vulnerable stakeholders need to be further explored and assessed.

6. Epilogue
6.3 Reflection

GROUP REFLECTION

The Q3 Design and Research Studio: Spatial Strategies for the Global Metropolis, was the first studio of our Urbanism Masters to include such an extensive scale and an intensity of group work. The project allowed us to discover different complex challenges, interactions and ultimately solutions. In this reflection, we intend to reflect on three key moments of our project and the decisions, work processes, and group work dynamics that resulted from these, and the impact these have had on us as a team and the overall project.

Already from the first week of the studio, we were confronted with the scale and complexity of the topic. Tackling a project on Zeeland's energy transition already seemed daunting before we even really started. A feeling shared by our group members was a lack of a general understanding of the region, location, and energy transition. It almost felt impossible to grasp the extent and complexity of an entire region. Considering the jump in scale between Q2 and Q3, we really needed to reframe our understanding and accept the difference in the level of detail achievable in this project. But by giving us space to explore and engage with the topics individually and together, we were finally able to build a strong foundation for the project's continuation.

A first group bonding moment was the field trip to Zeeland. Renting a car, we spend the day exploring and observing the agricultural landscape as it passes by the closed windows. Vast expanses of flat agricultural land, the waters of the Schelde Delta, and expanding energy infrastructure are slowly creeping into the landscape. Seeing these elements interact so closely during the field trip made us realize that the themes could not be addressed individually. With the guidance of our studio tutors, we decided to conceptually situate Zeeland within a polycrisis, in which the three elements compete for space. This significantly increased the complexity of our project and led to ongoing doubts throughout the process. Reflecting on this decision now, at the end of the project, we unanimously agree that we could not have tackled the themes individually and that their interconnection strengthened our analysis and vision and enhanced the strategy's societal relevance.

Throughout the project, the transition community-centered approach gave us direction and a thematic focus, though it felt superficial given the project's short time frame and difficulty reaching meaningful depth. By knowing whose wishes and concerns would be at the centre of the project, we were able to evaluate our analysis, vision, and strategy through a single coherent perspective, despite juggling diverse ideas and understandings among our group members on a daily basis.

During the project, our team dynamics were both a source of connection and a frequent source of division. As enriching as our diverse backgrounds, interests and ideas were, they sometimes also led to misunderstandings, frustrations and friction within the group. Group process-wise, we took two different approaches: extensive, elaborate discussions and the divide-and-conquer approach, both with specific advantages and disadvantages, process-, project-, and learning-outcome-wise. What successfully worked for us to was to discuss the key parts together in the first seven weeks of the project to develop a coherent and inclusive narrative, in terms of ideas and perspectives of our group members. The last two weeks resulted in a larger division of tasks with the milestone of the final submission and presentation ahead of us. Looking back, we wish that some discussions may have been more linear and less circular. Although we tried different approaches and worked with writing an agenda for upcoming meetings to give us structure and do not lose sight of the goal of the discussion.

Especially the peer review after the mid-term presentation shed light on some group dynamics and brought points to improve and reflect on. Being confronted with our own biases and the boundaries of other group members made it easier to have conversations about group dynamics in the last two weeks of the project. Our resolutions for improvement were grand, but re-entering the same project context made it sometimes hard to fully follow through on them.

As challenging the Q3 group project was at times the shared goal and satisfaction of the project falling together give us motivation and wind at times when we needed it the most.

7. References
7.1.1 Bibliography
7.1.2 Table of figures
7.2 Appendices

7. References
7.1.1 Bibliography

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Created by the author. Adapted from provinces by PDOK https://www.pdok.nl/introductie/-/article/bestuurlijke-grenzen; and arable land area per province by CBS (2024) https://www.cbs.nl/nl-nl/maatwerk/2025/28/landbouwgrond-naar-gebruikstitels-per-provincie-2008-2024; and inhabitants per province by CBS (2022) https://www.cbs.nl/nl-nl/maatwerk/2023/07/inwonertal-per-provincie-1-september-2022

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Disclaimer: The author included as many sources as possible. Some references may be missing, as this requirement was introduced after the lecture in week 6 of another course.

Figure 50 – Stakeholders
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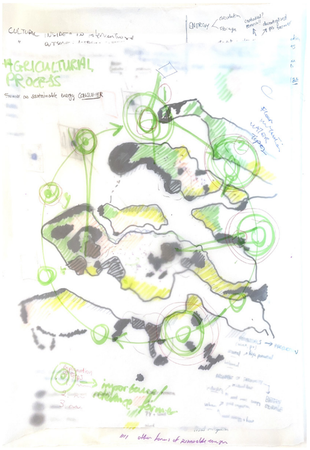
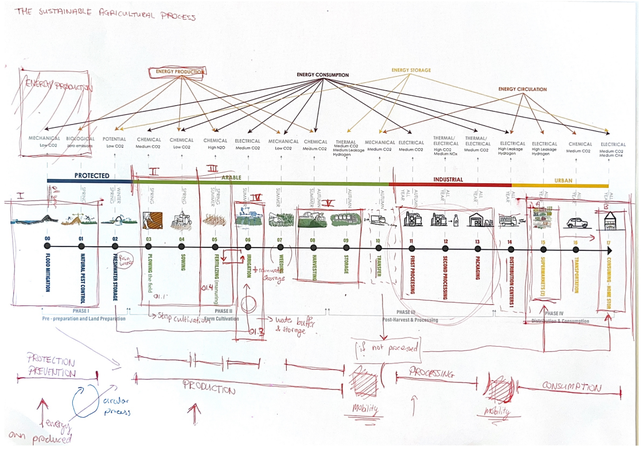
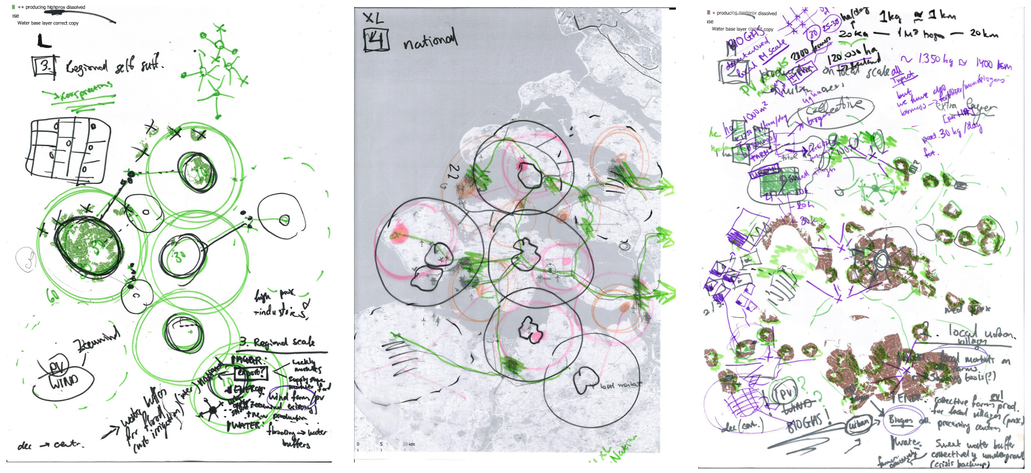
Rocco, R. (2025). A Brief Introduction to Spatial Justice. Zenodo. https://doi.org/10.5281/zenodo.17481513

