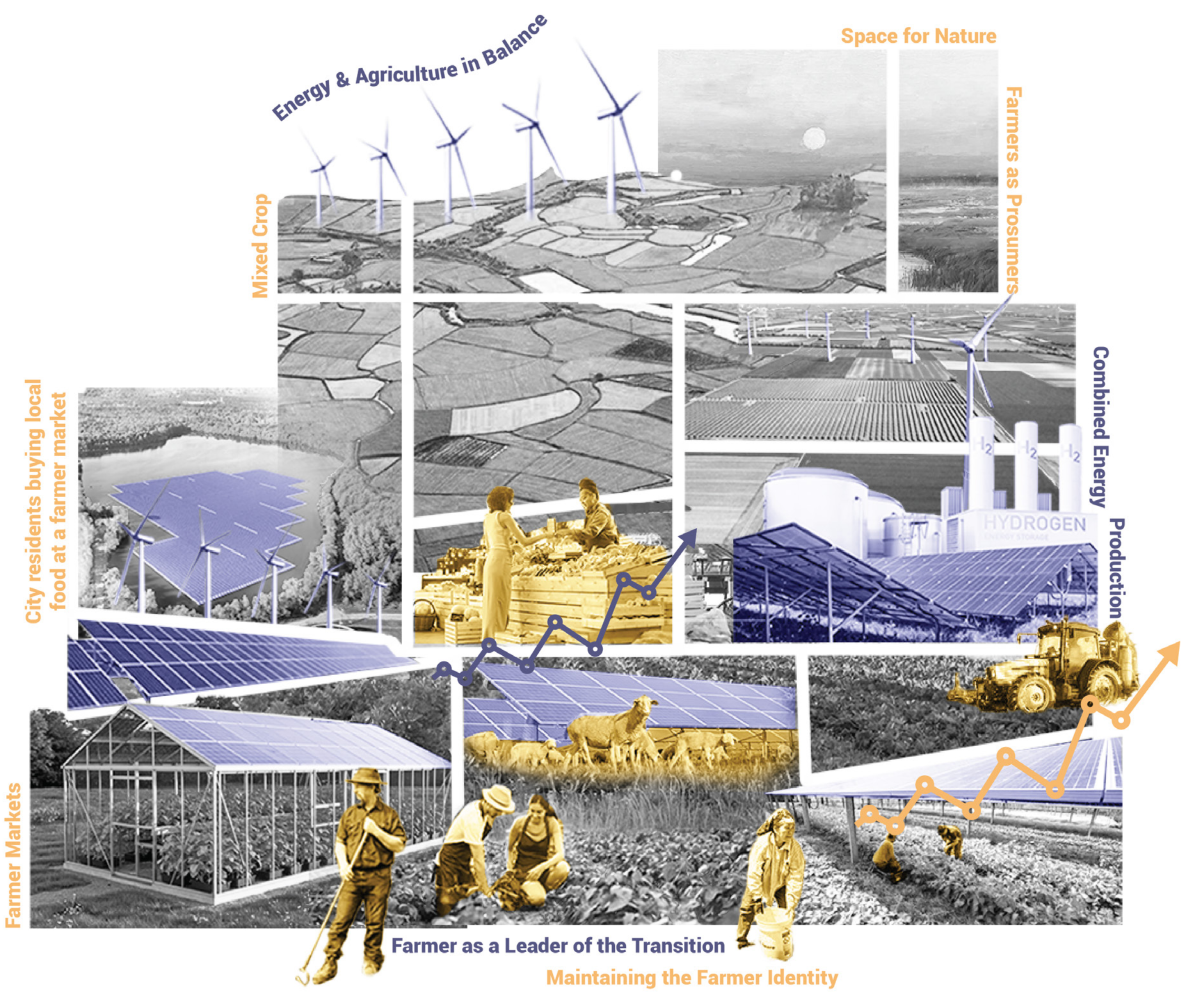
Energetic Agronomies

A radical approach to reimagine farmers as the backbone of energy transition

April 9th, 2025

AR2U086 & AR2U088 Report



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Research & Design Methodology for Urbanism (AR2U088)

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Introduction to the course
Urbanism can be described as understanding the spatial and dynamic built environment within the past, current and future framework. Policies, theories and design are tools used to uphold spatial quality and social equality. Concepts such as society, culture, politics and environment are recurring in urbanism as a discipline. In the past quarter of the MSc Urbanism track, the studio 'Spatial Strategies for the Global Metropolis' focused on the regional scale, using group work as the main work structure for nine weeks.

Designing on the regional scale creates the possibility of exploring urbanism across administrative borders and investigating systems as a dynamic whole. Letting go of borders allows us to investigate relations between interdependent places. Spatial developments can be understood on multiple levels, which results in analyzing the effects of design between different scales to come to a regional design. The regional and governance context becomes more prominent. It becomes a process of collaborating, negotiating and navigating procedural frameworks across all the domains and stakeholders.

This specific studio focuses on these regional processes and thematics while functioning as the main component of this quarter. The result is a formulated strategy as a response to complex regional challenges concerning the energy transition, visualized in a spatial vision and a development strategy. With lectures, workshops, field excursions and the complementary ´Research & Design Methodology for Urbanism course (AR2U088)´ the process of the studio is supported throughout the quarter. The overall aim of the course is to develop regional strategies combining design, policy and spatial implementation with a critical view of societal relevance, sustainability and spatial justice.

Abstract
The current direction of energy production in the Netherlands will not reach the goal of climate neutrality by 2050. Existing methods are insufficient, storage is lacking, and space is scarce. Meanwhile, farmers bear the responsibility of consistently changing climate policies, facing uncertainties, and the NIMBY mindset blocks the drastic transformation of agricultural areas. The current profit model of energy suppliers demotivates local participation in realizing solutions. Rethinking the relationship between land, energy, community and politics, can transform these challenges into a bold and innovative approach that bridges these sectors.

By 2125, agricultural land will produce and store all green energy of the Netherlands and farmers will hold a secure position within a sustainable urban-agricultural system. Eliminating the current profit model of energy suppliers will result in a kickstart for local participation while balancing the spatial demands of renewable energy and the identity of agricultural land.

To address structural problems at the core, a radical approach is necessary, which results in working with several disclaimers over a timeframe of 150 years. A review on ethical considerations and defining a theoretical foundation, supports comprehensive decision-making throughout the project. By implementing the spatial qualities of the Dutch landscape in the definition of bioregions, the strategy can implement suitable energy production methods on agricultural lands surrounding our cities, to provide the local energy and food demand. Through investigating the possibilities of innovative technologies of energy production, ecological farming strategies and a restructured social contract, this project provides a strategy towards a local energy system.

With a case study of one of these cities, the project illustrates further spatial implementations and design possibilities, phasing movements and interventions to the year 2175. By addressing not only spatial and ecological needs within the energy transition, a social equitable path is provided, challenging the current state of affairs. The research concludes in proposing an energy transition with farmers perceived as the solution, while reshaping rural-urban relations in the future.

Keywords:
Energy transition, farmers, social contract, fair energy, bioregions

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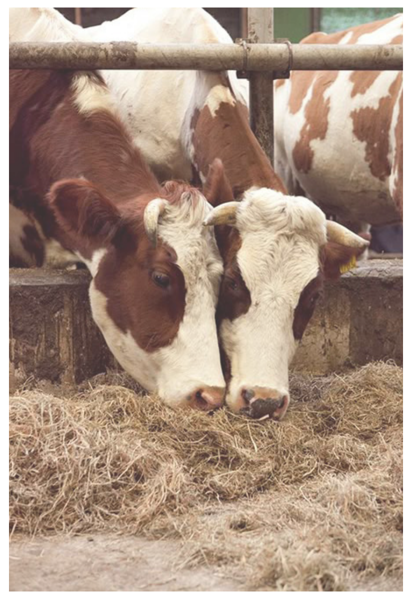
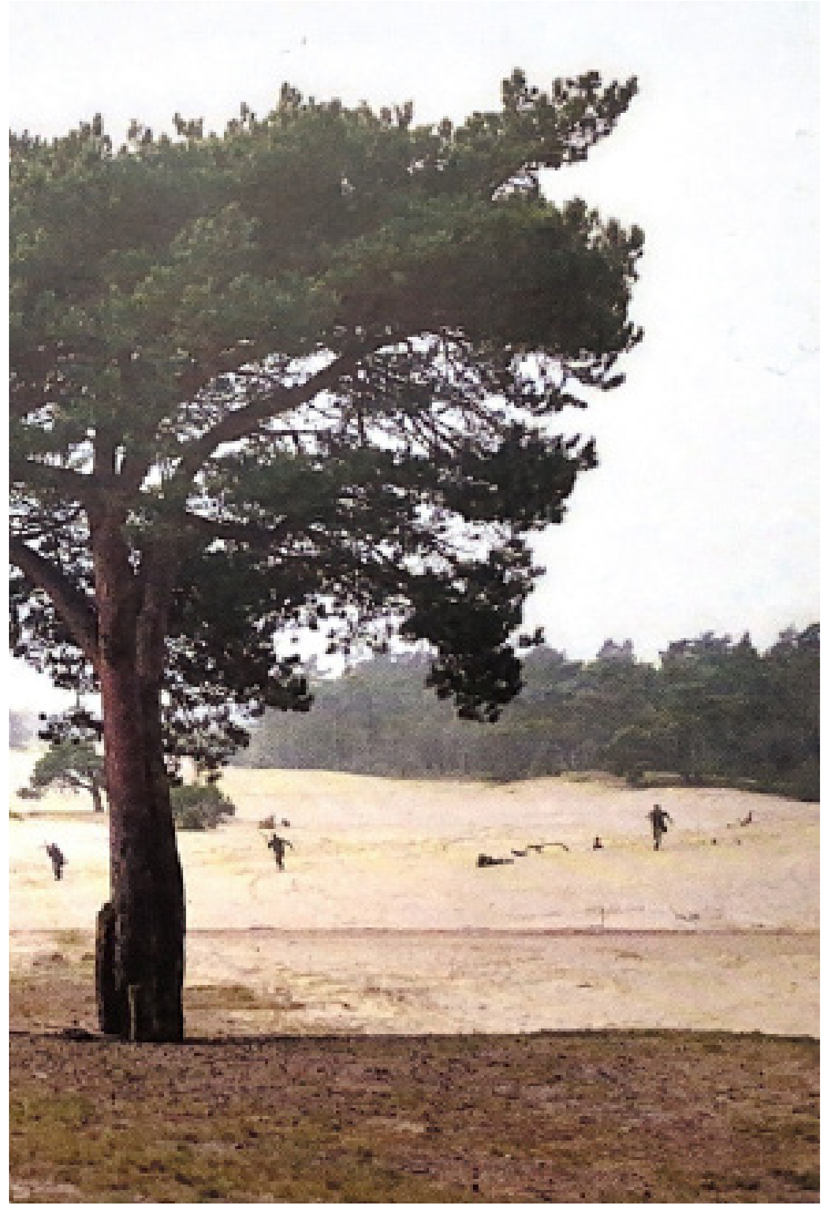


APPENDIX



INTRODUCTION

To introduce this project, this chapter provides a comprehensive outline of the context in which it was designed. It explores the current state of the energy transition in the Netherlands, the position of our community during this transition and the specific challenges that this project aims to address and improve. Finally, this chapter offers guidance on the changing role of our community.

Agriculture in the Netherlands

Agriculture has been a main characteristic of the Dutch landscape for centuries. In 2023, the agricultural landscape of the Netherlands was formed by 46.125 farms and agricultural businesses. Out of all these companies, 60% were active in livestock, 25% in crops, 15% in horticulture. The remaining 10% participates in more unique farming strategies, such as agroforestry and orchards (Wetenschappelijke Klimaatraad, 2024). This significant amount of agricultural companies has been participating intensely in the Dutch economy, providing around €65 billion in exports. This is 17,5% of the total exports of the Netherlands. This high amount of exports makes the Netherlands the second biggest food exporter, after the United States of America (Rijksoverheid, z.d.). Despite its current huge impact on the Dutch economy, there has been a decline of 47% since 2000 in the number of agricultural companies and farms. The biggest loss of companies is determined in horticulture and livestock farming (Wetenschappelijke Klimaatraad, 2024). Research shows that pressure and insecurities, rising from society and politics, are the biggest reasons for this declining trend. New policies on nature, the environment and especially nitrogen form the main changes and are the drivers of topics of discussion. Farmers feel unheard and misunderstood. Small mistakes in administration or not adapting quickly enough, resulting in high fines of thousands of euros, causing frustration and insecurity for the farming community (Sterke Erven Monitor, 2024).

These changes are all founded on the global developments of climate change. During the Conference of Parties, held in 2025 in Paris, a new climate agreement has been installed. The participation of 195 countries was discussed, creating new sets of rules for reducing global emissions. The main goal is to limit global temperature rise to 1.5 degrees Celsius. Every five years each country will recalculate whether they are in check with the goals and change their policies if necessary, with no difference made between countries based on the state of development (NEA, z.d.). To reach these goals, further agreements within Europe have been made. All EU parties have signed on to reduce their emission by 55% and climate neutrality must be the norm by 2050 (Rijksoverheid, z.d.). Agriculture produces a large part of these emissions, mainly due to methane production, dung storage and the production of eclectic energy with fossil fuels used in their industry. Unfortunately, with the current policies in order, the Netherlands will not reach these goals.

By 2025 the Netherlands strives to be completely switched to renewable energy sources, bringing an end to fossil fuel energy production. One of the most recent developments has been the shutting down of gas extraction in Groningen. However, there is no single renewable energy source yet that can fully provide all the energy that we need in our society. The energy must be produced by combining different renewable sources, which means new technologies for producing energy need to be developed quickly, while in the meantime we have to provide a grid that can distribute and store all of the produced energy. To make the situation even more complex, the Netherlands has also committed itself to the Global Methane Pledge, in which participating countries commit to reducing methane emissions by at least 30% by 2030 compared to 2020. This stresses the importance of farmers reducing their impact on climate change, and the need for an energy transition (Rijksoverheid, z.d. & Wetenschappelijke Klimaatraad, 2024).

If we want to reimagine our society and spatial landscape we have to analyze the history and future possibilities on a political, societal and spatial level. This research will focus on the farmers as a community within the dynamics of the energy transition.

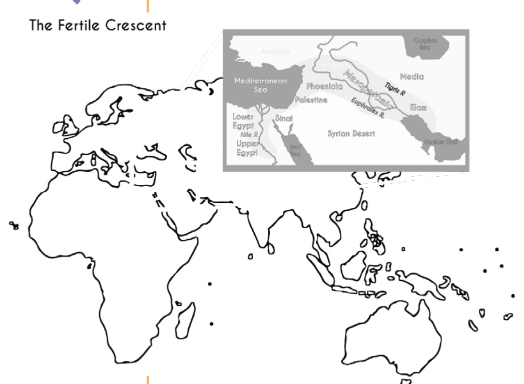
History of agriculture

The "centers of origin" for cultivated plants. These are the regions of the world where key crops were first domesticated and began to spread. China, India, Indo-Malayan region, Central Asia (including regions like Pakistan, Punjab, Kashmir, Afghanistan, and Turkestan), Near East (the Fertile Crescent), Mediterranean Ethiopia, Southern Mexico and Central America, South America (small regions of Ecuador, Peru, Bolivia, Chile, Brazil-Paraguay)

10000 BCE

11.700 BCE Humans began cultivating wild plants, leading to more reliable food sources and larger societies.

9000 BCE Crop cultivation begins in the Fertile Crescent (modern-day Iraq, Lebanon, Jordan, Iran, Turkey, Syria, Palestine and Turkmenistan).



7000 BCE Domestication of goats, sheep, and pigs in the Fertile Crescent.

5000 BCE

- First irrigation systems in Egypt and Mesopotamia.
- Crop rotation implemented in Western Asia.

Terraced land and rice farming in China.

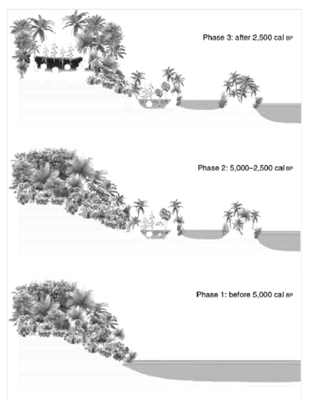
6000 - 2400 BCE Manure applied to fields as a natural fertilizer.

2300 BCE Composting in the Akkadian Empire, Mesopotamia.

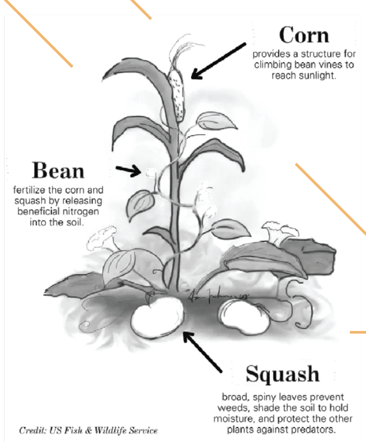
2000 BCE

- Terracing in the Andes for erosion prevention and water retention.
- Rainwater collection systems developed in India, Mesopotamia, China, and Palestine.

Agroforestry practiced in the eastern Amazon



1000 BCE Three Sisters polyculture in Mesoamerica and North America.



500 BCE Rainwater harvesting techniques in Ancient Rome.

450 BCE Terra Preta created with biochar in the Amazon, enhancing soil fertility.

300 BCE Crop diversity and resilience against flooding and drought by raised fields in present-day Bolivia and Peru.

0 BCE

200 CE In China, rice and fish grow together, with fish controlling pests and fertilizing the soil.

300 CE Pasture rotation and crop rotation in the Roman Empire.

500 CE

600 CE Irrigation systems developed by the Hohokam tribe of present-day Arizona.

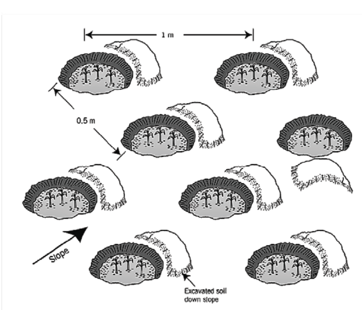
Forest farming and agroforestry practiced in areas of Asia, such as Sri Lanka.

- Extensive irrigation and rainwater catching systems developed by the Kushite people of modern-day Sudan.
- Hopi Nation farmed with dry agriculture methods.

1000 CE

1200 CE Water and organic matter collection system with pit planting techniques in the Sahel region of Africa.

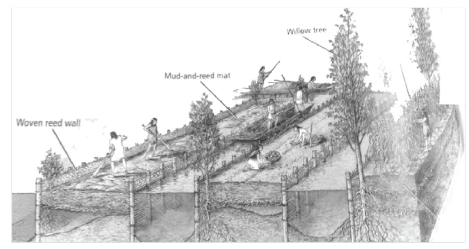
Planting techniques in the Sahel of Africa



Subak irrigation system developed in Bali, Indonesia.

1500 CE

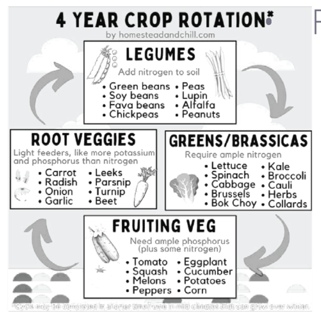
- Chinampas developed by Aztecs in Mesoamerica.
- Resilient crops developed by the Incas for the harsh conditions of the Andes.



1600 CE Soil microbes started to be studied due to the invention of the microscope.

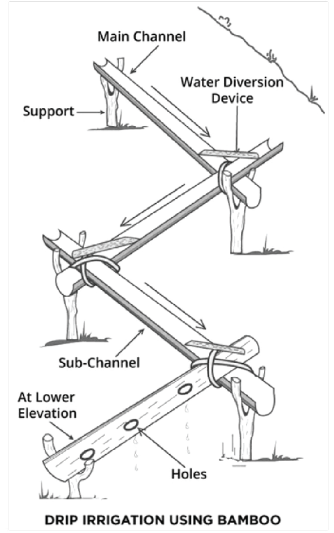
Soil microbes

1800 CE



Four-year crop rotation system practiced in Europe, increasing yield and supporting livestock.