7. References
7.1 Appendices



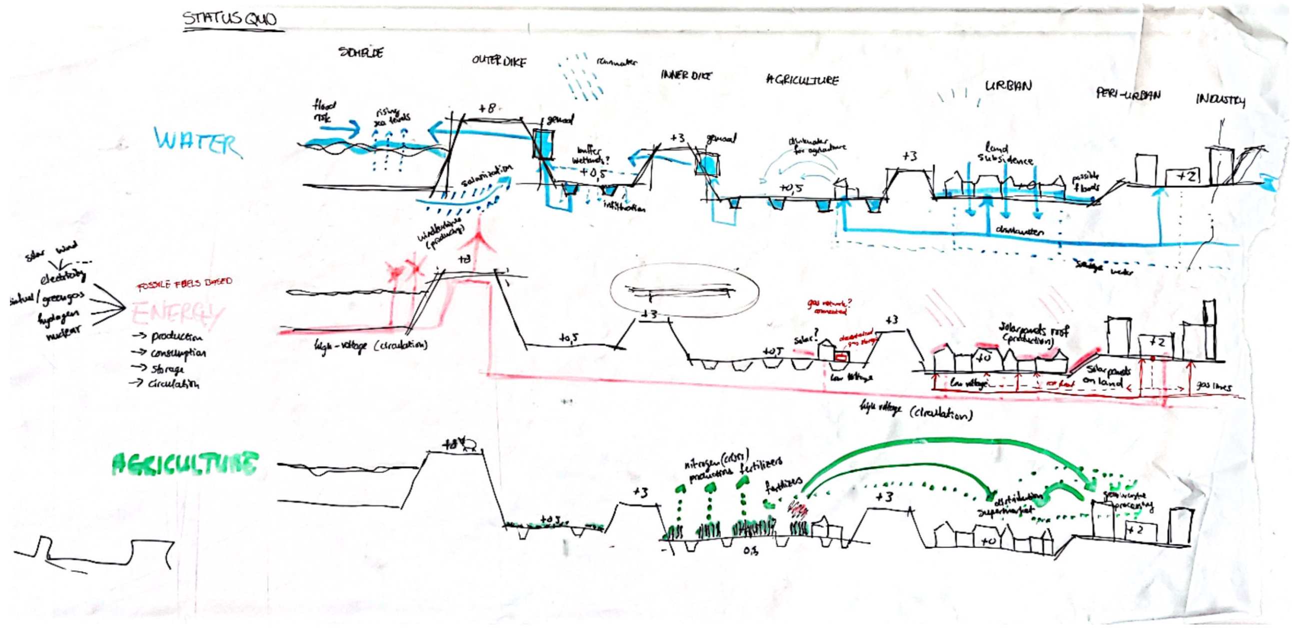


Vision process



Strategy process

Potential maps



Systematic sections between the 3 topics

Zeeland, O. (n.d.). Vooruit met de boer!, Proefboerderij Rusthoeve [Video]. YouTube. https://www.youtube.com/playlist?list=PLNpU5SavfCoce8mtlxNiKfCdrhMjyoZgB	agriculture	water	energy	general
Jael van Brakel (26) *organic arable farm*	I expected [with organic farming] perhaps a little more height in the containers [vertical farming]. That's what you often see on television. But it was very different. It's really soil cultivation [horizontal farming]. *When you grow organically, what is really challenging for you?* "Yes, diseases are pests. For example, you also have aphids, thrips, spider mites. These are all insects that reduce production, so we use other insects to eat the bad insects.	'So this is the basin. It can hold 6,000 cubic metres of water. It's a kind of giant rain barrel." *If you didn't have this, couldn't you collect rainwater from the ditches [from the polders]?* "No, collecting water from the ditches is too risky for us because you don't know what kind of bacteria are in it." *Have you ever had your basin run dry?* "No, I haven't. Fortunately, because otherwise I'd have a big problem with a water shortage. And then, well, the only solution I can think of at the moment is to turn on the tap, but that costs a lot of drinking water and a lot of money."		He has 25 employees, mainly from abroad. "The Dutch don't really like doing the work. It's hard work and, well, partly because of the salary. But you have to be competitive with the price of your product, because the supermarket doesn't want to pay more for the products we have." In this greenhouse, visitors can pick and purchase organic fruit and vegetables themselves [oogst tuintje]. Visitor: "Because it's organic and super fresh. And it's fun to pick it yourself, and I think it's really delicious."
Maaike Rouw (22) *diary farm*	"We spread the manure on our own land to help our crops grow. But there is a limitation. Yes, there is indeed a limitation. Fortunately, here in Zeeland we have a lot of arable farmers who can make good use of that manure. So we work with them." *She also says: 'There aren't that many cattle farmers in Zeeland.' So that's a very nice balance, that I can exchange my manure with the arable farmers around me. And, well, I think that's a very healthy balance. There aren't that many cattle farmers here, so the few that there are are very welcome.*			*The sector is constantly evolving, but it is also facing increasing opposition and stricter regulations.* "I have to be honest, I was very passionate about it in the beginning. I went to protests and things like that. But now, when I look back, I try to avoid the news. I don't watch the news anymore. I don't read anything online anymore either. I just don't want to follow it anymore, because it all gets into your head and stuff. My focus is simply on the cows."
Kars van Catsand *fruit farm*	*What actually surprised me was that I knew I was going to a non-organic company, but that Kars is still working with bees here, attracting bees himself and also using other insects. I found that interesting. I hadn't expected that. I thought, 'They only spray here.' So that surprised me.* Do you also work with chemicals? "Yes, we also use chemicals, because we are a conventional company. So that means that you also use conventional chemicals.			And where do your employees come from? "Mainly from Poland. Some of them have been coming here for 20 or 25 years. And they bring their friends, family and acquaintances with them because they like it here too. And yes, I think they earn a little more here than in their own country." *I think it's good that they house workers on their own premises. It's also a bit of a service and makes it attractive to come and work here.* *The future?* We could start a campsite or camper van sites or, well, a place where you can drink coffee and tea and hold meetings.
Geert van de Velde (24) *arable farm*	Are you allowed to fertilise freely? "No, no, as you can see here, the manure is quite thin. We have to comply with government regulations and we have standards for nitrogen and phosphate that we have to adhere to. *I certainly understand that Geert has difficulty with regulations. Actually, it's something every farmer encounters. Very often, it doesn't quite match what you have in mind.* *In addition to fertilising, the land is sown with green manure. These are plants that are not harvested, but ploughed into the soil to nourish it with organic plant material.*	"Well, this is our [water] bassin. It's not that full. I can't pump any more out of it, now we would need to build another basin next to this one. We can't get this water from the ditch, so we have to harvest it. So we've installed new drainage under a plot of land. That costs a lot of money too. And we've had that run into a well. And then, if the salt value in the wateris right, only then does it go into the basin to be pumped. *The big problem here in Schouwen Duivland is that the water here is too salty. You can't use water from the ditch on your land* No, we're surrounded by salt water here and no fresh water is brought in.		*Do you see a future for farmers on Schouwduivenland?* Yes, because crops are simply very important to have, and to have a product. I think it's also becoming increasingly scarce. So I think we need to be very careful with the agricultural land we have here and with the knowledge we have. We can grow crops and do things that they cannot do in the rest of the world and will never be able to do."
Proefboerderij Rusthoeve *arable farm*	*And now, in this strip, there are two different varieties of sugar beet. Anneleen is investigating the effect of strip cropping. This involves planting different crops next to each other to see if they can help each other. For example, against disease or to strengthen the soil.* *How do you see the future for young farmers in Zeeland?* "For some, strip cultivation will be a wonderful system and will really fit in with their business operations. For others, it will be something to do with precision farming, robotisation, or perhaps scaling up. I just hope that everyone will be given the space to do what is right for their business."			*When I look around here and listen to people talking about how they are engaged in innovation, how they are willing to move with the times and adapt, I think that farmers are not going to disappear any time soon. I think these people are all putting their shoulders to the wheel. That we can move forward in a different way. And that's what's being said here, too. The farmers, the young farmers we've spoken to, won't farm the way their parents did, but they'll still be farming.*

Media analysis interviews

Community Based -Production Projects

Soil Health

Living and fertile agricultural soils: that is the ambition of a regional composting project being developed in the Groot Saeftinghe Border Park. Locally sourced grass clippings, including those from nature reserves, dykes, and ditches, are processed by farmers themselves into high-quality compost and spread on the land. Compost is a source of nutrients for agricultural crops and contributes to a better soil structure, increasing soil life and retaining water for longer. This is a good example of circular Focused on reusing raw materials, materials, and products as often as possible. land management.

Sustainable Energy

Zeeuwind achieved economic resilience, which was made possible through multiple factors, unique among them are: 1) Zeeuwind's origin in the environmental NGO at the provincial level, which provided it with the necessary knowledge and network for a strong start. 2) The memberships of municipalities. 3) The focus on the level of the province to site new projects. 4) A contract of ten years with the energy incumbent. 5) The strategic decision to expand the technological portfolio. 6) Expansion of business through new partnerships and joint ventures.

Nitrogen into Fertilizer

In recent years, Colsen has developed AMFER, an innovative technology for extracting nitrogen from sources such as manure and sewage, and converting it into high-quality fertilizer. With AMFER, the family business now has a technology at its disposal to process all available manure in Zeeland, preventing at least 60 percent of ammonia emissions and supplying 15 percent of all households—a municipality the size of Middelburg—with green gas. This innovation contributes to solving the nitrogen, energy, and climate crises, while maintaining a revenue model for farmers. AMFER applications are not limited to Zeeland but are now also finding their way into the rest of the Netherlands, Spain, the United Kingdom, Japan, and the United States.

Land Exchange Programm

The Land Exchange Agency helps farmers and governments. By exchanging land, agricultural businesses can utilize their plots much more efficiently. When the agency began in 2012, farmers' land was much more fragmented than it is now, especially in areas without major land consolidation projects. With the help of the Land Exchange Agency, governments can work on solutions for society, such as improving road safety, creating water storage, or developing nature reserves.

PV PAINELS Programm

In 2016, Zeeuwind started a limited liability company called the ZonOffensief Zeeland, which focused on facilitating the installation of PV panels on the roofs lent by small and middle-sized enterprises.

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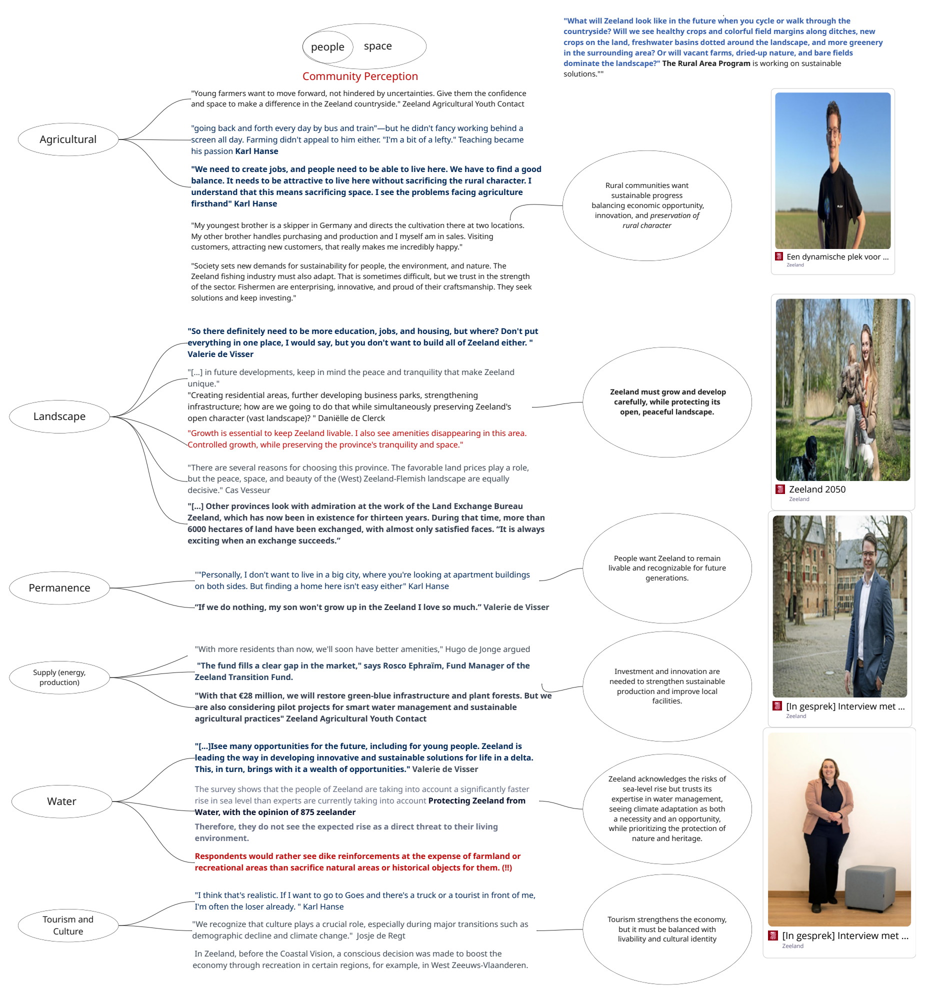
Rain Water Storage