- Bamboo drip irrigation waters the agroforestry systems of Khasi and Jaintia Hills region in northeast India.



1900 CE Crop rotation and soil health advocacy by George Washington Carver.

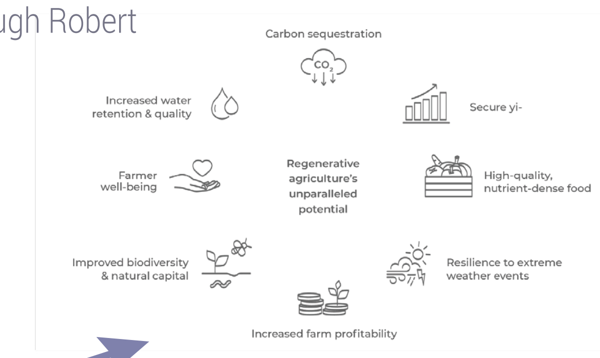
1930 CE No-till farming movement initiated by the Dust Bowl. (Protects the soil and improves its health).

1940 CE Sir Albert Howard shares soil stewardship practices from India and Barbados, inspiring the sustainable agriculture movement.

1970 CE Organic farming principles gain recognition, with a strong focus on soil health.

1980 CE Yacouba Sawadogo restores water collection and soil health principles in West Africa.

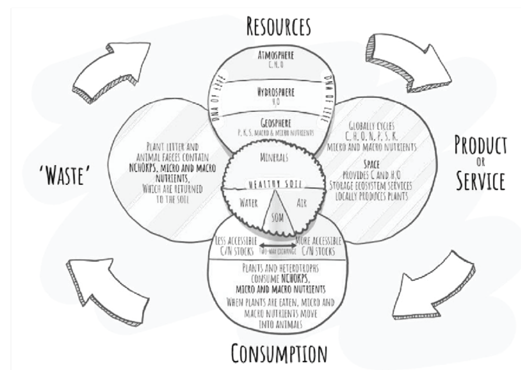
1990 CE The term "regenerative agriculture," gains support through Robert Rodale's advocacy.



2000 CE

2014 CE Rodale Institute releases a white paper titled Regenerative Organic Agriculture and Climate Change, highlighting the role of farming in combating climate change.

Soil health



COP28 emphasizes the critical need to address the agricultural sector for climate change mitigation.

2023 CE

Problem statement

As shown in the more recent decennia, the farmers' community has become a subject of high discussion and societal changes. Farmers are perceived as the problem, as one of the main drivers in our society concerning environmental degradation, emissions and thus contributing to climate change. This specific community is facing an unsure future, which results in dissatisfaction, mistrust in the government and low participation.

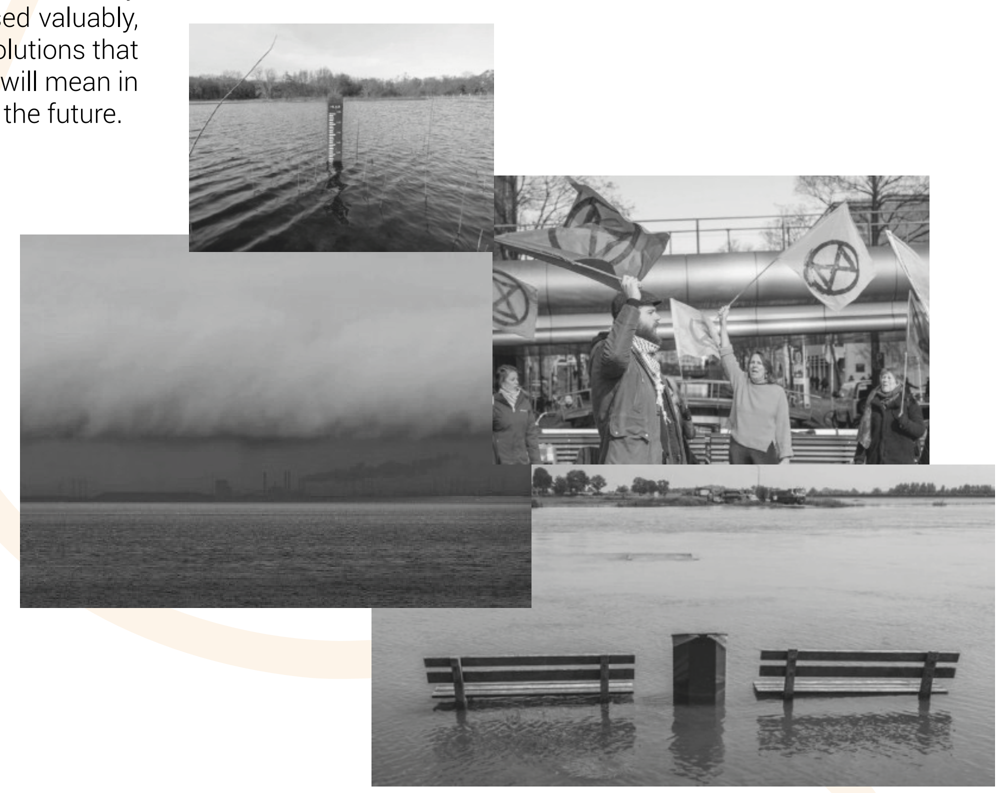
Besides the urgent need to adapt to reach the climate goals, the research of this project will provide a just strategy for the energy transition, by focussing on a community that is positioned as the scapegoat of societal issues. Farmers bear the responsibility of consistently changing climate policies, and the NIMBY mindset blocks drastic transformation of agricultural areas, while the land of farmers is becoming a strategic asset for the green transition. Moreover, the current profit model of energy suppliers demotivates local participation in realizing solutions. This conflict is reshaping the Dutch countryside. The pressure to replace farmlands with solar parks, wind farms, and energy storage infrastructure disrupts rural traditions, threatens food production, and challenges the identity of the landscape and the farming community.

By proposing a spatial strategy with a strengthened role for farmers, the insecure future of this community can be tackled in both our society and in their ambitions. The proposed way of the activities of the agricultural sector could create livelihood security. Without a bold, innovative approach that bridges the agricultural and governmental on addressing climate change, we risk staying locked in a system that demands too much, delivers too little, and meets resistance at every turn.

Our position towards the problem

While taking a stand in developing a local system to position farmers securely within the energy transition, the current governance of the Dutch energy model has to be reviewed. Here, radicality is a crucial tool. If the proposal of this project has to tackle the issues as discussed valuably, we need to address the issues at the roots. The urgency for sustainable and fair solutions that are not simply a temporary fix requires a structural change. This is what radicality will mean in our research, resulting in a long-term vision based on the expected possibilities of the future.

"Thinking about the energy transition, my first insight is climate change. The energy transition is one of the main tools to stop or reduce it from happening, because we need to emit less, whilst producing just as much energy."



"To me, the energy transition means participation in some way. We need to produce so much energy and we can not leave this responsibility to the government or energy suppliers alone. Participation is needed to reach our goals, but also to act upon the NIMBY movement."

"It is crazy and absurd that there is a triple profit model on energy. It is a basic need at this point in our society, so why is it something that we capitalize on?"

"If you produce more energy than you need and want to give it back to the grid, you have to pay the energy supplier! Is it not the goal to produce more renewable energy? Why should you as a consumer be punished for participating in the energy production for the grid?"

"I get it that farmers feel like scapegoats in the climate crisis! For the past decennia, especially the last five, they have been portrayed as one of the main causes of climate regulations. It is not a surprise that protests are the result of this, but even then they are shown as unwilling and aggressive towards change."

"Farmers the problem? They are the solution! The current way of farming might not be the way of the future concerning climate goals, but there is so much space and there are many possibilities in this landscape!"

"The energy transition requires renewable resources. Nuclear energy has been proven to be efficient and highly rewarding whilst producing energy without a lot of emissions. Why is there so much stigma on it? Is it unfamiliar or is it truly that unreasonable to depend on?"

"Nuclear fission is dangerous, but fusion seems to be the perfect way to produce unlimited free energy for us all! Imagine, what if the Netherlands becomes the main producer of nuclear fusion?"

Concepts

Demand for an orginal energy circulation system

Context

Unable to reach climate goals
The current direction of energy production in the Netherlands will not reach the goal of climate neutrality by 2050.

Insufficient energy production
Existing methods are insufficient, storage is lacking, and space is scarce.

Affected community should be involved in policy making

Need for a bold shift in governance system

Approach

Different approach to develop a sustainable energy system

Community

Responsibility farmers
Meanwhile, farmers bear the responsibility of consistently changing climate policies,

Community restrictions
and the NIMBY mindset blocks drastic transformation of agricultural areas.

Uncertain position
This also leaves farmers in uncertainty while their land becomes a strategic asset for the green transition.

Demotivating governance
Moreover, the current profit model of energy suppliers demotivates local participation in realising solutions.

Spatial conditions and cultural values require proper consideration

Give farmers a secure position within an equitable framework

Threat

Reshaping countryside
This conflict is reshaping the Dutch countryside.

Threat to identity
The pressure to replace farmlands with solar parks, wind farms, and energy storage infrastructure disrupts rural traditions, threatens food production and challenges the identity of the landscape.

Radical approach
Without a bold, innovative approach that bridges these sectors.

Stuck in system
we risk staying locked in a system that demands too much, delivers too little, and meets resistance at every turn.

Only achievable with a stirring approach

Opportunity

Rethinking relationships
By rethinking the relationship between land, energy, community and politics,

Urban agri-cultural system
we can transform these challenges into a sustainable urban-agricultural system.

Farmers should be addressed as part of the solution

Through an innovative perspective on collaboration between involved actors

Aim

Farmers as solution
Specifically, the aim of this study is to explore how farmers can be positioned as the solution in the energy transition of the Netherlands

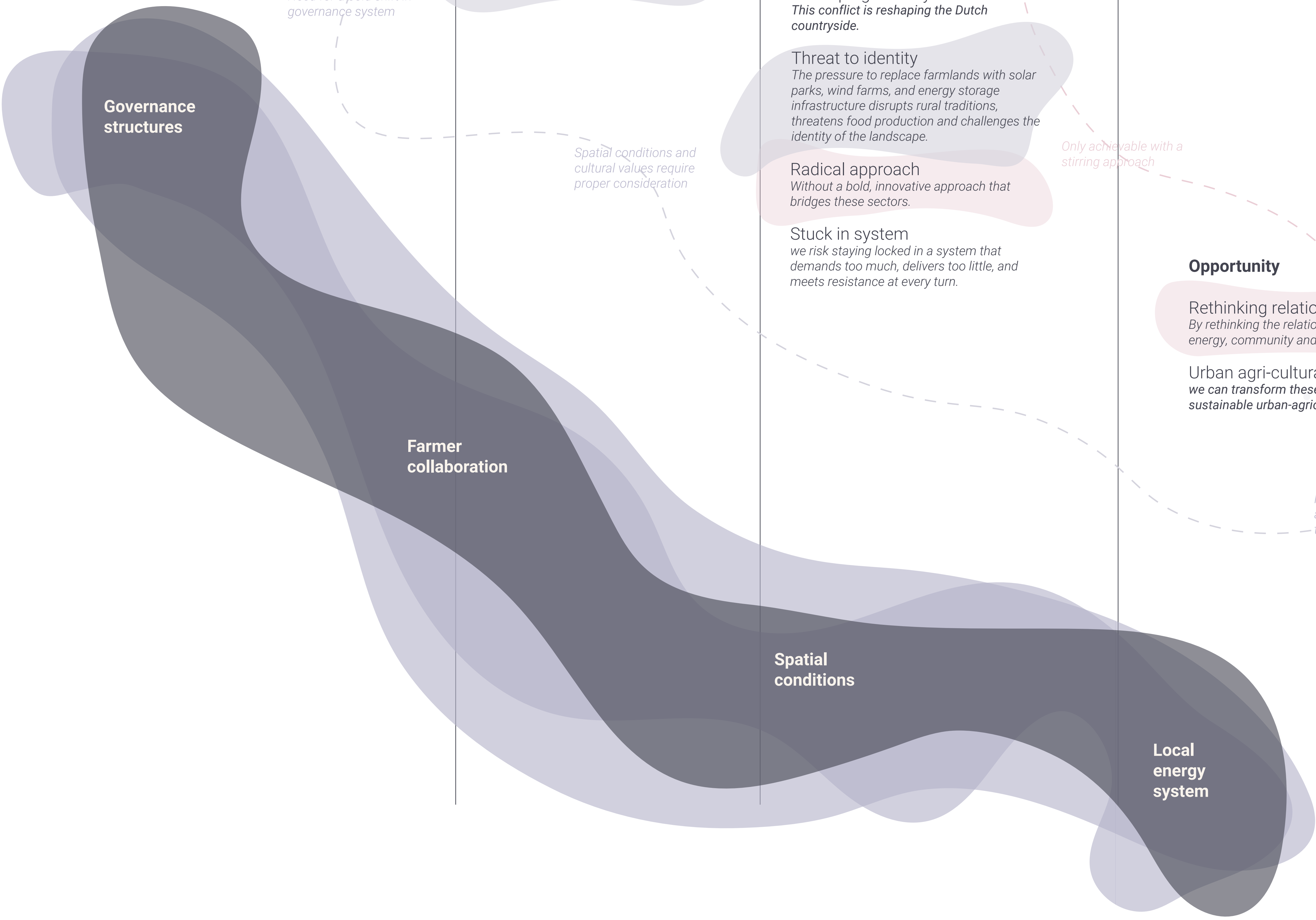
Multi-purpose landscape
by investigating how agricultural land can shift to a multi-purpose landscape for nature, farming and energy.

Towards a symbioses of rural land purposes

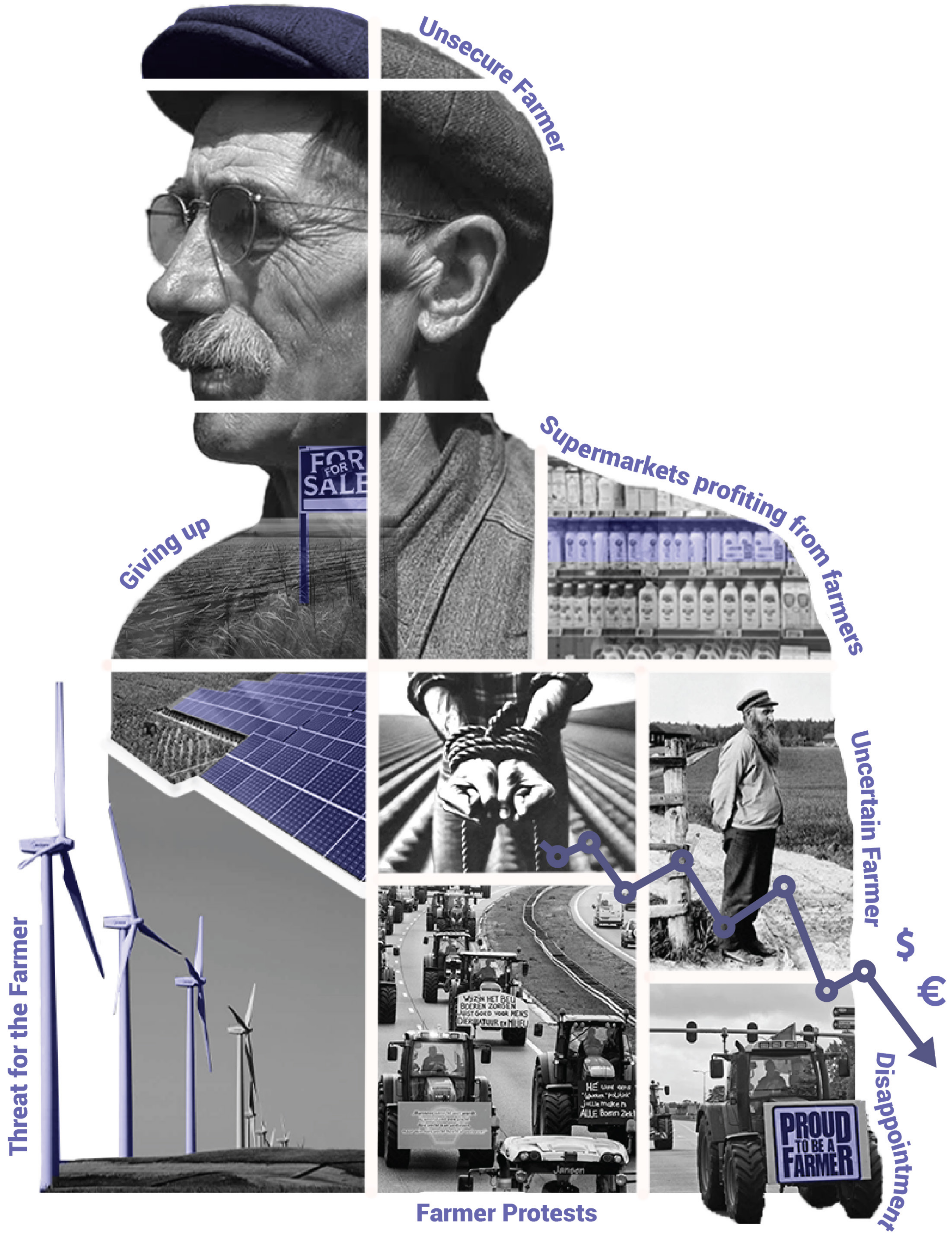
Objectives

Quantative and qualitative
The research will be carried out through a combination of quantitative and qualitative research

Collecting data
of site visits, spatial data, statistics, interviews, and literature research.



Current role of farmers



Current role and challenges
Today's farmers in the Netherlands face an increasingly uncertain future. Many are considering leaving the sector due to economic, environmental, and policy pressures. One of these pressures is the energy transition, which currently poses a threat rather than an opportunity to farmers, especially if they are not actively involved in the decision-making process. Despite being the backbone of our food system, farmers often see limited profit, while supermarkets and other intermediaries gain the majority of the financial profit from their products.

In January 2025, the Court of The Hague ruled that the Dutch government must stop the degradation of nitrogen-sensitive Natura 2000 areas and ensure that by 2030, 50% of these areas are reduced below the ecological safety limit (De Rechtspraak, 2025). In response, many farmers are being encouraged or even bought out to either reduce livestock, change manure processing practices, or shift to nature-focused land use. These developments have led to widespread protests, as they not only threaten the livelihoods of farmers but also their identity, culture, and legacy for future generations.

The future role of farmers
To secure a just and inclusive future, this project proposes a reimagined role for farmers; one rooted in intragenerational and intergenerational justice. This vision centers on supporting both current and future farmers by respecting and maintaining their cultural identity and providing economic security.

We embrace the principle of recognitional justice: acknowledging the unique position, struggles, and values of farmers, and ensuring their voices are heard. In their future role, farmers can continue their way of life and farming, resulting in keeping the identity of the landscape.

Desired role of farmers

A just energy transition
A socially sustainable future demands a fair distribution of the burdens and benefits of the energy transition. Farmers should not only bear responsibility for reducing emissions but also be empowered as active participants in the process. By becoming prosumers; both producers and consumers of renewable energy, they can benefit from energy production on their land.

To support this shift, this project proposes establishing a Farmer Organization that advocates their interests, mediates with stakeholders, and ensures that farmers are never left behind again in major transitions. This participatory approach empowers farmers to shape the policies that affect their land, energy, and future.

Farmers as the key to energy transition
The ultimate new role for farmers is to feel empowered, valued, and actively involved in addressing climate change and energy transitions, while preserving their role as food producers and landowners. This approach would expand their capabilities, ensuring they have real freedoms and opportunities to lead lives they have reason to value. Supporting the needs of both farmers and the ecosystems they influence helps create a more just, balanced, and resilient future.