Farmers Podcast................

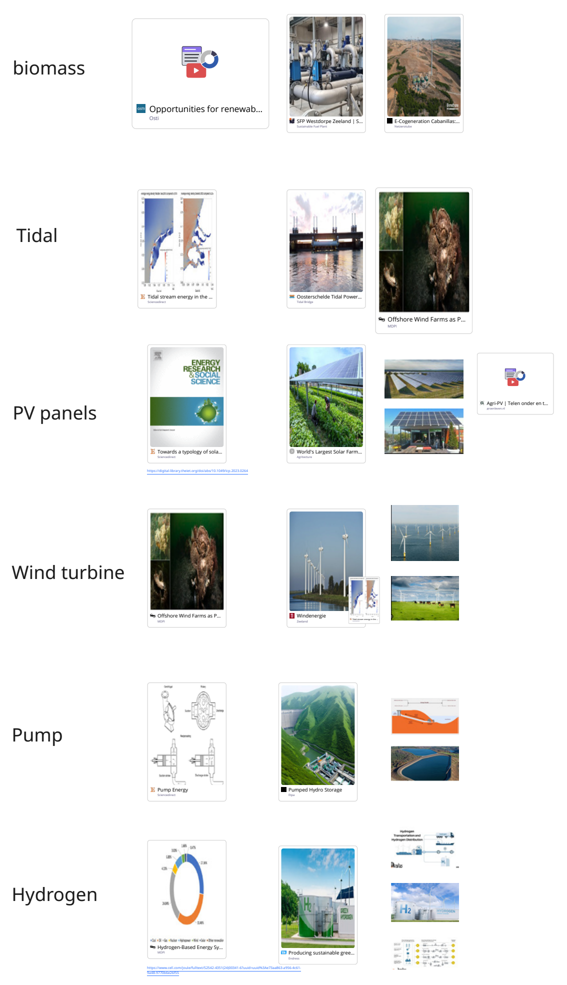
Agricultural Initiatives in Zeeland

Articles, media analysis

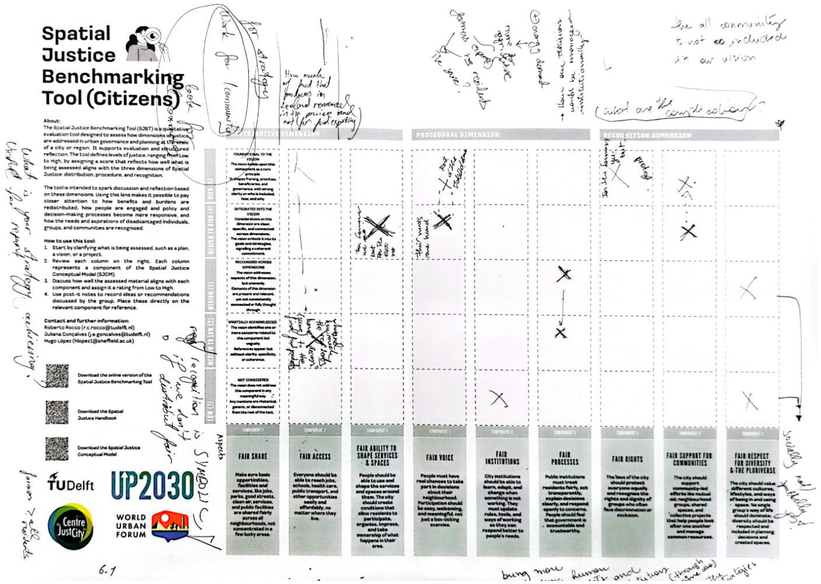


Media analysis analysis

Energy types in zeeland



Energy Initiatives



Spatial Justices Matrix

POSITION PAPERS

AUTHOR - ANA TIERCHER

RESIDENTS

The population of Zeeland has grown up in a landscape of vast agricultural fields and dispersed urban centres, where green polders and windmills define the everyday horizon. While emblematic of the Netherlands, this scenery reaches its most expansive and poetic expression in Zeeland. Being raised in such an environment, meant having their recognition as citizens linked to this landscape. The attachment is not only emotional but also social. However, in the face of ongoing migration in the province, driven by the mismatch between spatial organization and the demands of urban development, these inhabitants, deeply connected to the vast horizon of polders that surrounds them, increasingly recognize the need for adaptation. Such changes are essential to ensure that they can continue to live, work, and build their futures within Zeeland itself. This distressement surrounding the prerogative of leaving, coupled with their landscape qualities, creates an intersection that needs to be present in discussions about Zeeland's future.

Zeeland`s residents are a predominantly Dutch population, with a secondary education level and between 50-65 years old. In recent years, the population under 35 years has been declining (see figure 1), while the population over 40 years old has been growing (RIJK, 2026). As indicated by themselves (Zeeland Province, 2025), the lack of education, specialized jobs, housing, and basic services to meet a growing urban population, justifies migration to neighboring provinces.

Furthermore, existing agricultural practices of the region may also represent a possible lack of openness to new markets and opportunities, and therefore, a lack of alignment with economic development, resulting in a certain stagnation in population growth and development, as well as in economic practices in general. (Johnston, B. F., & Mellor, J. W. 1961).

However, Zeelanders do not view this naturalization of migration positively. Having been raised and educated in the region, their connection to the land is both spatial and emotional. This bond is intensified by the surrounding polders and plantations, reflecting the intrinsic link between human nature and the natural world (Wilson, 1984). Ultimately, this relationship between space and humanity shapes their daily actions, core values (Rocco, n.d.), and their very identity. A resident of Zeeland's sense of citizenship is highly tied to the urban landscape that raised them. Therefore, having to leave Zeeland in search of employment, studies, or housing causes them considerable unease.

The main desires stem from the wish to stay in their homeland, while at the same time, the landscape that raised them, remaining there in essence. Their connection to the landscape underpins their civic, social, and personal life. They want not just to remain in Zeeland, but to stay in the calm, natural environment that formed them.

It is possible, consequently, to identify a projected tension between the need to transform the rural system and the desire to preserve Zealand's nature identity. As speeches by the local population to the Zealand newspaper:

The project planned for Zeeland energy transition, aims to encourage its self-sufficiency, in the sense that the farmlands produce and consumes its own food and, especially, its own energy, in a fair, efficient, and ecological way. The objective is to achieve a spatial synergy between food and water security and renewable energy production, reinforcing both independence and sustainable development.

Immediately, this implementation would be not only a reduction in the costs related to food and energy, but mainly, raise more opportunities related to specialized employment and education. Consequently, with this new demand and expansion, amenities related to housing, health, leisure, and culture would be implemented and the residents' permanence, would therefore, be ensured.

Conversely, the project vision has a decisive impact on Zeeland's landscape. On an unobstructed horizon, the human eye can perceive roughly 5 km of open field1. The expansion of renewable energy, especially wind turbines, could obscure green and blue horizons across most of its urban centres. Diffuse visual pollution from various energy sources could intensify this further. Noise pollution, within a 2.5 km radius (van den Berg et al., 2008), would affect most urban centres (see figure 2). If implementation provides minimal benefits, its impact on residents' daily quality of life will be alarming.

The focus of attention, though, is on the concern, conscious or not, related to the sense of citizenship of these residents. Implementing numerous pieces of equipment related to renewable energy production in the Zeeland landscape could erase its main quality, according to its residents: its identity of tranquillity and naturalness. If this occurs on a large scale, and without regard for these desires, it could be extremely detrimental to the sense of citizenship of these residents, since the space that shaped them will have been drastically transformed.

Conclusion

Overall, expanding this Zeeland's economic potential, especially through the renewable energy industry, demands more specialized and nonspecialized jobs, fostering the presence of higher education. This, in turn, can lead to greater availability of basic services. Although visual and noise impacts may raise concern, aligning them with broader benefits can reduce negative perceptions (van den Berg et al., 2008). Residents, deeply attached to their landscape, may accept these changes as they support their main aspiration: to remain, strengthened by improved amenities. (see figure 3).

This anticipated engagement will only be successful if it aligns with the residents' primary demand: preserving the agricultural identity of Zeeland's vast polders. Because this landscape has built their identity, its essence protection, is a non-negotiable part of the process and crucial to any future alignment.

Thus, ensuring the permanence of these residents demands changes, but these changes, to guarantee their sense of citizenship, must also preserve the strongest aspect of Zeeland: its green and blue horizon.

POSITION PAPERS

AUTHOR - ROBIN GEUTING

NATURE

Across Europe, biodiversity in the Netherlands is at the poorest state. Biodiversity is the starting point: without plants, there is no food, no oxygen, no clean water. Biodiversity is crucial to our environment and ultimately, therefor, to our lives (Kuller, n.d.). This contributes to the rising interest in ecology and the relevance of salvation of the whole creation, including non-humans (Latour, 2009). From the perspective of non-human nature, this biodiversity crisis reveals a structural problem: ecosystems and species are most effected by the consequences of decision making, while having no formal voice in political and planning arenas.

This position paper explores the proposed vision of the studio on the challenges of the energy transition on the intersection with agriculture and water in the region of Zeeland. The pressures on farmers to innovate and transition towards a sustainable agricultural system come together with the potential of renewable energy production on farmlands. This paper adopts the standpoint of nature as stakeholder, critically analysing if the proposed vision supports the restoration of biodiversity, soil quality, and water systems. It argues for strict nature-positive criteria for both sustainable agriculture and energy production on farmland.

2. Role and interest of nature

The theory 'Rights of Nature' argues that elements of the natural world should hold legal rights in their own name, rather than being protected as property or resources for humans (Stone, 1972). Contemporary debates on the representation of nature and legal rights for biodiversity illustrate the importance of nature as a stakeholder, rather than a passive background to human activity.

When looking at the power and interest diagram of the agricultural landscape of Zeeland, nature would position itself as the stakeholder with highest interest and lowest power. Non-humans are essential in sustainable agriculture, but also for security and stability of water and energy. However they do not have a voice to speak, hence the lowest power, and are dominated in planning arenas by governments, farmers, food producers, supermarkets and the energy industry. Nature can be given a voice by different organizations or institutions. For example, national or provincial governments, nature organizations and activists or knowledge institutions as illustrated in diagram 01 (Het Nationaal Dashboard Biodiversiteit, n.d.).

By framing the main goals of nature, spatial complications or synergies with the proposed vision for Zeeland can be identified. Nature is the phenomena of the physical world collectively, including biodiversity of plants, animals and the ecosystems of the landscape (Oxford, 2003). Nature aims for restoration and safeguarding of its biodiversity, soil health and freshwater availability, contributing to food production and climate regulation. The vision acts on the intersection of agriculture, water and energy by combining two aspects: the innovation towards a sustainable agricultural process, and the production of renewable energy in form of PV-panels and wind turbines on agricultural land. Nature's position demands that any intervention in the agricultural landscape of Zeeland is evaluated through its contribution to ecological recovery rather than its efficiency gains or financial returns.

3. Aspect 1: Sustainable agricultural proces

The sustainability of the agricultural system of Zeeland is under the stress of soil degradation, freshwater scarcity, the use of agricultural pesticides, and climate risk. This calls, in combination with the decline in biodiversity partly caused by the nitrogen crisis, for ecosystem restoration both within and outside nature reserves (Provincie Zeeland, n.d.). Nature's position is conditionally supportive, but only if the restoration of biodiversity and ecological processes is taken into account, rather than merely optimizing production or framing the process as "sustainable farming".