METHODOLOGY

This chapter provides a clear overview of the procedures, methods and frameworks that guided the research and design of this project. It discusses the various research questions and the conceptual framework within which the work was conducted. Additionally, it examines different scenarios and societal changes that influence the project, establishing a well-defined context for this research.

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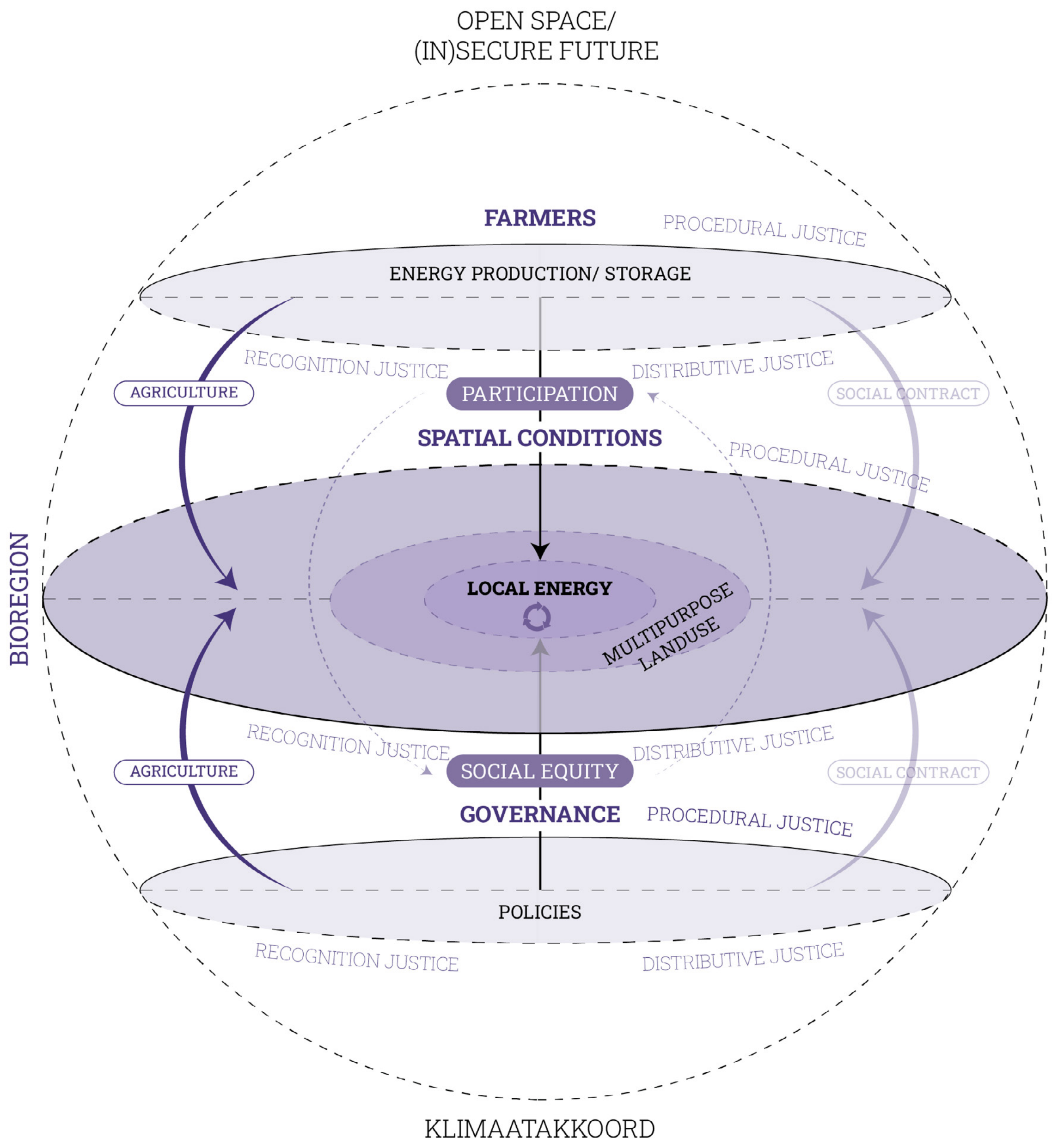
RESEARCH QUESTION

Renewable energy solutions demand significant land use and thus create spatial challenges. At the same time, agricultural overproduction also occupies vast areas. Because of shifting policies aimed at reducing production to meet the European climate goals, the future of farmers holds an uncertain position in Dutch society. As farmers are now seen as one of the problems contributing to climate change, this research explores how they can be the solution to our energy transition by optimizing agricultural land use, by balancing energy production, agriculture and nature while ensuring a viable future for farmers. The project is therefore led through a main research question and four sub-research questions.

Research question
How can the Netherlands balance the spatial demands of renewable energy production with the spatial identity of agricultural land, while ensuring a sustainable and equitable future for farmers by acknowledging the site-specific conditions within a new social-political contract?

Sub-Research Questions
1. How can local farmer communities be involved in a local energy system whilst maintaining their agricultural identity in our future society?
2. How can we change the current social contract to new governance models and policies to ensure fair compensation and long-term security for farmers in the energy transition?
3. What are the spatial demands, possibilities and restrictions regarding the energy transition and renewable energy production for agricultural land?

CONCEPTUAL FRAMEWORK



The conceptual framework outlines key values and variables guiding the research and design process of this project. It visualizes interconnected concepts, ethical positions, and theoretical perspectives that influence the spatial vision, placing farmers, governance, and local energy production at its core.

Theoretical perspective
The framework is grounded in an integrative ontology, combining relational and realist perspectives. On one hand, it supports the view that all entities; people, ecosystems, systems; exist in complex and interdependent relationships. For instance, agricultural land is not an isolated surface, but a complex place within a system of water typologies, climate patterns, food supply chains, and cultural practices. On the other hand, certain environmental conditions such as climate change, nitrogen emissions, and energy shortages are realities, existing regardless of subjective perception. These dual perspectives allow the framework to address both systemic interdependencies and objective environmental constraints (Leshem & Trafford, 2007; Jabareen, 2009).

Structure of the Framework
At the center of the framework is the local energy system, positioned as the main transformation focus. Surrounding this main focus are two key actors; farmers, who would make the transition possible by producing and storing renewable energy on agricultural land; and governance, representing the policies and regulations that will enable or constrain these changes.
These layers form a "sandwich structure" with the local energy system as the filling, illustrating the mutual reliance between farmers and other actors in shaping the energy transition. Within each layer, ethical dimensions; recognitional, procedural, and distributive justice, are embedded to assess the inclusiveness, fairness, and legitimacy of the strategy proposed.

Justice-based approach
Recognitional Justice: Recognizes the identity, knowledge, vulnerabilities, and cultural significance of farmers, while also including the non-human processes of nature in consideration.
Procedural Justice: Embeds the voices of vulnerable groups; especially farmers, into decision-making processes.
Distributive Justice: Focuses on equitable distribution of both burdens and benefits. Farmers should not solely bear the responsibility of emission reductions. Instead, they must also benefit from the transition, through financial benefits, energy autonomy, and decision-making power. This also aligns with the principle of intergenerational justice, ensuring future generations of farmers will have realistic and sustainable livelihoods.

Selected concepts and interrelations
- **Social Contract:** A revised contract between the state and farmers is necessary to establish fair land use and energy responsibilities.
- **Bioregion:** The spatial and ecological context defines the relational field of action, ensuring site-specific interventions.
- Open space and farmers' uncertain future: These function as systemic drivers; highlighting both the urgency and opportunity within the agricultural landscape.
- **Climate Agreement:** The foundation of the project within national climate regulations.
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These concepts are interdependent, dynamically interacting rather than functioning in isolation. Their interconnectedness is visualized in a circular diagram, emphasizing the system-based nature of the transition. Concepts like the uncertain future and climate agreement, while external to the central relationship, provide essential boundaries and opportunities.
This framework will be used throughout the research and design process to:

- Investigate the relationships and tensions between actors, values, and spatial conditions.
- Analyze stakeholder dynamics and ensure inclusive, equitable strategies.
- Take spatial decisions based on the identified ethical and ecological relationships.
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By synthesizing ontological depth with justice-based ethics, this framework positions farmers not as passive actors, but as empowered leaders of the energy transition; balancing socio-ecological integrity with climate resilience.

DISCLAIMERS

This project presents a radical approach to the ongoing energy crisis by addressing the root causes within current systems of governance, production and distribution. It takes a systemic perspective to address the problems surrounding the energy transition, questioning the foundational structures that define energy as a market product rather than a collective right.

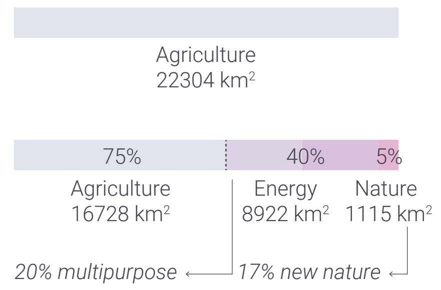
The narrative of this research is built on a set of speculative assumptions, articulated through a series of disclaimers. These include the anticipated breakthrough of nuclear fusion, which could render energy abundant and freely accessible. The disclaimers also conclude widespread societal mindset shifts around consumption and sustainability, and the recognition that traditional models of industrial farming can no longer hold a place regarding sustainable pressures. Central to this project is the assumption that farmers are willing to engage in cooperative models and participate actively in the reimagining of their role within a national energy system. By engaging with these speculative claims, the project aims to provoke new imaginaries and strategic pathways toward a just and sustainable future.

Modern society | Future society | Disclaimer | Explanation


Individual farmers


Farming organization

To create a local energy system, farmers need to be united within a Farming Organization. Instead of looking into municipal borders, farmland surrounding the city are united through bioregion borders. Within the organization, the land needs to be divided over food production, energy production, and rewilded nature. A minimum of 20% multipurposed land can make the necessary shift for our agricultural landscape.

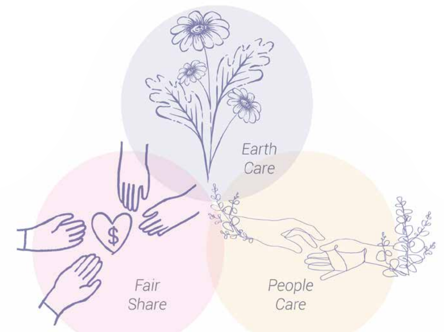


CBS (2025), CLO (2025), CML (2024)


Modern agriculture

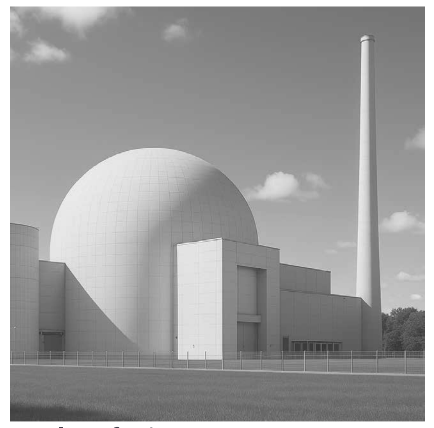

Eco agriculture

The farmers of today are burdened with the harmful effects of modern agricultural systems, which is why we need to shift towards an eco agricultural system. Permaculture can give shape to this new system, as it imitates natural ecosystems to create self-sufficient and regenerative agriculture. It takes inspiration from nature to create a food production system that works in harmony with the natural world.

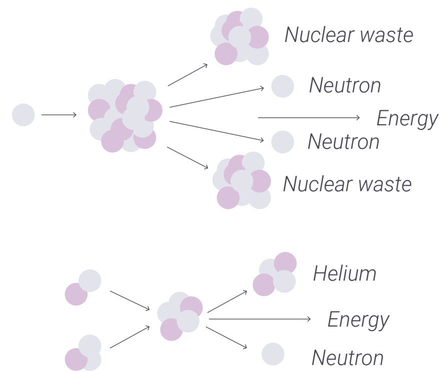


Holmgren, 2002/2017


Nuclear fission


Nuclear fusion

Ongoing successful experiments of facilities in the EU, US and China increase the possibility of shifting to this nuclear fusion as an energy source in the future. This method is both safer and cleaner than nuclear fission, and is therefore an interesting sustainable option to produce energy. Improving this methods will take decades, which makes a complete transition something of the far away future.



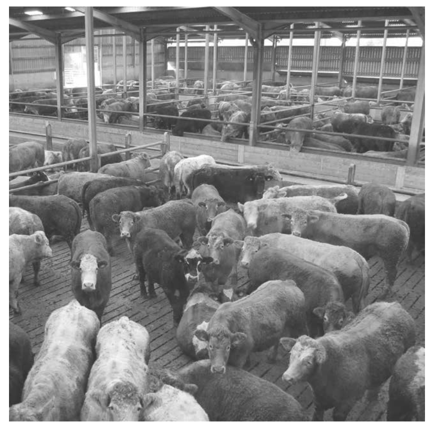
CCFE (2025), NRC (2024), AD (2024)


Unregulated overflow


Fluctuating overflow

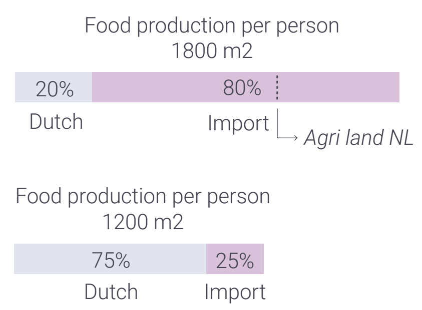
The destructive floodings of summer 2021 stimulated further research into the effects of climate change. Increasing heavy rainfall events will cause more frequent floods in future. It is crucial to keep innovation the 'Ruimte voor de Rivier' plans to develop a resilient landscape to fluctuating events. Overflowing areas will happen, thus as the Netherlands we need to work with the water, instead of fighting against it.

LIWO (2024), KNMI (2021), Nationaal Delta-programma (2025)


Omnivore diet

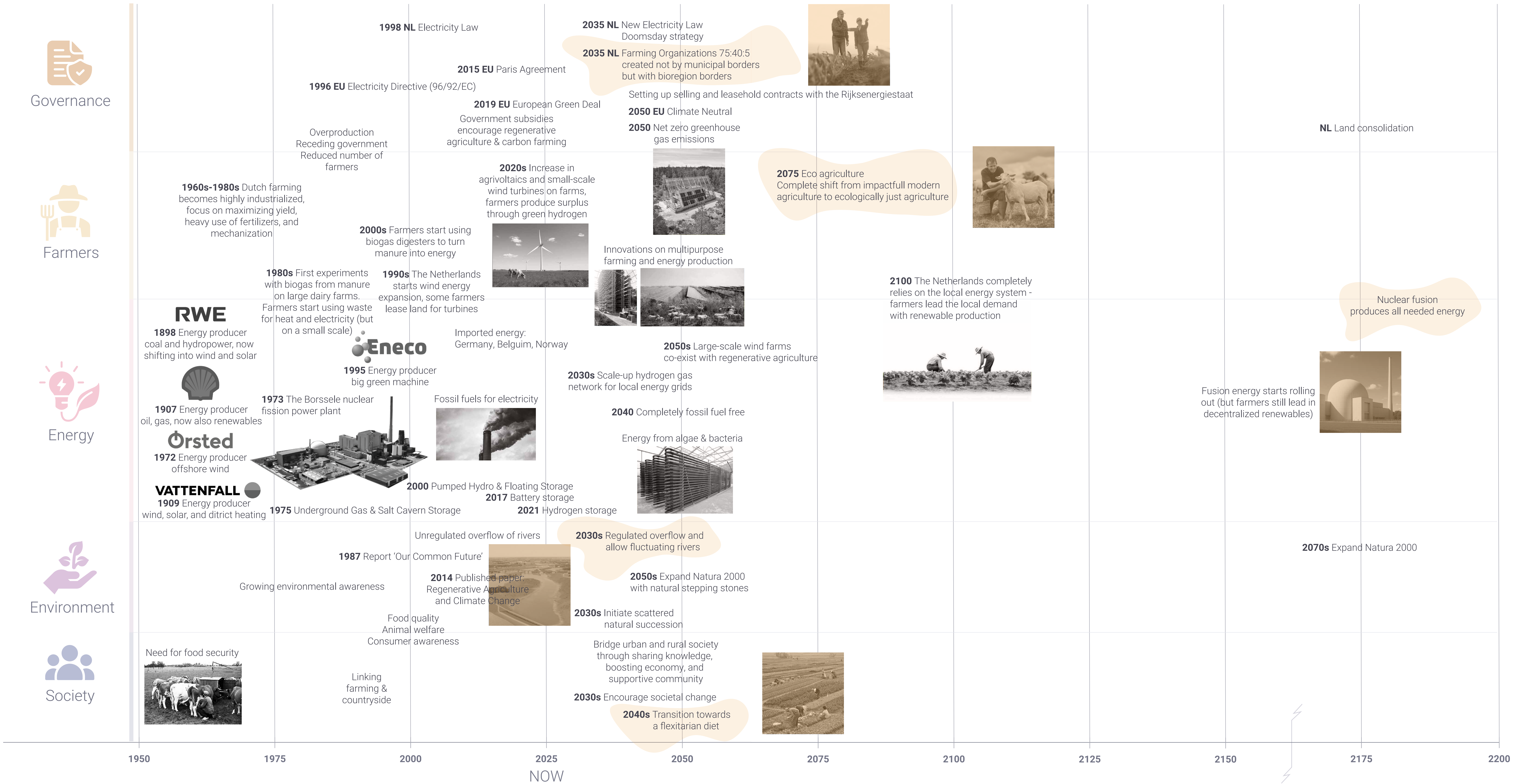

Flexiterian diet

To lower the impact of climate change, our society needs to minimize the effects of food production. The current diet footprint of one person in the Netherlands is 1800 m², 80% of which is import. This can be lowered to 1200 m² through a strict flexitarian diet of consuming fish and meat once a week. Through this diet, the import decreases by 80%, and 900 m² is produced locally within the Netherlands.



CLO (2024), PBL (2019)

DISCLAIMERS ON THE TIMELINE



METHODOLOGY FRAMEWORK

Methodology of the research
This research addresses the opportunity for farmers to be the solution for the current energy transition. It looks at the history and the future desires of farmers, different stakeholders and policies to formulate a new social contract in which farmers hold a secure position in Dutch society.