An important spatial aspect is that nature is given more space outside of protected nature areas, including agricultural land. As stated in the European Biodiversity Strategy of 2030, at least 10% of agricultural land should be dedicated to biodiversity and nature (Het Nationaal Dashboard Biodiversiteit, n.d.). However this will contribute to a higher spatial competition on the agricultural land, together with food production, water management and renewable energy production. It is important to see these intersections as potential synergies.

4. Aspect 2: Production of renewable energy on arable land

Research has shown that impacts of renewable energy production as PV-panels and wind turbines are mixed, some systems improve habitats, but others may disrupt ecosystems if not properly managed. This is caused by microclimate alterations, as changes in local temperatures and humidity, influencing both crop growth and local weather patterns (Mundu et al., 2026). On the other hand the climate benefits of renewable energy production is essential for reducing pressures on ecosystems. and agrivoltaics systems can create new habitats, improving microclimates on farmlands (Chatzipanagi et al., 2023). Early research has shown that the presence of wind turbines on European farmlands is unlikely to have disadvantageous effects on farmland birds (Devereux et al., 2008).

From a non-human standpoint, energy production should be prioritised on roofs, infrastructures and degraded or brownfield sites, and only considered on agricultural land when strict nature-positive conditions are met.

5. Conclusion

To conclude, the position of nature on the Zeeland vision for sustainable agriculture is positive, if biodiversity, soil health and freshwater systems are treated as non-negotiable preconditions rather than flexible boundaries.

Habitats should be expanded and connected by giving 10% of agricultural land to biodiversity, soils should be regenerated through diverse crop and land use, and emissions as nitrogen reduced by using natural fertilizer. The addition of the production of renewable energy on agricultural land is more conflicting to nature's interests. Wind turbines and PV-panels can influence ecosystems on agricultural land, and should be placed primarily in less sensitive locations. It is allowed when robust design and integrated multifunctional solutions of energy production and agricultural practices ensure ecological improvements.

Spatially, this results in mapping overlaps between producing energy land, ecological networks and freshwater systems (diagram 02). These conflict zones should be seen as strict mitigation areas, where nature should be prioritised. In addition, nature should be given a voice through governments and nature organisations in political and planning decisions making. Allowing ecological criteria to reshape the vision for the agricultural landscape, because biodiversity, ecosystems and water systems are vital elements of the agricultural system.

POSITION PAPERS

AUTHOR - LYDIA PANAGOULIA

PROVINCE OF ZEELAND

As the Province of Zeeland, we face a complex polycrisis: rising sea levels and extreme river discharges threaten the shores, while freshwater scarcity jeopardizes a farming sector traditionally reliant on rainwater. (Province Zeeland, 2026b) Moreover, this instability is compounded by a nitrogen crisis, high energy prices, and a strained port industry, all while the memory of the 1953 flood underscores the region's vulnerability.

To confront those problems, one major pillar is for Zeeland to be the pole for all the Netherlands by being cleaner, greener, and stronger (Province Zeeland, 2026d) and closing the gap between increasing energy demands and biodiversity conservation. Pivoting towards a sustainable transition, utilizing, for example, flexible electricity consumption, innovative storage, and green heat sources to decarbonize our greenhouses and transport. (Province Zeeland, 2025)

A final goal for 2050 is a nature-inclusive society where life in the delta is in balance. By becoming the world's first climate-resilient region and a global hub for food innovation, we ensure a safe, healthy, and promising future for every resident. (Province Zeeland, 2026a; Province Zeeland 2026e)

02. Evidences

02.1 ZEELAND PLAN 2050
To ensure a future-proof Zeeland, a holistic approach is needed. It is crucial to include topics such as population growth, nature, agriculture, industry, water, and the built environment to ensure climate resilience.

First, we are committed to making our region more attractive, ensuring that people choose to stay and settle in villages. By maintaining the unique quality of these surroundings, through a vision of collective livability (Ontwerp D. 2025). Simultaneously, the built environment is transformed by reducing CO2 emissions to 95%. Our 2030 objective is to insulate 32% of all homes, easing the transition to smart energy sources. By prioritizing green gas, hydrogen, and electricity, we reduce pressure on the energy system while securing a healthy, promising future for all residents.

In the agriculture and nature sector, we are enhancing the natural health of the delta by moving toward a closed-loop system that operates in harmony with our fertile marine soils. By using natural processes such as pest control and fostering biodiversity, we maintain productivity without the burden of excess emissions or heavy fertilizers. (Province Zeeland, 2020) As a Natura 2000 area, we prioritize nitrogen reduction and the restoration of our "green-blue oasis," recognizing that nature is the fundamental asset for our farmers' livelihoods. The transition to sustainable greenhouse horticulture is key, with projected savings of 35% in heating and 50% in electricity by 2050. (Province Zeeland, 2026) To manage scarce grid capacity, we are promoting self-generation through solar, wind, and green gas, combined with "behind-the-meter" storage and flexible consumption—utilizing smart processes like manure cooling and grass drying to balance the system. Whether through local geothermal sources, residual heat, or the establishment of energy hubs, we empower farms to become sustainable energy producers while securing a resilient, nature-inclusive future for the province. "Farmers contribute to the biodiversity and natural quality of the Netherlands." (Province Zeeland, 2026c)

Thirdly, the industrial sector is pivoting toward a sustainable, integrated landscape; An innovative offshore energy island will serve as a landmark for coastal defense and a hub for wind, hydrogen, and storage. As a focal point in the Netherlands to a vital chemical cluster and the nation's only large-scale naval shipyard, Zeeland is making joint investments in CO2-free generations and 380 kV infrastructure. The energy vision anticipates a local industrial energy consumption to drop from 8 PJ to 6 PJ by 2050 through smart electrification, heat pumps, and mutual heat exchange networks. (Ontwerp D. 2025) By integrating solar, wind, green gas, and potentially nuclear energy, it is possible to implement a strategic backbone that powers both economy and climate goals.

Fourth, securing a reliable freshwater supply is critical for agriculture, industry, and drinking water. This can be achieved by maximizing the retention of local precipitation and optimally storing winter rainfall for summer use in artificial basins and nature reserves. A key priority is underground storage, supported by a specific infiltration policy for irrigation. (Province Zeeland, 2026) To combat heat, drought, and flooding, we are accelerating measures to retain water longer—from local sites to the primary water system. Moreover, by exploring innovative reuse of urban wastewater, treatment plant effluent, and desalination, it is ensured that water safety risks are manageable. This also integrates water management, protects the Delta, and transforms Zeeland into a truly climate-resilient region. (Province Zeeland, 2026b)

02.2 COMPARISONS AND COMMONALITIES
Above the aforementioned, our vision aligns with the Province's three pillars: first, making the Netherlands cleaner, greener, and stronger. (Province Zeeland. 2026d). Second, both visions share a common commitment to individual electrification, where farmers and residents utilize self-generated systems and processes with one's own energy production. (Molajou et al., 2021; Ontwerp, D. 2025)

However, the third pillar of vision's Province emphasizes bustling cities and innovative research hotspots, (Province Zeeland, 2026d) while our focus remains on the spatial synergy between food, energy, and water security (WEF NEXUS) within rural areas in agricultural practices; (Molajou et al., 2021) Moreover, the Province's energy vision distinguishes between five typologies, specifically separating "rural areas" from "nature areas" because the latter faces no major sustainability challenge due to near-zero energy demand. (Province Zeeland, 2025b) However, we recognize that while nature areas have zero energy demand, the agricultural - rural landscape is the true engine for transition.

03. Reflections

Concluded, the major aim is a safe, climate-resilient delta where water security and a reliable energy supply form the basis of a healthy living environment. In prioritizing the agricultural sector as a building block for national strategic autonomy (Province Zeeland, 2025), food security and a rural landscape with a distinct culture is ensured; with breeding innovations and resilient crops, Zeeland will continue to be at the forefront of global food knowledge. (Province Zeeland, 2020) However, the Province focuses on large-scale infrastructure in some key locations, and our approach focuses on the individual's empowerment. With a focus on energy demand, 'behind-the-meter' storage, and smart electrification, we are empowering farmers to autonomously make the switch to sustainable processes. This focus on self-generation ensures a nature-inclusive society by 2050, a thriving, sustainable, and promising future for all the people in the province.

AUTHOR - ALEXANDRA DEFFNER

ENERGY COOPERATIVES

The ongoing energy transition in the Netherlands' south-west delta region, Zeeland, national, regional, and European climate ambitions are driving local stakeholders towards renewable energy production and consumption (Zeeland RES, 2025). Due to its strategic location within the Schelde delta, with strong winds and ample space, Zeeland is considered fertile ground for large-scale expansion of green energy generation and production (IMPULS Zeeland, n.d.). Various energy companies are part of and strongly contribute to regional climate agreements and plans, seemingly following them to ensure their continued competitiveness and existence.

In Zeeland, the agricultural sector, one of the major contributors to the regional economy (Provincie Zeeland, 2026b), the province of Zeeland is encouraging a shift towards the electrification of the agricultural energy landscape (Provincie Zeeland, 2025). This includes the smart electrification of the agricultural sector to minimise peak load, as grid congestion is an increasing challenge for Zeeland residents, businesses, and companies (Provincie Zeeland, 2025). Therefore, the region of Zeeland can be situated within the polycrisis (European Commission, n.d.), amid competing interests over water, land, and energy, in which its stakeholders, including energy companies, need to take leading roles in addressing these challenges.

The local and regional energy landscape in Zeeland is dominated by various energy companies, which can be clustered by their ambitions and positions within the energy transition. On the side of energy production, these include the traditional energy producers such as the EPZ (Elektriciteits-Produktiemaatschappij Zuid-Nederland) nuclear plant and the Zeeland Refinery, an oil refinery transitioning to green hydrogen (EPZ, n.d.; Zeeland Refinery, 2025). Alternative energy producers such as the renewable energy cooperative Zeeuwind and Delta Energy (Zeeuwind, 2026; Delta Energy, 2016). The grid operators of the electricity network: high-voltage TenneT and low- to medium-voltage provider Stedin (Stedin, 2024; TenneT, 2026). Additionally, the Energy Port Zeeland is a public-private partnership comprising companies, government bodies, and knowledge institutions collaborating together to drive the energy transition and fund on-going innovations (ORE, 2026).

Rising the question: will support the progressive farmers within their motivations and ambitions to close the cycle between production and consumption, or will they solely support their own interests and business case?

To address the polycrisis and its direct implications for the regional farming community, the Farmers for AGRIfuture project envisions farmers transitioning from being solely energy consumers to energy producers to achieve security and stability (1). Focus is placed on producing renewable energy, suchas wind, solar, and biogas, to enable the farmer to become self-sufficient (2). The decentralised off-grid system would allow the farmers to become self-sufficient with an option to connect to the smart grid (3).

As the role of the farmer is shifting from consumer to producer (1), possibly resulting in decentralisation of the energy grid, this shift either reduces or intensifies existing challenges. Grid operators may be concerned about grid capacity and the increasing risk of grid congestion (NOS Nieuws, 2025; Eneco, 2025; TenneT, 2025). Nonetheless, they might also be interested in opportunities arising from the system's decentralisation. On the other hand, traditional energy producers such as EPZ could perceive decentralisation simultaneously as a risk and an opportunity. Whilst decentralisation of the energy grid could enable broader connections with future potential customers, it could also threaten their business model and lead to a loss of demand in their energy and green hydrogen markets (EPZ, n.d.). Renewable energy cooperatives such as Zeeuwind may support the proposed bottom-up decentralisation of their members, as it is in line with their own ambitions (Zeeuwind, 2026). Ongoing public-private partnerships, such as Energy Port Zeeland, may also support the grid operators' and energy cooperatives' positions that smaller-scale energy production may either overload the grid or lead to added competition with offshore wind farms. As a result, the vision to increase the farmers' agency may threaten some energy companies' business plans and economic strategy.

The focus on renewable energy production (2) plays into the hands of most of the energy companies in Zeeland. This may also lead to increased competition among Zeeland's energy producers. TenneT and Stedin, the two grid operators in Zeeland and beyond, might position themselves neutrally in this situation, possibly more in favour of the shift to renewable energies (TenneT, 2026; Stedin, 2024). Traditional energy companies, despite simultaneously transitioning to more renewable energy sources to power their own operations with wind and solar (Zeeland Refinery, 2025; EPZ, n.d.), may experience declines in customer base and economic security. Increasing the supply of renewable energy aligns with the ambitions of the renewable energy cooperative Zeeuwind to make it more accessible to everyone (Zeeuwind, 2026). Ongoing public-private partnerships in Zeeland, such as the Offshore Renewable Energy Network Zeeland (ORE), of which the Energy Port Zeeland is part, focus on harnessing offshore renewable energy, which could complement the proposed onshore renewable energy production (ORE Network, 2026).