Using the main research question and four sub-research questions as provided in the chapter 2, three lenses are represented in the research:

1. The community lens
2. The socio-political lens
3. The spatial conditions lens

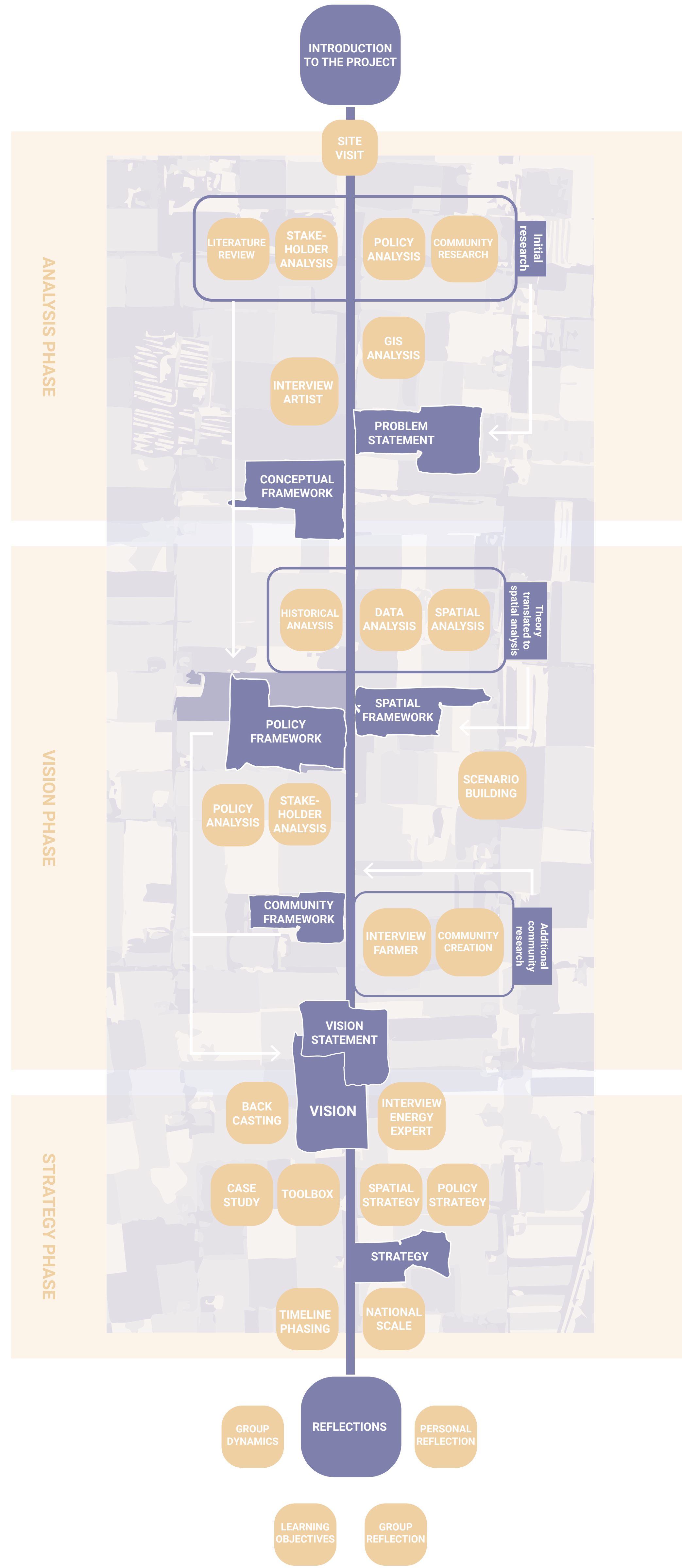
To explore the community lens, qualitative research methods are applied, including a series of semi-structured interviews with a Dutch farmer, and an artist working on the different perspectives of farmers, climate activists and politicians on land, identity and transition. These insights are complemented by a literature review focusing on the history, narratives and the socio-economic position of farmers in the Netherlands.

The socio-political lens involves a desk study of national and European energy and climate policies, using academic papers, government reports and online policy databases. This analysis helps uncover the structural barriers and governance frameworks that are currently in place. Based on this research, a new governance framework is developed, focusing on fair, green and clean energy provided by the farmers.

The spatial conditions lens focuses on understanding the spatial opportunities of integrating energy production into agricultural landscapes. Using Geographic Information System (GIS) tools and various open-access datasets, this lens mapped land use, energy potentials, and ecological conditions. From the spatial analyses, conclusions are made on where multifunctional land use (combining energy, food production, and nature) can be realized.

Each lens provides this research with a base that affects the spatial phase of the project. The insights are translated to a comprehensive vision on the energy transition, and spatialized in a development strategy. This strategy is demonstrated through a case study, illustrating how the integrated vision can be applied in a real-world context. By combining qualitative, policy-based and spatial research methods, this methodology provides a multidisciplinary foundation for reimagining the role of farmers in the energy transition.

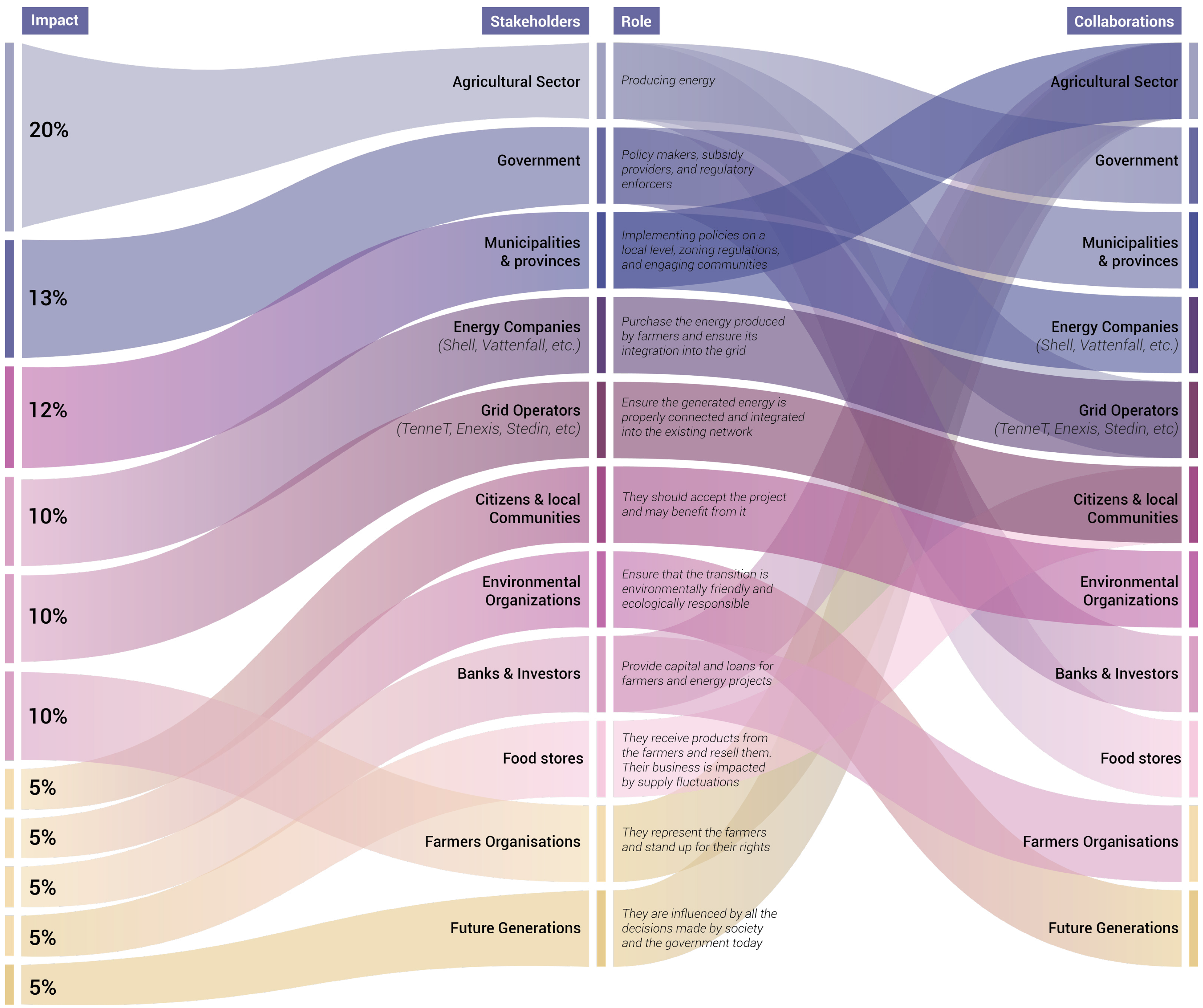
Methods used during the research
To answer the sub-questions we have used the following methods:
1. Literature Review - To understand the historical development, societal perception and potential future role of farmers in the energy transition, academic articles, government reports, news articles and different websites were reviewed.
2. Interviews and conversations – Interviews were conducted with a farmer, an energy expert and an artist. These qualitative insights were used to understand personal experiences, community values and perceived challenges and opportunities.
3. Desk research – A focused desk study of current Dutch and European policies related to energy, agriculture and climate was conducted using academic sources and online platforms.
4. GIS Spatial Analysis – Spatial data from open-source platforms was used to map land use, energy potential, infrastructure and ecological zones.
5. Design Framework Development – The presented lenses provide a structural approach to gather the diverse insights for further decision-making. The insights form the foundation of unraveling the conceptual framework, where each concept is translated to synergize into the local energy system.
6. Case Study Application – The integrated vision was applied to a specific case study area, allowing the frameworks to be translated into a spatial strategy.



POSITIONING COMMUNITY

The first focus of the conceptual framework regards the role of the farmer community. This chapter gives a deeper insight into the farming community, their position and their interests. Beyond farmers, many other groups play a crucial role in the energy transition. This chapter highlights the stakeholders involved, their interests, power and influence, and how energy governance and systems are structured.

Stakeholders



The proposed transition involves a wide range of stakeholders, with the agricultural sector and governmental parties playing key roles. Within this framework, the agricultural sector is envisioned to continue farming while also producing renewable energy on agricultural land. Given that energy production would happen directly on farmland, farmers remain central actors in this transition.

An organization for farmers is introduced to advocate for the interests of the agricultural community. This organization functions as a representative party, ensuring that farmers have a voice in decision-making processes and facilitating dialogue with other stakeholders, including government institutions and food retailers. Its presence strengthens a bottom-up approach by empowering farmers and addressing their current marginalization in policy and energy discussions.

The government, as the principal policymaker, holds a regulatory role by setting legal frameworks and implementing new legislation. Farmers may be offered options to produce energy independently or to lease/sell parts of their land, in which case these areas would be temporarily managed by governmental entities for energy production. Municipalities and provinces are responsible for implementing the policies at the local level, with municipalities additionally engaging citizens in the process.

Grid operators maintain the role of integrating the newly generated energy into the national energy grid. Collaboration among all stakeholders; government, municipalities, grid operators, and the agricultural sector, is essential. For instance, effective collaboration between the agricultural sector and governmental institutions will be crucial, while cooperation between public parties and grid operators is necessary for energy integration.

Interest and power dynamics

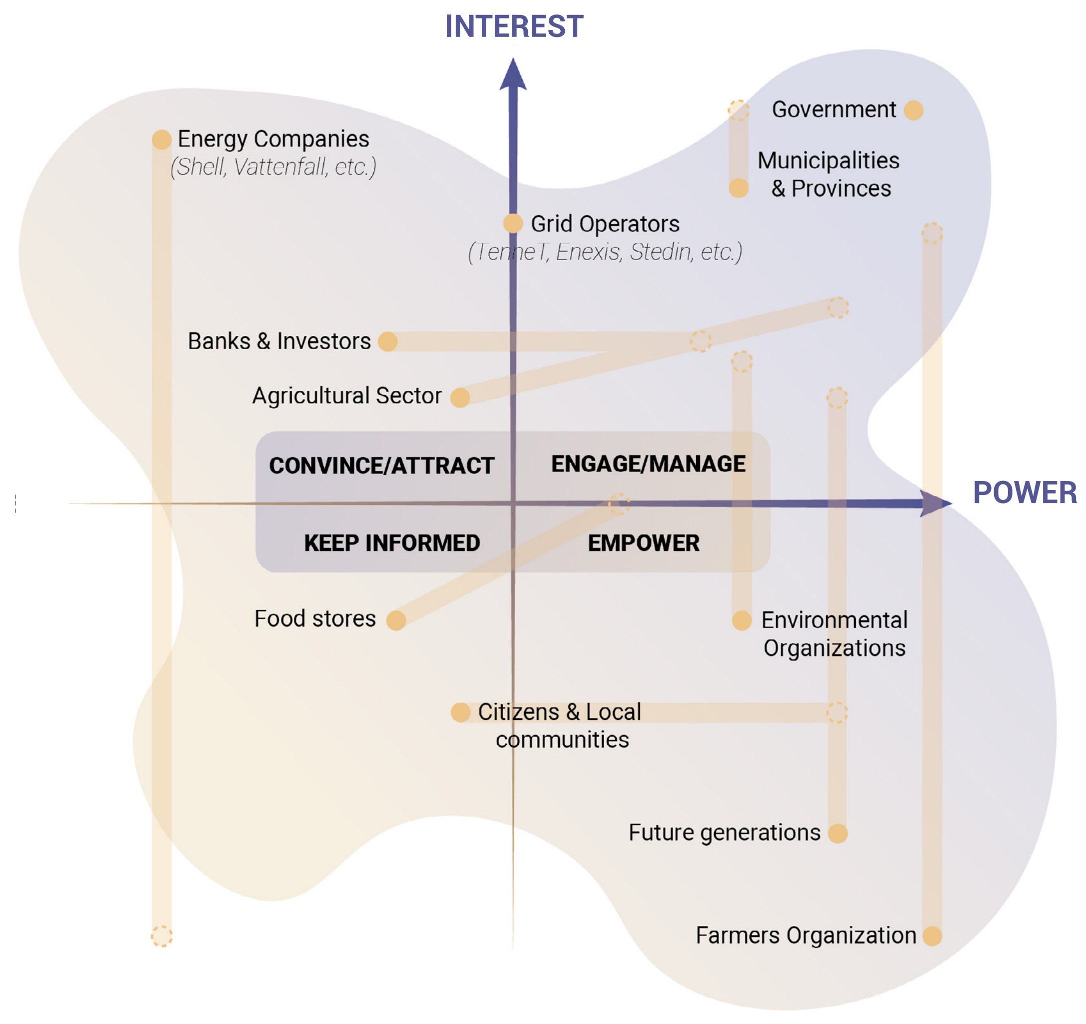
Interests and power dynamics
Stakeholders differ significantly in terms of both power and interest. Currently, farmers possess limited influence and minimal interest in the transition. This research aims to shift this position by increasing both their interest and power. Establishing a farmers' organization is a strategic step in achieving this, as it provides a platform for collective action and advocacy.

To broaden societal engagement, financial institutions, investors, food retailers, citizens, and future generations should be drawn into the transition through inclusive communication and participation. Some groups, such as banks and agricultural businesses, may require persuasion to align their interests with the goals of the proposed transition. Others, like food retailers, should be regularly informed, while citizens, communities, and future generations have to be empowered.

Energy companies currently hold considerable power, which will be reconsidered to rebalance their influence. Lastly, the active involvement of governmental actors who currently hold both significant interest and authority has to be preserved.

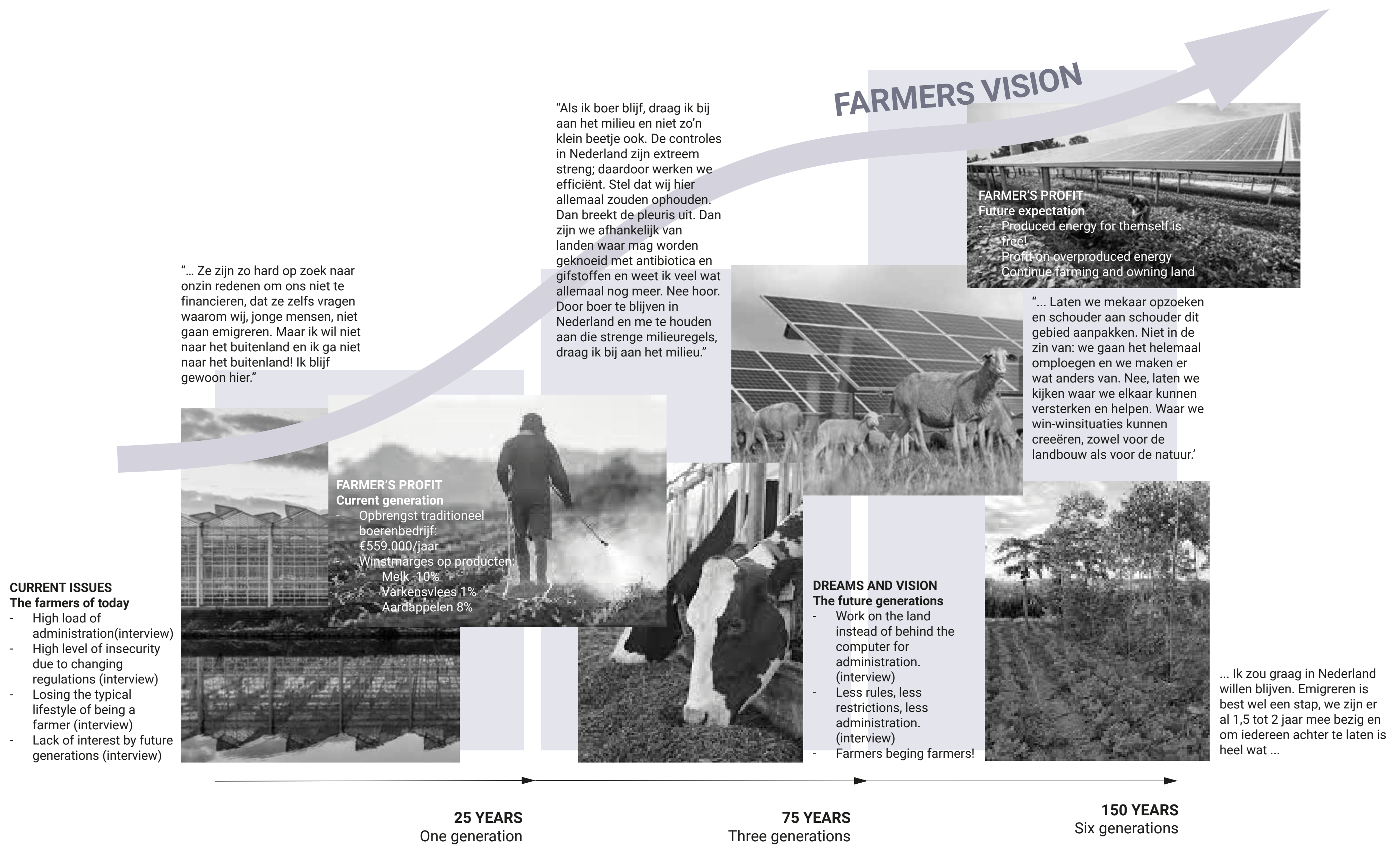
Procedural and inclusive justice
A critical dimension of this transition is procedural justice, with particular attention to vulnerable groups; the farming community. Their involvement throughout the process is essential, not only through direct participation but also through organized representation. Governmental negotiation with farmers should ensure that different positions toward energy production are possible. If some farmers choose not to engage in energy production despite being presented with different choices, their decisions should be respected.

Participation barriers such as literacy or accessibility must be addressed. An organization representing farmers can help mediate these challenges, ensuring that all communication is clear and inclusive. To prevent power imbalances during negotiations, the presence of a neutral mediator is recommended. This ensures that neither the government nor municipalities can pressure farmer representatives. Additionally, farmers' rights must be incorporated into policy frameworks to guarantee legal protection throughout the transition.



Stakeholders	Interests	Problem perception	Attitude towards vision	Power	Resources
Farmers & Agricultural Sector	Farming, their traditional style of living and a stable future	Mistrust Burdens by transition demands	Doubtfull	Production Blocking	Space Knowledge
Government	Energy transition Climate agreements	Pressing, but severence is depending on political orientation	Interested, but skeptical	Blocking	FInance Governance power/influence (Knowledge)
Municipalities & provinces	Energy Welbeaning of inhabitants	Pressing, but severence is depending on political orientation (top-bottom)	Interested, but less skeptical than the government	Blocking (Production)	FInance Governance power/influence (Knowledge)
Energy Companies (Shell, Vattenfall, etc.)	Financial profit Energy transition	Serious problem, trying to save themselves and their profit while possibly being more dismissive	Unhappy Very negative	Production	Fincance Lobby/trade
Grid Operators (TenneT, Enexis, Stedin, etc)	Neutral	Neutral	Neutral, but questioning how storage and distribution is going to work out	Storage Distribution	Storage Distribution Spatial knowledge
Citizens & local Communities	Cheap energy	Pressing, while feeling powerless or uninterested	Sceptical Interested	More power than they relize blocking in some sense	Voting Participation Protesting etc.
Environmental Organizations	Green energy Moving away from fossils	Pressing and of the highest importance	Interested in more green energy production but sceptical about the 'polluting' farmers	Blocking in some sense	Participating with knowledge Protesting Legal actions
Banks & Investors	Financial profit	Neutral	Sceptical about their profits Possibly unhappy	Financial	Finance
Supermarkets	Financial profit Product availability	Neutral	Neutral	Consumption	Food distribution
Farmers Organisations	Best conditions for the farmers	Mistrust Burdens by transition demands	Doubtfull	Consumption	Knowledge (Space)
Food Distributors (stores)	Financial profit Product availability	Neutral, as long as they receive their products with profit	Sceptical about availabitly and profit	Consumption	Food Distributors
Future Generations	Reliable durable future Energy transition	Pressing, while feeling powerless or uninterested	Hopefull but sceptical	Production Blocking	Future Generations

Interest of farmers: participation in discussion



The goal of developing a strategy to improve the position of one community has to be made measurable. By investigating the current situation based on profits, security, and dreams, we can determine what the farmers want and need. Within developing a spatial vision, designers sometimes lose track of whether their design is truly helping the target community. This investigation will help keep the focus on the farmer community throughout the decision-making of this project.