Supporting and encouraging farmers to become self-sufficient, off-grid, with the option to connect to the grid (3) and to extend and/or sell their surplus energy to surrounding businesses or residents will pose the greatest challenge to the existing energy industry. Zeeland's grid operators are already constantly seeking solutions to the growing pressures on the electricity grid (TenneT, 2025). Both have gotten very creative with temporary solutions, working with altered consumption patterns and decentralised batteries and generators (NOS Nieuws, 2025; Eneco, 2025). Hence, they would be expected to be in favour of farmers producing energy off-grid, self-sufficiently. For traditional energy companies, this could be an increased challenge. As the farmers become self-sufficient, they will not be dependent on purchasing energy from larger businesses and could also supply surrounding villages and smaller cities. Given Zeeuwinds' vision to promote the use and generation of sustainable energy sources through investments and small and larger scale (Zeeuwind, 2026): as stated on their website, "Through our cooperative, everyone can take responsibility for their own energy supply and allow others to benefit from it." On a smaller scale, Zeeuwind also supports individual initiatives and alternatives that meet the needs and wishes of its members (Zeeuwind, 2026). On the other hand, private-public partnerships depend on innovative ideas and uninterrupted funding to support the ongoing projects. Existing or future businesses, governments, and knowledge institutions might be interested in supporting farmers' energy self-sufficiency, either for research or investment purposes.

In conclusion, while some energy companies may experience tensions between their existing interests and the perceived benefits of change, their strategies are already being reshaped by shifts in supply and demand and by alignment with national and regional goals. For many, concerns around competition, long-term economic viability, and even basic stability and security remain central. Within this landscape, the energy cooperative Zeeuwind can play a pivotal role, not only as a supporter but as a strategic ally with shared ambitions and values. Fostering transparency, open dialogue, and developing a pilot project can help expand the concept and actively involve a broader range of stakeholders across Zeeland.

Although grid operators may remain cautious due to capacity constraints and, therefore, less enthusiastic, they are still important actors in enabling implementation. Similarly, public-private partnerships are likely to be interested, particularly in piloting, financing, and scaling the initiative, as it complements their broader agendas. Traditional energy companies face both opportunities and threats in a decentralized system; while it may broaden their customer base, it also challenges their position. Therefore, establishing agreements, particularly with traditional energy producers, will be essential to ensure cooperation and support across regional and cross-border energy system

AUTHOR - PIM LELY

CONSERVATIVE FARMER

The agriculture of Zeeland, one of the most important places in the Netherlands for the production of food (Provincie Zeeland, 2024). Not only does the province of Zeeland have a long tradition of agriculture, but it is also my home for four generations. But more and more I see our landscape changing for the worse.

Not only is our landscape changing, but our future is also in jeopardy. Farmers feel that these changes are pressured from the top down to address the polycrisis (RTV Utrecht, 2026). Within the proposed vision, a multifunctional agricultural system is introduced, combining food production with renewable energy and water systems (FAO, 2026). There is a feeling of being left out of the picture and questions about how this vision takes farmers into account. (Figure 1.)

As a farmer myself, it is clear that farmers are not blind to the many problems society is facing. There is a willingness to see change, but the vision is too far removed from practice. For a more conservative farmer, this creates doubt about whether these changes will actually bring the stability that is being promised (Rijksuniversiteit Groningen, 2025). While more progressive farmers may see opportunities, this perspective remains hesitant towards how these changes can be realistically implemented.

That change is inevitable, and as farmers this is understood as well. For their stability and security, farmers want to better understand the implications that the rules entail and ensure that the continuity of their way of life is guaranteed. There is a willingness to help and to change, but the stability in the plans that are now on the table is hard to find (Nieuwe Oogst, 2026).

With other words, it is asked for an agricultural system where the conditions are not only viable for the change itself but also for the people who work in the system. This means predictable policies and long-term economic viability (PBL, 2023). This all together can result in an approach that is not only viable for the Netherlands as a whole, but also ensures stability and security for the farmers themselves.

But to make this future possible, the vision that is now on the table (Figure 2) is not directly rejected, but seen as a stepping stone to approach the challenges we are facing. However, there are concerns that the reality of these proposed changes does not always reflect everyday practice, and does not give a fair image of both the farmer and the designer of the vision

However, several obstacles stand in the way of making the vision viable for farmers. One of the biggest barriers is the ever-changing policies and regulations of the top-down government, which make the future unclear. Not only are these policies unclear, but they also tend to change frequently within a relatively short time. The vision that is on the table does not take into account that farming is a long-term practice, often continuing through multiple generations (NOS Nieuwsuur, 2022).

In other words, if the rules are constantly changing, especially in relation to the energy transition, investments and long-term decisions become difficult to make. This results in a cautious approach, as farmers depend on stability to plan ahead (WUR, 2023). It may seem like they are unwilling to change, but in reality, due to the lack of stable and predictable policies, both their willingness and their ability to engage in the proposed transition are on loose sand.

Another obstacle that lies in the way is the mismatch between the scale of the vision and the capacity of farmers to act as energy producers. The story can be perfect across different scales, but operating between regional or national levels sets the bar really high, as farmers face multiple barriers in implementing energy production in practice (Nieuwe Oogst, 2025).

This becomes visible in the landscape itself (Figure 3), where the integration of energy production and new land uses changes the traditional spatial organisation of farms, while at the same time requiring knowledge and skills that often go beyond the everyday expertise of farmers (Van Steenbergen, 2026).

On the other hand, as farms are generational, the experience of an energy and food producer can build up over the years, but this requires a more realistic view coming from the vision. Not all farmers look at the larger scale, and so it becomes hard to implement all these changes in the daily practice of these farmers.

Lastly, one of the most difficult challenges is complex and one of the hardest things to change. The impact of the vision on the identity of the farmer has implications, not only tangible but also cultural. Traditionally, a farmer produces food and the identity is deeply rooted in what is produced. It is built over generations and is also linked to how we see farms nowadays.The vision will introduce the farmer to be multifunctional. This can bring new opportunities not only to contribute to solutions for the polycrisis but also for their own stability and economic sustainability.

But if we look more at the practical side, not all farmers are able or want to change. It moves away from what they love to do and, more importantly, it moves away from their values that define their work. Altogether, the vision asks for not only a technical or spatial change, but also requires a significant cultural change (WUR, 2023).

All of this shows that while the vision offers opportunities to address the polycrisis, it does not align with the everyday reality of farming. From a more conservative farmer perspective, the main concern is not the change itself, but the uncertainty that comes with it. For the vision to become viable, it should better take into account the long-term nature of farming, the need for stability, and the identity of the farmer. Only then can this transition not only work on paper, but also in practice for those who are working the land