In the current profit model of agriculture, the average financial profit of a traditional agricultural company is €599.000 every year. The yearly income of a farmer can differ for different types of agricultural farming. A few examples are listed:

Livestock.. €108.000
Livestock (bio)...€131.00
Horticulture... €111.000
Horticulture (bio).. €88.000
Dairy cattle..€77.000
Poultry..€115.000
Standard agriculture..€81.800
Standard agriculture (bio).......................................€89.900

The average agricultural income in the Netherlands in 2021 was €81.800 (Wetenschappelijke Klimaatraad, 2024). However, this average is subjective to each year, due to differences in harvest, profits and regulations. Firstly, new environmental regulations can be imposed within a short period, causing unexpected but required financial investments, possibly putting a farmer out of business. Secondly, the percentages of financial profit on certain products and harvests fluctuate. This is also the reason why the amount of financial profit is subjective to the economy and the type of crops or livestock (Boerderij, 2022).

Currently, some examples of these percentages are:
Meat production (pork)...1%
Milk.. -10%
Potatoes..8%
Onions.. 15%

As discussed in the problem statement, farmers are also facing high societal judgment and stigma. To understand their situation in depth, the importance of this research is to listen to the farmers' community about their situation themselves became evident.

To gain insight, a visit to an exhibition about the agricultural community and the changing landscape contributed. In this exhibition interviews with farmers, environmental experts, residents near agricultural landscapes and other stakeholders were shown, complemented with photographs of the landscape and processes that are discussed. The quotes and statements from the exhibition that are most relevant to the farmers' community and the problem statement of this project are found in the appendix. Moreover, an interview with the artist who carried out the research of the exhibition grew understanding of the ongoing situation of farmers. During this interview, the artist expressed his expectation for the future. According to him, if our society does not take action into the current process of the decreasing amount of agricultural companies, only about five companies will run the entire industry of agriculture. Small farmers would not survive the financial drain and insecurities. In terms of recommendations, he stated that farmers want to have autonomy over their own grounds and livelihood. The main issue is imposing restrictions, as is happening today through the current regulations. In the artist's opinion, the best course of action is trying to convince farmers to participate in the proposals of other policies. Despite it being a difficult task, it is crucial to respect their position and wishes, in combination with financial support.

Due to a lack of time and a limited network, finding farmers willing to share their viewpoints, desires, and struggles directly was difficult. Still, one farmer who was open to participate was interviewed. This particular farmer had decided to leave the Netherlands and start over with farming in Spain, because of less regulations, more freedom and more security. Still, when asked about his dream in 150 years for his great grandchildren, he would imagine farming in the Netherlands just like he is doing now. Besides this, one of the most absurd developments now is agricultural land with nutritious soil that is being transformed purely for energy production. However, if innovations in technology would allow it, the ultimate solution he would be open to is producing energy in synergy with farming activities.

These findings are to be taken into account in the development of the framework, vision and strategy, to find a synergy that benefits both the farmers and energy transition. Because, farmers are crucial in the energy transition. The open space and great amount of square meters coverable with solar panels, and the use of biomass as energy source are just some of the potentials that create great possibilities for the production of renewable energy. Meanwhile, the financial gain from this energy production becomes a form of income for farmers. The described synergy would provide the necessary space for local energy production, and farmers would receive financial stability in their new role.

Moreover, the strategy that we wish to propose does not only affect the role of farmers within the energy transition. In the future, other societal problems and developments can have an effect. Some societal challenges we can expect in the future are educational inequalities, artificial intelligence, health in relation to the environment, territories of the future, and the continuation of the energy transition. Sometimes such a societal challenge might seem indifferent to the situation of the farmers, but they will affect our society and their interrelations in the future. In 150 years, the world will be a completely different place, thus by providing a secure and stable future for communities, we can face these challenges in a durable way.

Dutch government as stakeholder: a critical review

The Dutch government plays a central role in the national energy transition. As the primary decision-making body, it holds significant power in shaping long-term strategies and policies that affect not only the energy system, but also the future of Dutch farmers. Understanding the structure and evolution of the country's energy governance is therefore essential to identifying the systemic barriers to a just and sustainable energy future.

The Electricity Law
A turning point in the history of Dutch energy was in 1998, when the Netherlands adopted the Electricity Law (Elektriciteitswet). This law integrated the national electricity sector into the European energy market. This was contrary to the previous model in which energy was treated as a public good and utility. The Electricity Law was introduced in response to a European directive aimed at liberalising national energy markets. The broader goals of this directive were to create a unified and competitive European energy market, discourage monopolies and ensure equal access to the energy grid across member states.

Energy Production
With the liberalisation of the energy sector, energy production was opened to commercial competition. Multiple actors became involved in the generation, distribution and sale of energy. Producers, including both fossil-based and renewable energy companies, now generate electricity and sell it on the open market (with profit-making as a central feature of the system). This development fundamentally transformed energy from a basic utility into a market product.

Energy Markets
Electricity in the Netherlands is traded on various energy markets, where producers sell their electricity to suppliers and large industrial consumers. In addition to these functional actors, energy traders also participate in the market. Their role in this market is only to make profit: they purchase energy at low prices and resell it at higher prices during periods of shortages. While this trading activity is legal, it introduces instability into the system and contributes to rising prices, the burden of which is ultimately borne by the consumer.

Energy Suppliers
Energy suppliers act as some kind of customerservice between the energy market and end-users. They offer contracts to households and businesses, manage billing and provide customer service. In line with market liberalisation, this aspect of the energy system has also been privatised. Consumers are free to choose from a range of suppliers based on price, contract terms and service offerings. However, suppliers, like producers and traders, operate on a profit-driven basis. This means that consumers not only pay for the energy itself, but also contribute to profit margins across the supply chain.

Critical review
A central position taken in this project is that the production, distribution and consumption of energy must be fair and just. This project seeks to address the root causes of the current energy crisis and proposes a radical approach to resolving the systemic issues that underlie it.

At present, the Dutch energy system operates under a market-based model. In this system, profits for producers, traders and suppliers are ultimately paid by the consumer. While the liberalisation of the energy market was intended to encourage innovation and to keep energy prices low through competition, the reality has proven far more complex. Due to global uncertainties and geopolitical tensions, energy prices are fluctuating constantly, This principle has made energy for many citizens unaffordable. In response, the Dutch government has been compelled to implement subsidies and energy price caps in an attempt to secure access to affordable energy for the population.

These developments raise critical concerns about the role of market mechanisms in a society where energy is essential to human well-being and social stability. In this context, reliance on profit-driven models is not only unsustainable, but also unjust. An analysis of the current governance structures and relevant policies reveals that the roots of this inequality lies within Dutch energy law itself. Therefore, the first and most urgent step toward a just and sustainable energy system must involve radical governance reform. Through a restructured governance framework can the fair production, distribution and consumption of energy be realised in the Netherlands.

Current governance flowchart

1 Overheid en Regulering (Beleidsmakers en Toezichthouders)
Policy and Regulation (Policymakers and Supervisors)

The Dutch government (Ministry of Economic Affairs)
Manages economic policy, energy and sustainability for national growth and stability.

Autoriteit Consument & Markt (ACM) Authority for Consumers & Markets (ACM)
Ensures fair competition and supervises energy market regulations.

Klimaatwetten & Subsidies Climate Agreements and subsidy
Government policies supporting emissions reduction, renewable energy, and sustainable economic transitions.

European Union
Draws up guidelines for a joint European energy market.

The main reason for the Dutch Electricity Act 1998 was the First European Electricity Directive (96/92/EC), which was adopted by the EU in 1996. This directive aimed to:
- To harmonize the electricity market in Europe and open it to competition.
- To liberalize national electricity markets, which until then were mainly monopolistic.
- Ensure equal and fair access to the electricity grid.

Each EU country had to translate this directive into national legislation. In the Netherlands this happened with the Electricity Act 1998, which came into effect on July 1, 1998.

The European Union (EU) built a framework with regulations in which the EPEX SPOT electricity market operates for the European electricity market.

Through institutions like ACER and the European Network of Transmission System Operators for Electricity (ENTSO-E), the EU works to standardize and optimize electricity trading platforms like EPEX SPOT. However, the debate continues over the best structure the market for future energy needs.

- Paris Agreement
- European Green Deal
- SDE++ subsidie / SDE++ Subsidy
- Elektriciteitswet (1998) / Electricity Law
- Gaswet / Gas Law

2 Energieopwekking (Productie van Energie)
Energy production (Production of energy)

Major energy producers are purchasing renewable energy and fossil energy. Energy producers are allowed to make a profit and compete in the market, but sometimes receive subsidies or have to comply with emission regulations.

- Fossil fuels
- Wind turbines
- Nuclear power plant
- Solar panels

Energy is produced by different energy producers. Energy comes from fossil fuels, wind turbines, nuclear power plants and solar panels.

The Electricity Law (1998) opened up the market for competition.

The Electricity Act 1998 was established as part of the liberalization of the energy market in the Netherlands. This act was intended to reform the electricity sector by promoting competition, increasing transparency and giving consumers more choice. The law was introduced as a result of European developments, in particular the First EU Directive for the Internal Electricity Market (96/92/EC) from 1996. The Netherlands had to implement this directive into national legislation.

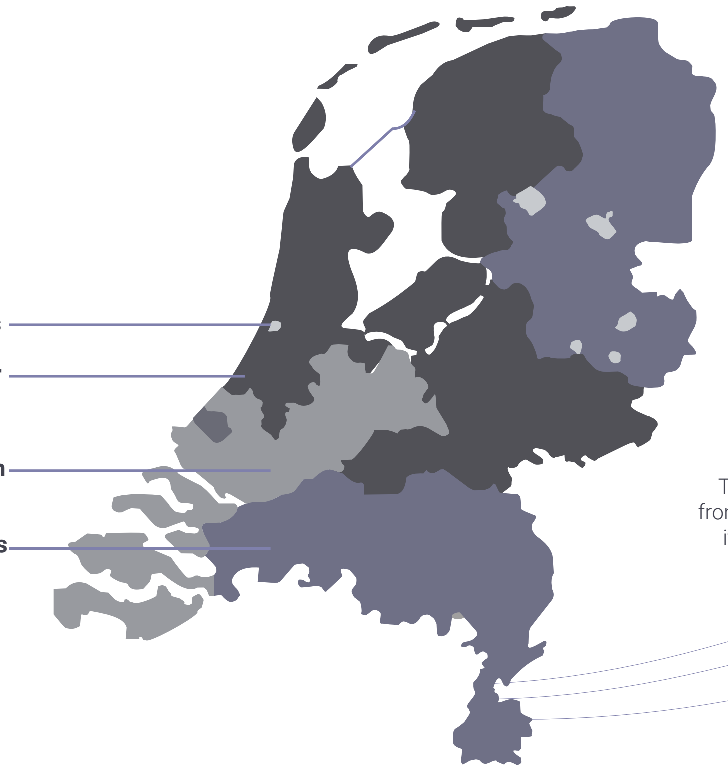
Energy producers

VATTENFALL · RWE The energy to lead · uniper · Others

Energy producers are allowed to make profit on selling their enery to the market.

3 Energietransport en Distributie (Netbeheer)
Energy transport and Distribution (Network management)

The Dutch electricity grid is managed by a national transmission system operator and regional distribution network operators. The national operator transmits high-voltage electricity from producers, while regional operators distribute it to homes and businesses. These government-owned entities ensure a stable energy supply and prevent monopolies.



Parties involved:
TenneT – Operator of the national high-voltage grid.

Regional Grid Operators (Liander, Stedin, Enexis) – Manage the distribution network and transport electricity to consumers.

TenneT receives electricity from producers and distributes it via the high-voltage grid.

Regional grid operators provide transport to households and companies.

4 Energiehandel en Leveranciers (Marktwerking)
Energy markets and distributes (Markt)

The energy trade and supply sector in the Netherlands operates within a liberalized market. Energy traders buy and sell electricity on exchanges, while suppliers like Eneco, Vattenfall, Essent, and Greenchoice purchase energy from producers or markets to sell to consumers through contracts. Consumers can freely choose their energy provider.

Energy markets

The EPEX SPOT (European Power Exchange)

The EPEX SPOT (European Power Exchange) is one of the electricity market spaces where energy is traded on the wholesale market. This is a day-ahead and intraday market, which means that trading takes place for the delivery of electricity on the next day or even within the same day.

Big companies can buy energy directly from the energy markets and participate in the trading.

Energy traders

Companies that purely trade energy without their own production or distribution. Their aim is to make profit.

Suppliers are allowed to make a profit, but ACM checks whether they follow the rules.

Suppliers buy energy from producers or via the trading market. They sell this to consumers and companies through energy contracts.

- Eneco
- Essent
- Vattenfall
- Green Choice

5 Consumenten en Energieverbruik
Consumers and Energy Consumption

Consumers in the Dutch energy market include households, businesses, and governments. They select an energy supplier and pay per kWh. Small consumers have fixed tariffs and legal protections, while large consumers can buy directly from the market. ACM regulations ensure fair pricing and prevent abuse.

This part of the market has been liberalized, allowing consumers to choose their own supplier.

Consumers can switch suppliers and are protected against abuse by ACM rules.

Customers choose an energy supplier and pay a price per kWh.

Small consumers have fixed rates and protected rights.

Ethical dilemmas

Before developing the initial ideas for this project further, it is crucial to be aware of the ethical implications. Critically reviewing these considerations will contribute to the decision-making throughout the project. As an urbanist, one could state that it is an obligation to recognize the impact of our decisions, as we are shaping the environment of both humans and non-humans (3.2 Gains and Prospects). With developing strategies and creating designs, an urbanist should always aim to steer the environment to a livable, sustainable, and just space. To grow understanding of the ethical implications of this specific project, four frameworks are assessed.

Deontological ethics. The initial approach to this research is driven from the possibilities within the space of agricultural land and the insatiable position of the farmers' community. This brought up the initial question, what if farmers produce all green energy? One could argue that this is morally right, as the approach aims to help out farmers in their current unstable (financial) position. In this light, the proposal would sustain justice to the burdens of accumulating difficulties of regulations. It would change the current negative view on farmers, as they would become the solution in the energy transition generations (3.1 Governance Framework). However, this approach completely disregards the traditional practices which makes farmers enjoy not just their work, but their agricultural lifestyle. Therefore, it is only fair towards the currently burdened farmers community to not simply assign them to the energy production task, but to propose a strategy where their traditional practices and the landscape identity are intertwined with innovative methods to tackle the energy transition (6.2 Spatial Toolbox).

Consequentialist ethics. The initial aim is to regard energy as a shared right of society. As a public good, energy should be distributed fairly over all people, without causing differences in accessibility that result in exclusion. With the approach, farmers are positioned in the center, offering them a secure position in today's society as in future generations (3.1 Governance Framework). However, if the methods of energy production would change, agricultural land might not be needed anymore. This puts the strategy into question, because will the quality of the land that has been used for energy production still be valuable? Therefore this research needs to strive to preserve and improve the quality of the land, with methods that do not harm the ecological purposes (6.2 Spatial Toolbox). Moreover, what happens to the farmers when society no longer needs their land for energy production? Therefore, this research needs to explore how to grow mutual respect to preserve a secure position within society (5.3 Community Initiatives). Hopefully, the local system of strengthened relations and reliance between the urban and rural that has then been built for decades, and farmers can continue their agricultural practices in an ecologically responsible manner that is respected and valued by society as a whole.

Ethics of care. The approach to the strategy of this project is not just centered around farmers having to produce all green energy, it is also about sustaining a place for farmers themselves in governance. Regarding this, the Governance Framework (3.1) should implement the diverse wishes of farmers, acknowledging that not the whole community will want to participate in the same manner. To care for these diverse positions, this research intends to propose a framework where working together with farmers lies at the foundation. The importance of respecting their wishes lies with the dependencies of our society on the agricultural sector, because, with this proposal our society does not only depend on their food production, but also on their energy production. To grow respect towards the agricultural sector, this research aims to build relationships between different communities (5.3 Community Initiatives). Moreover, the research seeks to develop sustainable environments by intertwining the preservation of ecological processes (5.2 Vision map).

Virtue ethics. In between the main aims to develop fair energy governance and just agricultural recognition, it is crucial to steer our society towards a more sustainable mindset. Within decision-making throughout the process, the project aims to interweave an approach that causes farmers to take responsibility for their influence on the environment, that makes society act on the impact of their consumption, and that stimulates community ties through the local system. Overall, this would steer towards a shared flourishing of our society, as individuals take responsibility in sustainable actions, to nurture the environment for future generations. Despite the radical approach that will be questioned at first, this project still intends to propose a just strategy that will stimulate planners to consider critically.

Sustainable Development Goals

The Sustainable Development Goals (SDGs) form a universal framework for achieving a more sustainable, just and equitable future by 2030. The 17 goals address a range of global challenges, including poverty, inequality, climate change, environmental degradation and peace. For the Netherlands, the SDGs serve as a guiding structure for national and international policies to make sure that long-term developments align with ethical, ecological and social values (SDG Nederland, 2025).

This project engages with urgent societal and environmental themes, from which strategies and spatial interventions are formulated. When making decisions on critical issues, it is essential to evaluate them through a universal framework in order to assess whether these choices are ethically right. The SDGs provide a tool for this purpose. Within this project, decisions are examined and justified through the lens of the following SDGs (listed in order of applicability to this project).

Incorporating sustainable development goals into design and planning processes is strategically essential and ethically responsible. These goals ensure that proposed solutions actively contribute to a broader perspective of societal well-being. By integrating sustainable development goals into spatial and policy-based interventions, designers and policymakers help to encourage systemic change.

SDG 7: Affordable and Clean Energy focuses on ensuring universal access to reliable, sustainable and modern energy. In this project, this means transitioning away from fossil fuels towards renewable energy sources and making sure that energy is affordable.

SDG 11: Sustainable Cities and Communities aims to create inclusive, safe, and resilient living environments. In the Dutch context, this includes supporting participatory planning processes and preserving both cultural and natural heritage.

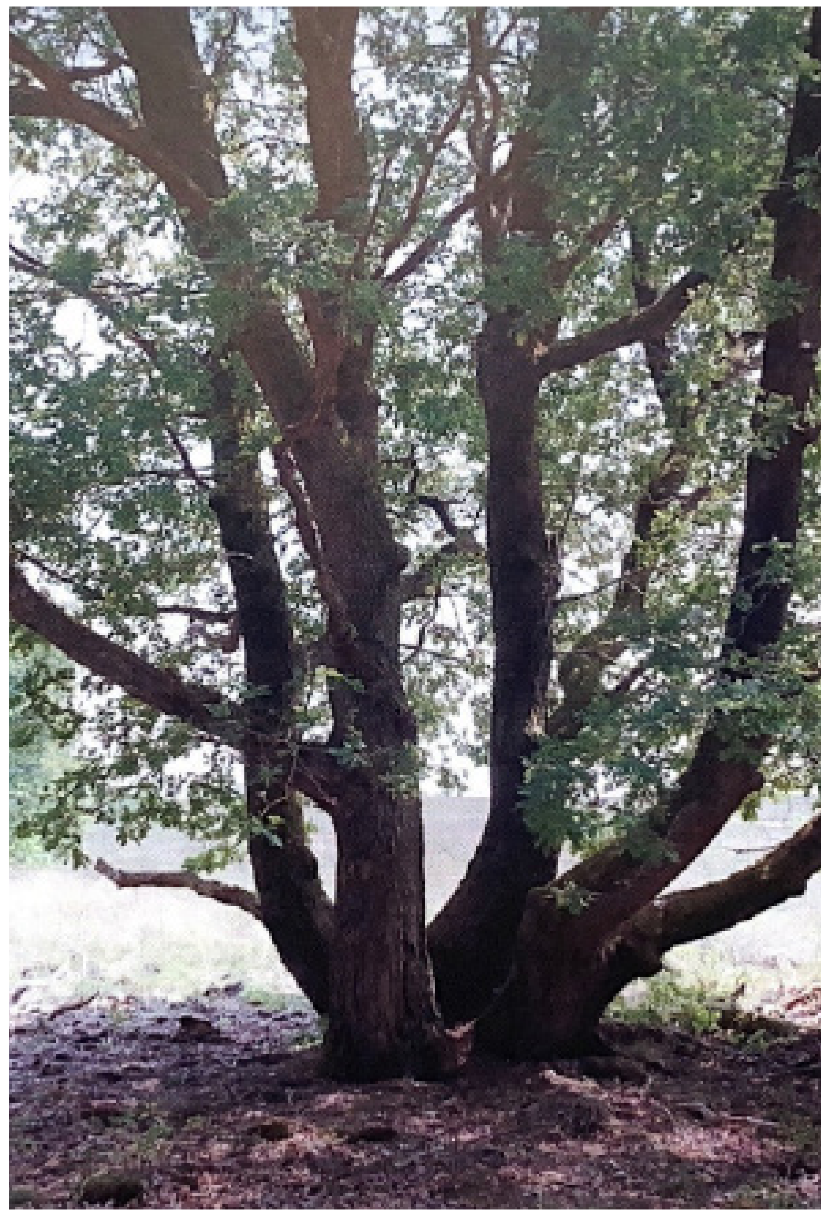
SDG 8: Decent Work and Economic Growth emphasizes the need for inclusive and sustainable economic development. Within the Dutch agricultural and energy sectors, this involves creating fair working conditions and supporting farmers in the energy transition instead of putting the burden on them.

SDG 13: Climate Action requires urgent responses to the climate crisis through national and local measures. In the Netherlands, this goal is addressed through energy transition strategies, ecological agriculture and climate-resilient land use.

SDG 15: Life on Land is about protecting, restoring and promoting sustainable use of terrestrial ecosystems. In the Dutch context, this mainly involves integrating biodiversity into agricultural landscapes.

SDG 12: Responsible Consumption and Production promotes efficient use of natural resources and lifestyle shifts.

SDG 10: Reduced Inequalities addresses both economic and social inequalities. This project aims to restructure specific governance frameworks to ensure equal access to energy as a public necessity rather than a market project.

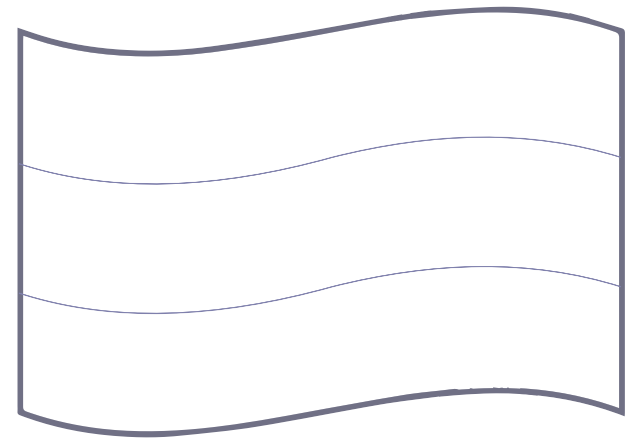


PROPOSED FRAMEWORK

The second focus of the conceptual framework lies in the governance. This chapter explores how to transform the Dutch energy system to benefit the farmer community. This includes the development and implementation of a new governance framework and policies. Strategies based on different urban typologies are outlined to support this transition.

NEW GOVERNANCE FRAMEWORK

1 Overheid en Regulering (Beleidsmakers en Toezichthouders) Policy and Regulation (Policymakers and Supervisors)



The Dutch government (Ministry of Economic Affairs)
Manages economic policy, energy and sustainability for national growth and stability.

Autoriteit Consument & Markt (ACM) Authority for Consumers & Markets (ACM)
Ensures fair competition and supervises energy market regulations.

Klimaatwetten & Subsidies Climate Agreements and subsidy
Government policies supporting emissions reduction, renewable energy, and sustainable economic transitions.

Paris Agreement

European Green Deal

SDE++ subsidie SDE++ Subsidy

Elektriciteitswet (1998) Electricity Law

Gaswet Gass Law

Nieuwe Elektriciteitswet (2035) New Electricity Law

The New Electricity Law (2035) ensures that we leave the European energy market and that we become an self-sufficient energy generator. This law proposes the active participation and collaboration between farmers and the government. Dutch farmers will become the main energy generator for our country by generation local energy for nearby cities. This energy will be bought by the government for a fair price. This approach gives farmers an additional job with an additional income. As they remain farmers, part of their job will be generating energy and maintanance. This gives farmers a sense of subsistence security and preservation of their identity while being a key participant in the new social contract of energy production.

European Union
Draws up guidelines for a joint European energy market.

European Electricity Directive (96/92/EC) was adopted by the EU in 1996 and made the energymarket possible.This resulted in the Dutch Electricity Law (1998), in which is stated that the Netherlands is participating in the energy market construct.

By introducing the New Electricity Law (2030), the Dutch goverments rethinks it's position on this market. They will only participate when energy use and storage is not balanced anymore by selling our surplus energy. The Dutch government will not be buying energy anymore from this market to keep this new Dutch energy systems fair for our inhabitants.

2 Energieopwekking (Productie van Energie) Energy production (Production of energy)

Energy toolkit:

Main energy sources:

Wind turbines

Solar panels

These will be the main energy sources used to generate the energy demand of the Netherlands, generator by farmers around specific cities.

Buffer energy source:

Nuclear power plant

Nuclear power plants will be used as a buffer energy source. When the farmers can not produce enough energy for our demand, we can use this type of clean energy.

Experimental energy sources:

Algae energy

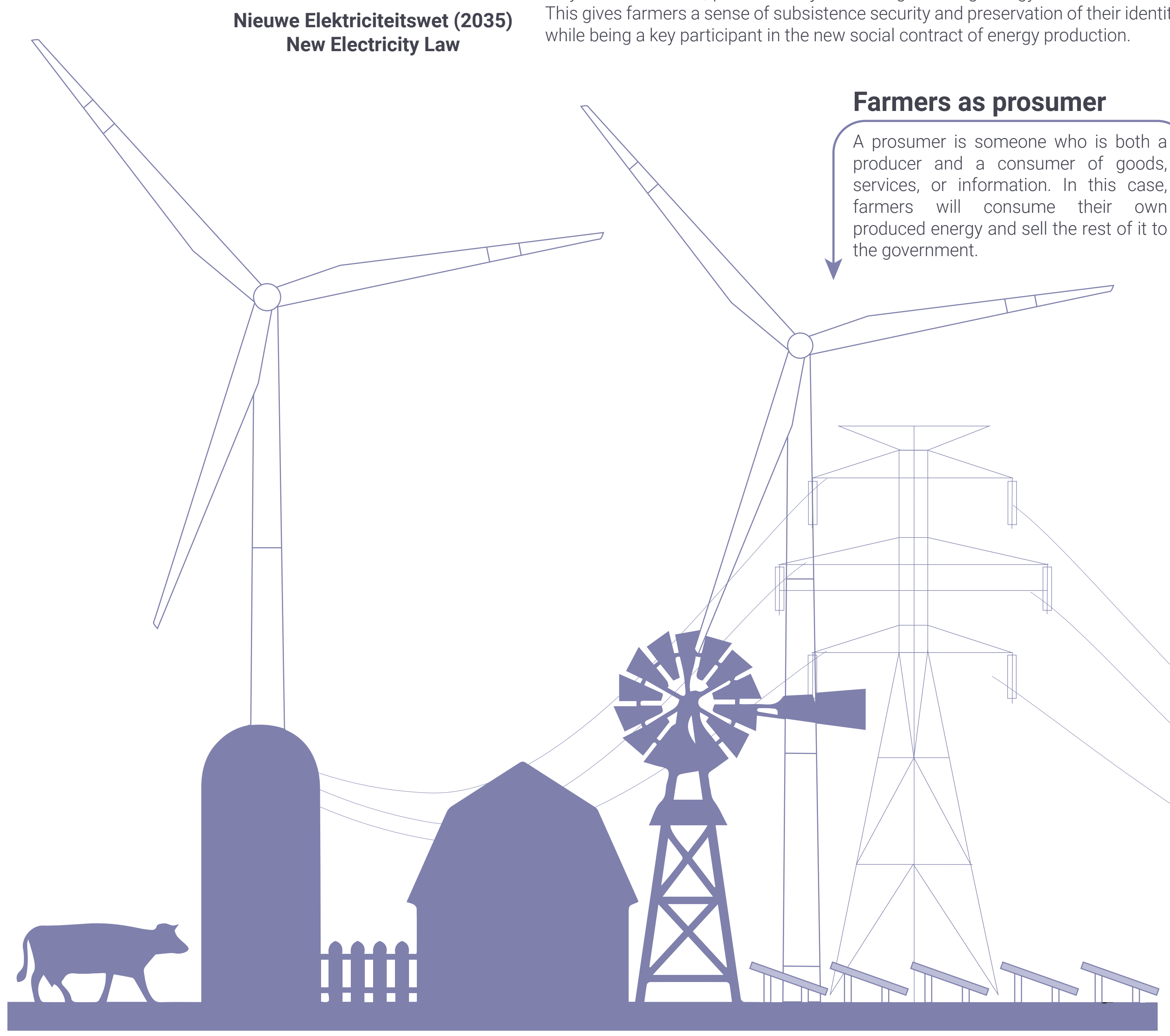
Hydrogen energy storage

Nuclear power plant to nuclear fusion

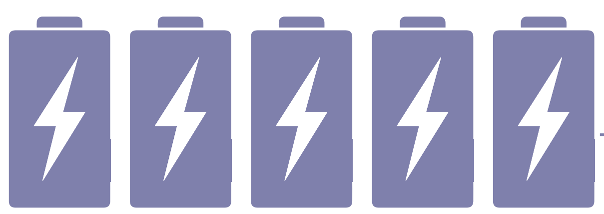
Because of pressing climate regulations, there is a need to keep innovating our energy sources. In this new law, the Dutch government subsidises these experimental energy sources to keep this innovation without the interference of a profit-making market.

Farmers as prosumer

A prosumer is someone who is both a producer and a consumer of goods, services, or information. In this case, farmers will consume their own produced energy and sell the rest of it to the government.



Agricultural land will produce and store all green energy of the Netherlands and farmers will hold a secure position within a sustainable urban-agricultural system. Through rethinking the relationship between land, community, energy and politics, we can break free from a fixed model that demands too much, delivers too little, and meets resistance at every turn. Eliminating the current profit model of energy suppliers will result in a kickstart for local participation, while balancing the spatial demands of renewable energy and the identity of agricultural land.

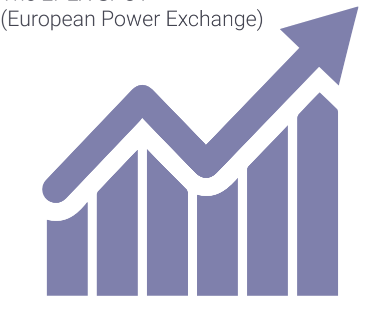


3 Energiehandel en Leveranciers (Marktwerking) Energy markets and distributes (Markt)

In this proposed governance workchart, the Netherlands will not be actively participating in the European energy market to keep the energy fair. In this case, the Dutch government will not be buying energy. Because one of the hardest challanges is the storage of electricity, we will sell the overproduced energy on the market, making a small profit. The money we made this way will be directly funded into the experimental energy sources to keep innovating.

Energy markets

The EPEX SPOT (European Power Exchange)



The EPEX SPOT (European Power Exchange) is one of the electricity market spaces where energy is traded on the wholesale market. This is a day-ahead and intraday market, which means that trading takes place for the delivery of electricity on the next day or even within the same day.

Big companies can buy energy directly from the energy markets and participate in the trading.

Energy traders

Companies that purely trade energy without their own production or distribution. Their aim is to make profit.

In case of surplus energy production, the Dutch government can still be participating on the European market by selling their surplus energy. We will still be participating in this way, because of the following reasons:

- Energy storage demand is high and it is challanging to provide enough storage that is needed for only our own consumption. It is needed to keep the production and consumption of energy balanced. Surplus energy that we cannot store will be sold to the market.
- Selling on the market instead of giving surplus energy away, will give the Dutch government some profits. This profits will be used for the innovation of our main and experimental energy sources.

4 Energietransport, distributie en opslag (Netbeheer) Energy transport, distribution and storage (Network management)

Eneco **Essent** **Vattenfall** **Green Choice**

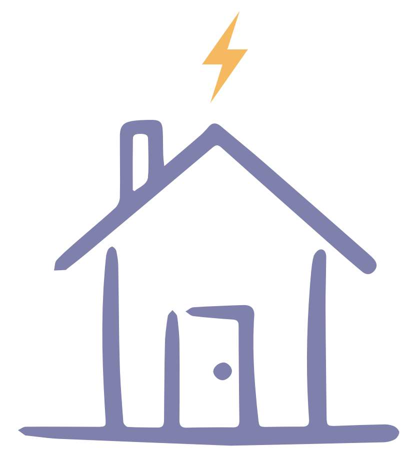
The different energy supplier companies will be merged into one big company, called: Rijksenergiestaat. They will still manage the contact and contract with the customer. They will be an organisation like Rijkswaterstaat. Although Rijksenergiestaat is a government agency, it is not a political body. It carries out its work based on government policies but operates with a certain degree of autonomy in its day-to-day management. It collaborates with private companies, research institutions, and local governments, and it follows long-term strategic plans rather than changing with every political shift.

Rijksenergiestaat

The locally produced energy will be partly be stored on the farmlands of the farmers, giving them the opportunity to use part their own energy for foodproduction. The surplus energy will be devided into energyhubs in cities and villiges. Surplus energy that we cannot store, will be sold to the market with a small profit. This profit will directly fund the innovation of the main and experimental energy sources.

5 Consumenten en Energieverbruik Consumers and Energy Consumption

With this new approach to locally produced, green and clean energy, the Dutch inhabitants and coörporations will have access to fair energy for the first time in the long time. By illuminating profit-making companies and organisations, the Dutch will not paying more than is needed for their energy.

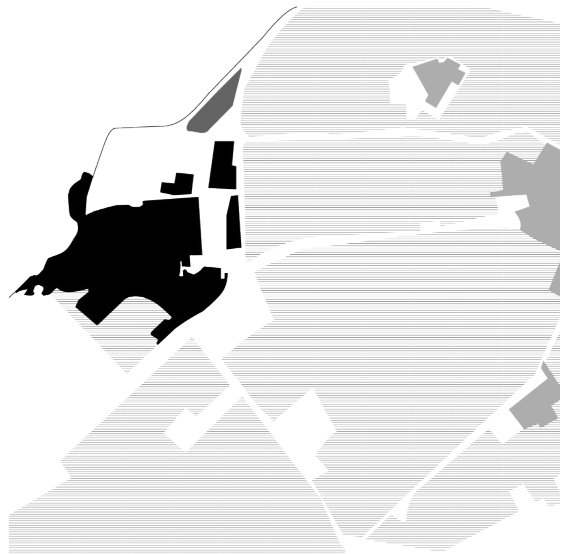


URBAN TYPOLOGIES

Amsterdam

Groningen

Den Bosch



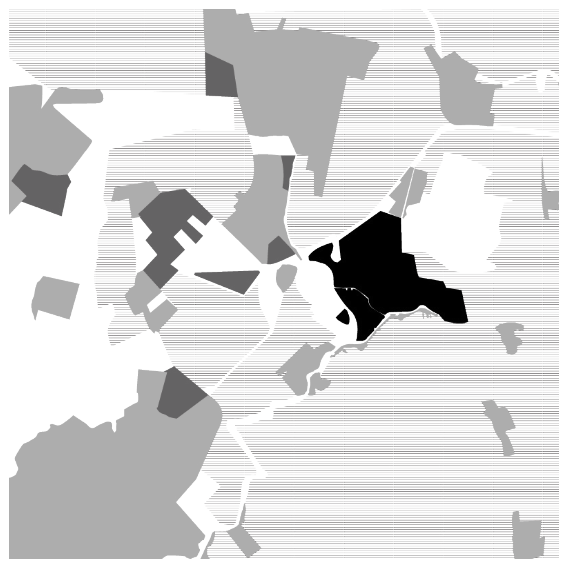
Lelystad

Den Haag

Maastricht

Dordrecht

Rotterdam

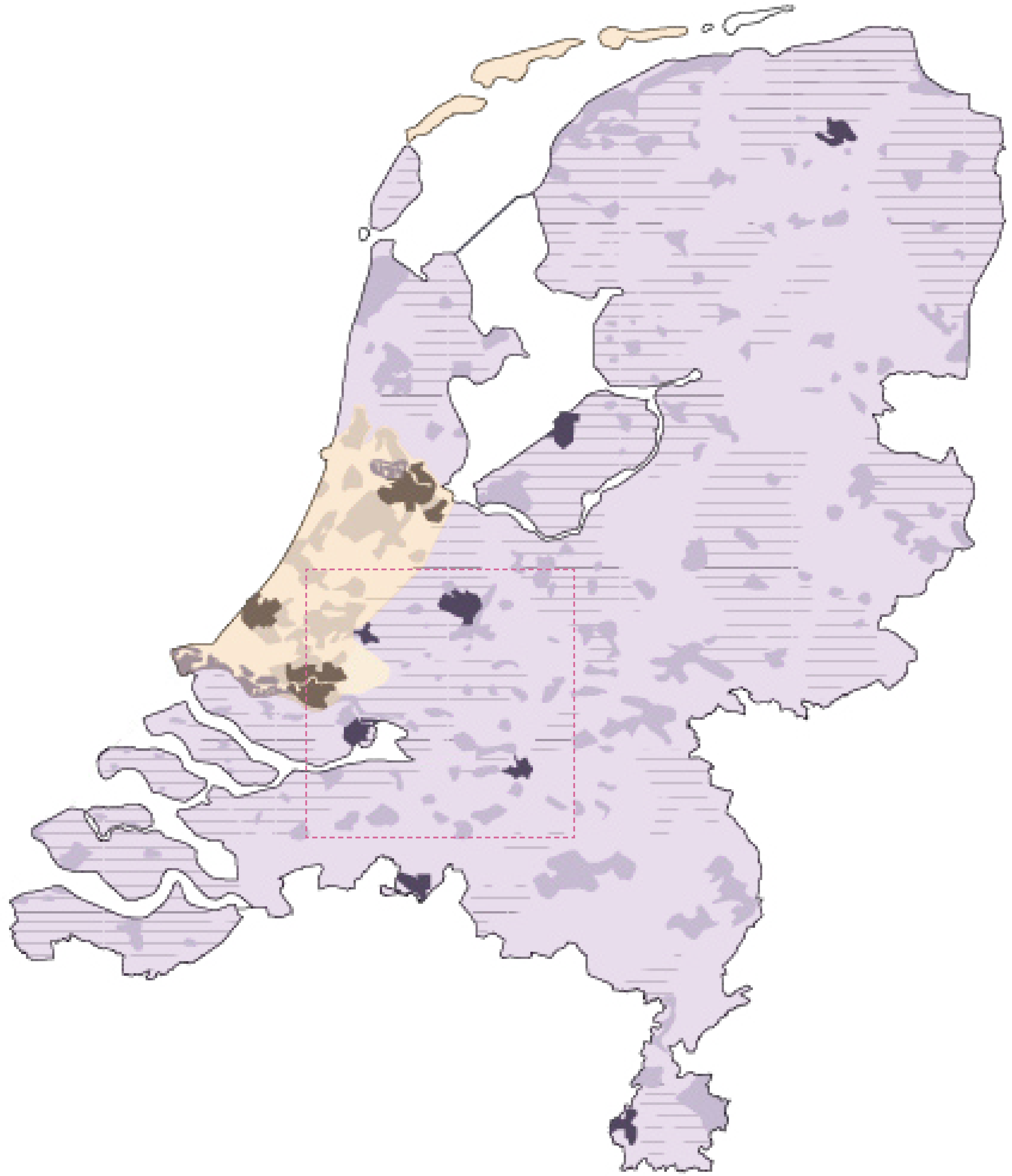


Gouda

Utrecht

STRATEGIES

National scale

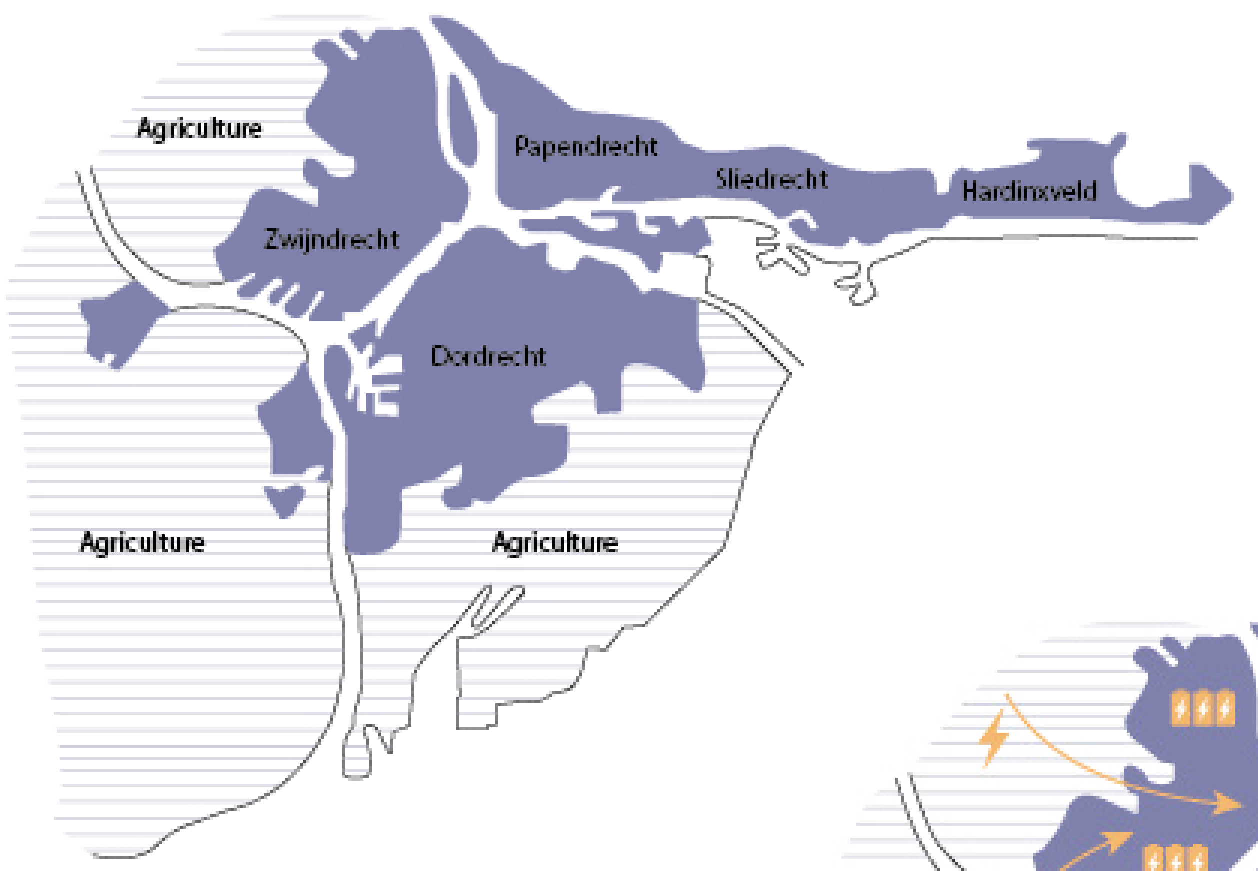


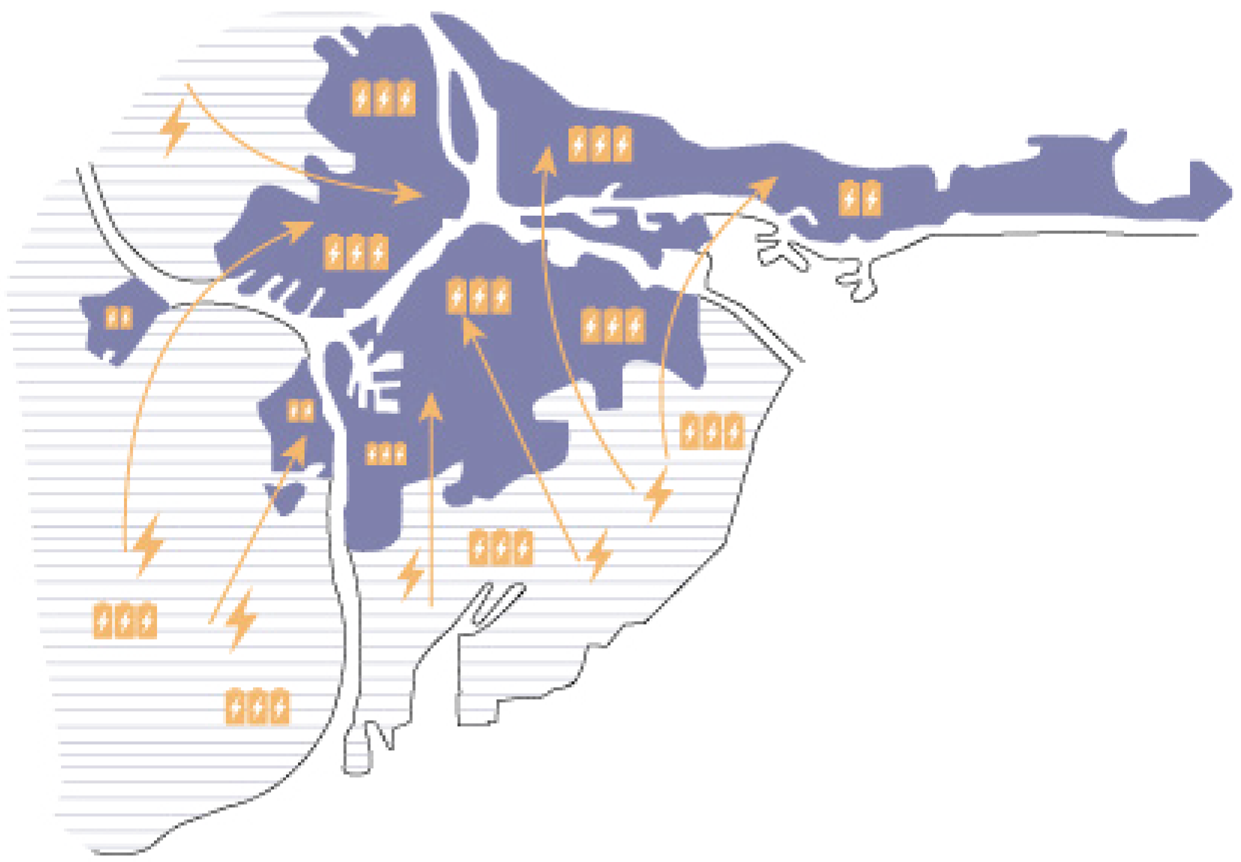
Within the new governance framework, farmers will be the main producer of energy, while the state manages the fair distribution of energy through the RijksEnergieStaat. To explore the spatial applicability of this principle, an initial analysis of urban typologies across the Netherlands was conducted. This analysis identified ten bigger cities scattered throughout the country and examined their spatial relationships with surrounding agricultural areas. These insights revealed patterns in the interaction between urban and rural landscapes, which made it possible to determine where this farmbased energy model could be most effectively implemented.

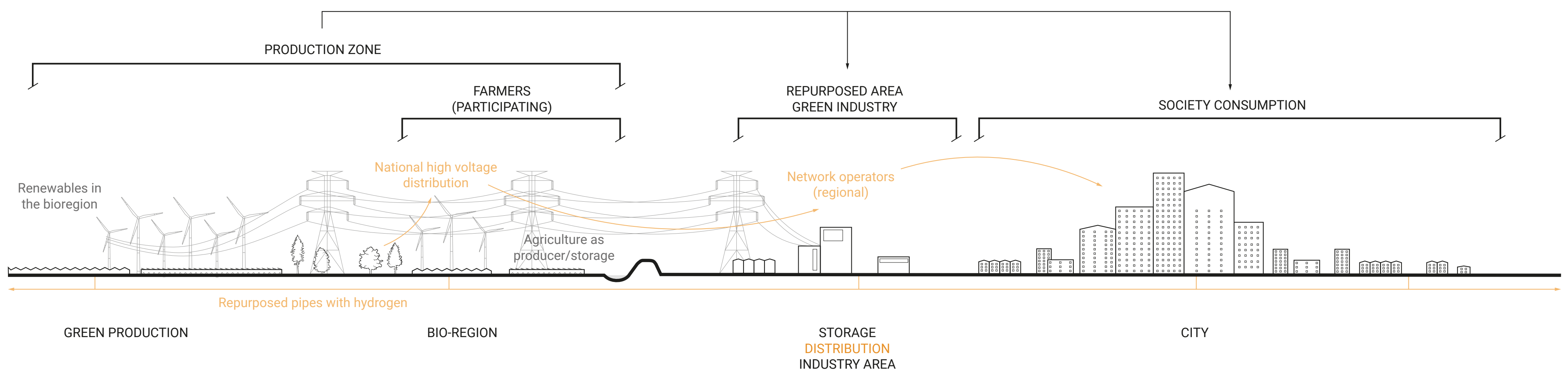
Based on the analysis of different urban typologies, this project divides the Netherlands into two distinct zones. The purple zone represents areas where sufficient agricultural land is available to supply both large and small cities in the surrounding region with renewable energy. In contrast, a different typology has been identified in the yellow zone, where the available agricultural land is insufficient to meet the energy demands of nearby urban areas. Each of these zones requires a site-specific strategy to ensure that local energy needs can be effectively met while responding to spatial limitations and potentials.

Strategy 1: Agricultural land as main producer of energy

The central strategy proposed in this research is to position agricultural land as the primary producer of renewable energy in the Netherlands. Within this approach, farmers take on a dual role as both food and energy producers, receiving fair compensation for the energy they contribute to the national system. Depending on local conditions, farmers can generate energy themselves using predefined local resources, or alternatively, lease or sell parts of their land to third parties if they are unable or unwilling to engage directly. This model gives farmers a secure and powerful role in Dutch society and meets the local energy demands in a green and clean way.

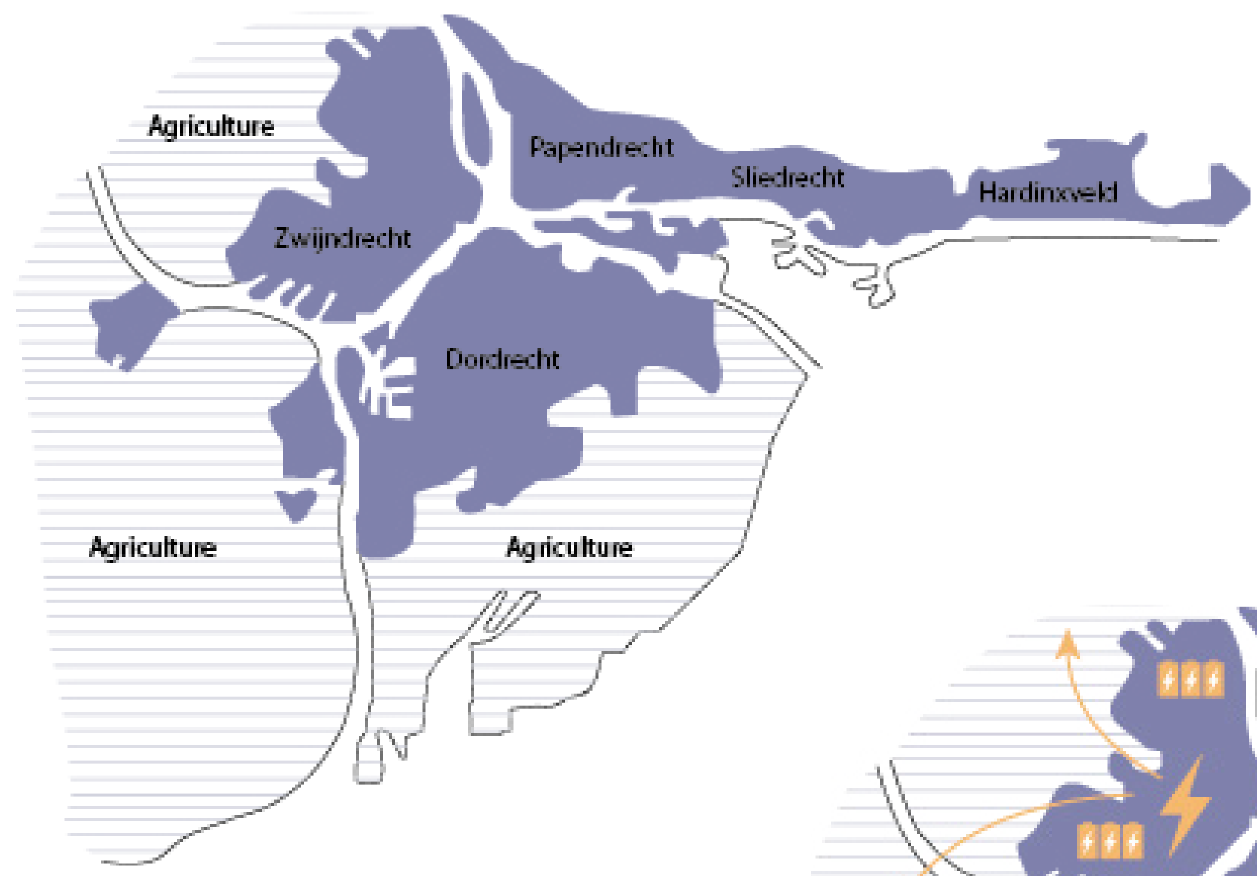


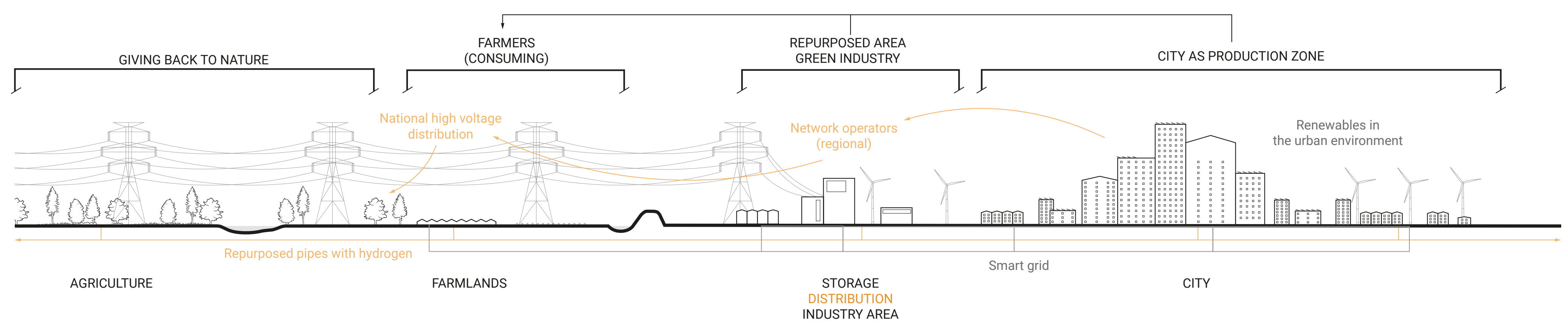




Strategy 2: City as main producer of energy

Around the Randstad in the Netherlands, a different urban typology is present. The largest cities Amsterdam, Rotterdam, and The Hague are densely surrounded by smaller towns and villages. This leaves limited space for agricultural land in this area. Based on this urban typology, this project positions such larger cities as the primary energy providers for the surrounding dense urban landscapes. By implementing a smart grid system and strategically placing electricity hubs and storage facilities, the cities can supply renewable energy to their region.





Farmers organisations

Introduction
Farmers' organizations are regional cooperatives where farmers come together to make collective decisions through their own governance structures. These organizations give farmers a voice in shaping the future of their land while strengthening their position in society and facilitating collaboration with governments. Within each organization, members determine what percentage of their land will be allocated for energy production based on a collective percentage given by the state. The decision of which farmers will be producing energy and how much is made collectively, based on four expected attitudes toward the energy transition, ensuring that different perspectives are considered. By working together, farmers maintain a degree of autonomy, enabling them to balance agricultural practices with energy generation in a way that aligns with their shared interests.

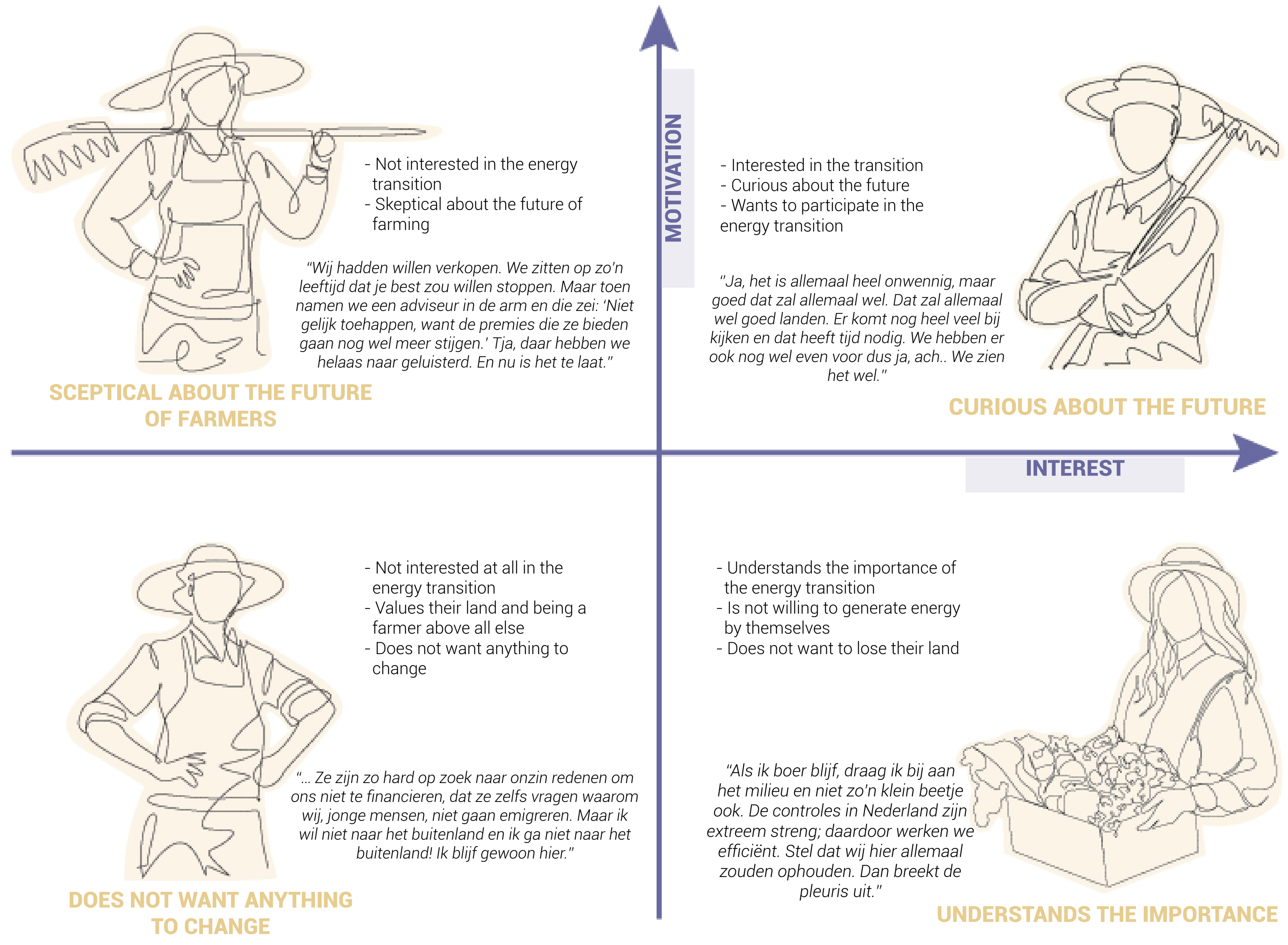
By organizing themselves in this way, farmers gain greater influence in policymaking and negotiations, allowing them to participate more effectively in land-use planning and sustainability initiatives. This cooperative model ensures that the energy transition is not imposed on farmers but rather guided by their own choices, fostering a fair and balanced transformation of the agricultural landscape.

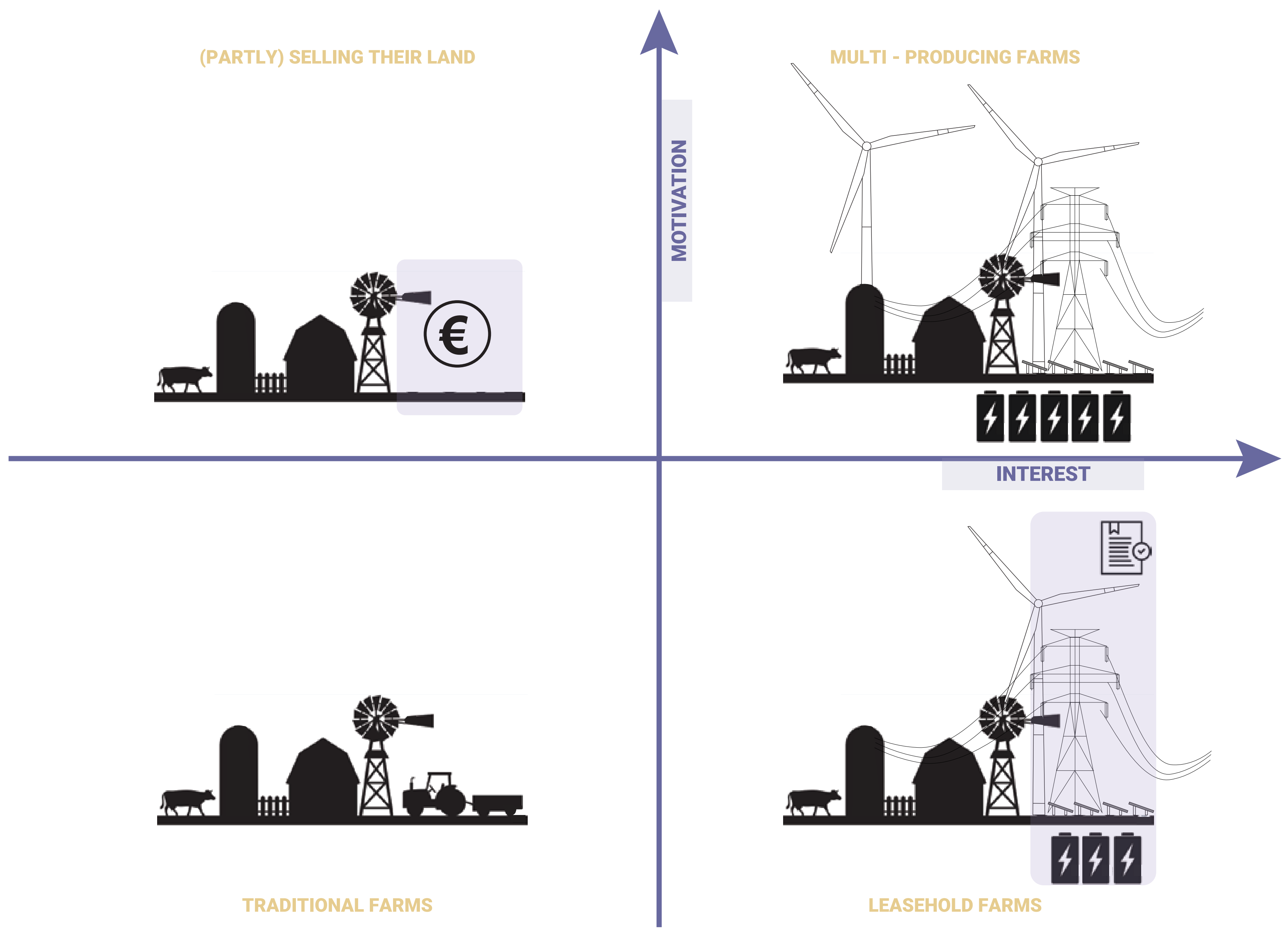
Different perspectives
Within the energy transition, farmers hold four different perspectives regarding their interests and motivation to participate: Sceptical About the Future of Farmers, Curious About the Future, Does Not Want Anything to Change, and Understands the Importance. These perspectives reflect varying levels of concern, openness, and resistance to change. Farmers' organizations ensure that all viewpoints are heard and respected. By allowing members to make collective decisions, each organization can create different types of farms that align with these perspectives. This approach guarantees that every farmer finds a suitable place within the transition while maintaining autonomy and influence over their land and future.landscape.

Different types of farms
To accommodate the diverse perspectives of farmers, four distinct farming models have been developed to ensure that every farmer can choose a path that aligns with their vision for the future.

Traditional Farming is for those who wish to maintain conventional agricultural practices with minimal changes. Leasehold Farms allow farmers to lease part of their land for renewable energy production while retaining ownership. Partly Sold Land provides an option for farmers willing to sell a portion of their land to the state or energy communities while continuing to farm on the remaining land. Multi-Producing Farms integrate various functions, combining agriculture with energy production, nature conservation, or other sustainable practices.

By offering these models, farmers' organizations create a flexible and inclusive system where every farmer can find their place in the transition while maintaining control over their future.





Leasehold policies

Introduction
Leasehold (erfpacht) is a legal arrangement where a landowner grants another party the right to use (part of) their land for a specific period, while retaining ownership. In this model, farmers who do not want to generate energy by themselfs can lease their land to the state or other energy communities for an annual compensation. This allows them to develop renewable energy projects such as solar or wind farms while maintaining long-term control over their property.

This approach offers multiple benefits: farmers receive a stable income from lease payments, the state or energy cooperatives gain access to land for sustainable energy projects and local communities benefit from increased energy security. Implementing leasehold for energy production requires clear agreements on lease duration, compensation and land use conditions to ensure a fair and balanced transition towards renewable energy while supporting rural economies. These agreements must be carefully drafted in collaboration with site-specific farmers.

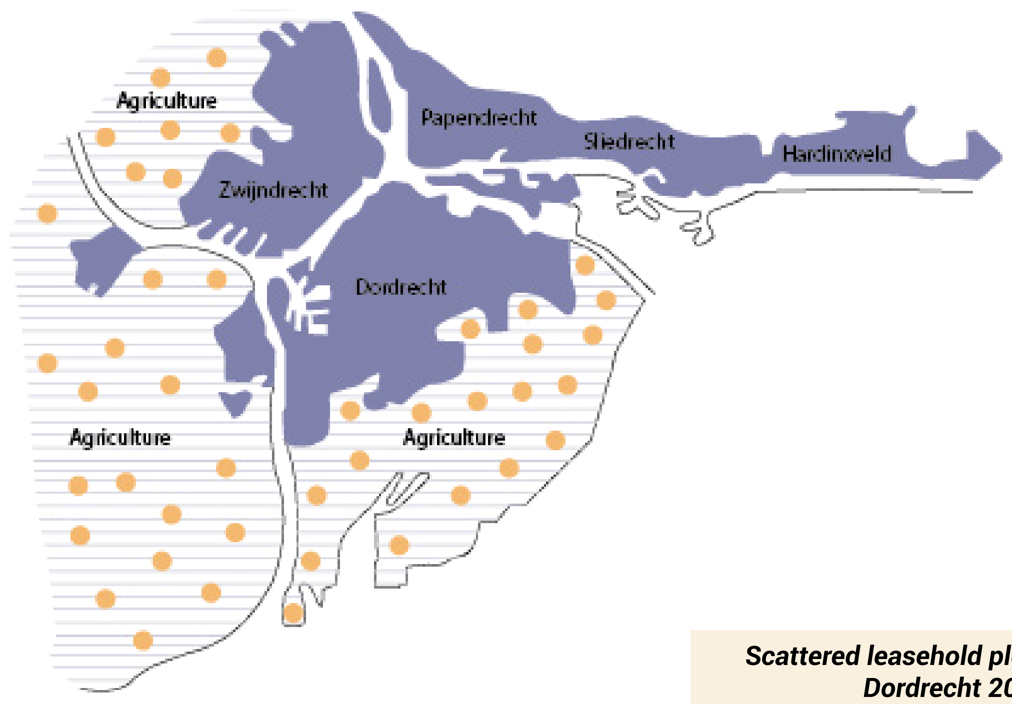
Leasehold contracts and future expectations
To implement a leasehold system where farmers lease their land to the state or energy communities for renewable energy projects, a structured long-term approach is required. The strategy begins with the establishment of a national leasehold framework that allows farmers to enter into legally binding agreements with the government. These agreements would grant the state the right to use the land for renewable energy production for a period of 150 years while the farmer retains ownership.

A leasehold contract between farmers and the state or energy communities would define key terms, for example: parties involved, a 150-year lease duration and land use provisions for renewable energy farms. It would outline compensation to ensure that farmers receive stable payments and clarify maintenance responsibilities for infrastructure. A crucial element is the buyout option, allowing the possibility of the state to purchase the land at the end of the lease based on a fair valuation. Implementation would involve voluntary agreements, government incentives and the RijksEnergieStaat to oversee contracts and ensure long-term sustainability.

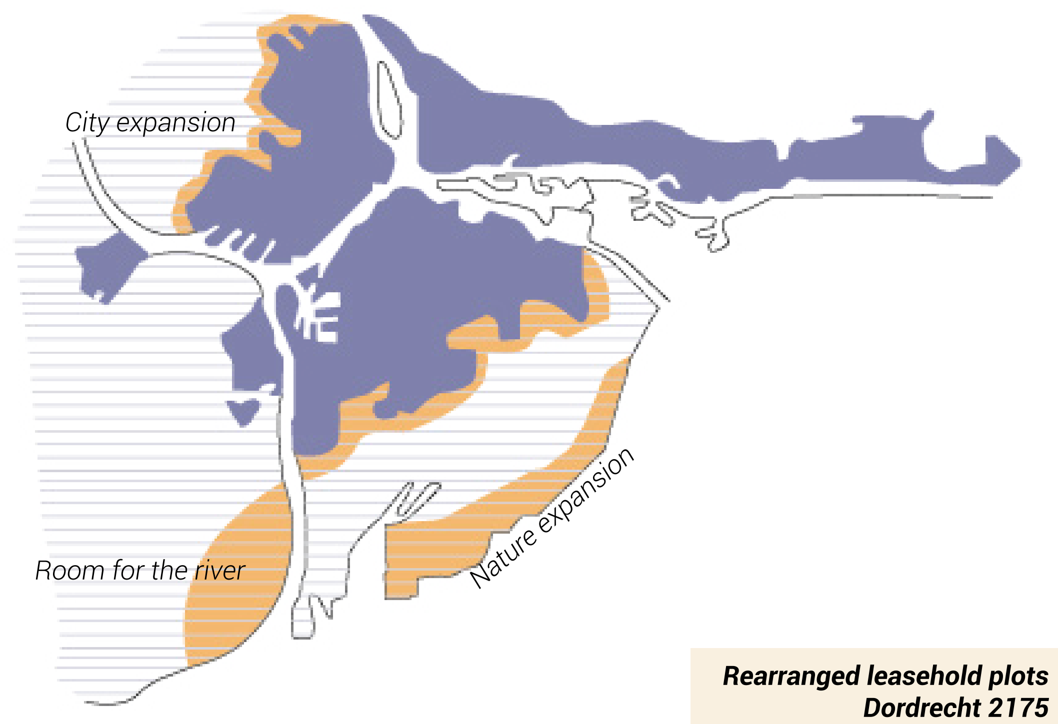
A great benefit of using the leasehold farms strategy is that future generations will decide about the future of their farms. At this specific moment in time, there is a great deal of mistrust among farmers toward the Dutch government. These particular farmers feel strongly about keeping their farmland within the family to ensure that their children and grandchildren have the opportunity to become farmers as well. Although this strategy is designed to provide farmers with a secure position in our society, we are still speculating about the broader future of farming. Presenting the leasehold strategy gives both the government and farmers the chance to adapt to the changing role of agriculture while allowing time to assess how Dutch society will evolve over the coming decades.

The decision to sell the land at the end of the contract will no longer be in the hands of today's farmers or the current government but in those of future generations. It is expected that society will undergo drastic changes over the next 150 years, leading to a decline in both production and consumption of various goods. As a result, less farmland will be needed to meet our needs, and scattered plots of land will be sold to the state at a fair price. Through land consolidation, these fragmented plots can be combined and used for urban expansion, nature restoration, or to address future challenges.

Land consolidation policies



Scattered leasehold plots Dordrecht 2075



Rearranged leasehold plots Dordrecht 2175

Introduction
Land consolidation, or ruilverkaveling, is a process in which scattered and fragmented plots of land are reorganized into larger, more efficient parcels. Traditionally, this has been used to improve agricultural productivity, infrastructure, and land use planning. By redistributing land, farmers gain access to better-connected and more fertile plots, while governments can use the process to enhance rural development and environmental sustainability.

Looking 150 years into the future, land consolidation could play a crucial role in reshaping the Dutch landscape. As societal needs evolve and the demand for farmland decreases due to shifts in consumption and production, scattered agricultural plots could be systematically acquired by the state and reorganized. This would allow for the expansion of cities, the restoration of natural habitats, and the adaptation to new environmental and economic challenges. Through careful planning, land consolidation can ensure that land is used efficiently and equitably, supporting both urban development and ecological balance in a way that benefits future generations.

Recommendations
Within the next 150 years, nuclear fusion is expected to become a reality. This breakthrough will revolutionize energy production by providing unlimited, clean energy for everyone, everywhere. As a result, the current energy transition will be temporary, and in the long run, farmland will no longer be needed for renewable energy production. To prepare for this shift, it is advisable to use the leasehold principle, allowing the government to gradually acquire and repurpose essential land for other societal needs, such as urban expansion, ecological restoration, and adaptation to new environmental and economic challenges.

Reorganizing agricultural land in the Netherlands also offers farmers the opportunity to redefine their role in the future of agriculture. By exploring various toolboxes and bioregions, farmers can determine what type of agricultural activities best suit their needs and the evolving landscape. To ensure a balanced and sustainable transition, this strategy should actively promote close collaboration between the government, landscape architects, and farmers, allowing land to serve both agricultural interests and broader societal needs.

Doomsday policies

As the Netherlands transitions towards a nationalized fair energy system, where farmers with agricultural land serve as the foundation of green energy production, electricity shortages may still arise due to seasonal variations, unforeseen technical failures, or prolonged periods of low renewable energy generation. This report outlines a realistic, structured strategy for managing controlled electricity blackouts while maintaining essential services and ensuring fair energy distribution.

This governance strategy is designed to prioritize essential services, implement phased electricity disconnections and ensure fair distribution of power outages through rotational load shedding (the deliberate and temporary interruption of electricity supply to certain areas or consumers to prevent a total collapse of the power grid). This structured approach minimizes societal disruption, ensures that critical infrastructure remains operational, and provides a clear recovery plan for restoring energy access.

STEP 1: PREVENTION

Preventing electricity shortages is the most effective way to ensure energy security and avoid the disruptive consequences of controlled blackouts. Prevention strategies focus on reducing peak demand, increasing supply efficiency, and enhancing grid flexibility to mitigate risks before they escalate into full-scale crises. By implementing proactive measures, the government can reduce the frequency and severity of energy shortages while maintaining economic and social stability.

A well-planned prevention approach benefits all stakeholders, from households and businesses to critical infrastructure providers. Effective prevention minimizes economic losses, protects vulnerable populations, and ensures that energy remains accessible to essential services. It also strengthens public confidence in the nationalized energy system by demonstrating resilience and preparedness.

1. ***Demand reduction for large consumers***
- Industries are given a mandatory energy cap in times of scarcity.
- Non-essential companies are required to reduce their consumption by 20%.
- Major users are encouraged to generate and use their own green energy.

2. ***Informing residents and the use of smart technologies***
- Promoting the adoption of energy-efficient appliances, improved insulation, and industrial energy-saving practices to lower overall demand.
- Through information folders and participation groups, households will be informed about their own energy use and ways to reduce this.
- Smart energy meters will be applied in every household to transparently communicate about possible energy shortages.

3. ***Maximizing energy storage use***
- Energy storage facilities (pump-storage plants, batteries etc.) are used to the maximum extent possible to absorb fluctuations.

4. ***Dynamic grid regulation through smart systems***
- Households, businesses and other sectors will be connected to a smart system in which it is possible to respond dynamically to energy shortages and surpluses.

Impact on citizens

These measures provide an early warning system, allowing households and businesses to adjust their energy consumption before blackouts occur.

Impact on government

Prevents unnecessary disruptions by optimizing demand before implementing drastic measures.

If these measures are not sufficient and a serious shortage threatens, controlled disconnection will take place.

STEP 2: SECTOR PRIORITIZING

In the event of a national energy shortage, not all sectors can be treated equally. Some industries and infrastructures are essential for societal stability, public safety, and economic continuity, while others can afford temporary shutdowns with minimal consequences. The sector prioritization step in a controlled black-out strategy ensures that critical services remain operational while less essential sectors reduce or pause their energy consumption. The Dutch government and the RijksEnergieStaat categorizes sectors into three priority levels:

HIGH PRIORITY

This category is the highest priority and should be always powered.

Hospitals, emergency services and security operations

Drinking water facilities and wastewater treatment

Food production and distribution centers

Public communication networks (government, media, telecom)

Strategic energy hubs and farms

MEDIUM PRIORITY

This category is the medium priority and should have limited power reductions.

Public transport (railways, metros, and EV charging stations for emergency services)

Large-scale industry producing critical goods (pharmaceuticals, essential manufacturing)

Educational and research institutions (power maintained where possible)

Prisons to ensure the safety of Dutch inhabitants

LOW PRIORITY

This category is the low priority and should be the first to experience Load Shedding.

Heavy industry with high energy demands but non-essential output (e.g., steel, aluminum, paper mills)

Commercial businesses (shopping malls, entertainment venues, offices)

Sports stadiums and event locations

Residential areas (experiencing rotational blackouts based on demand)

STEP 3: LOAD SHEDDING

Load shedding is a controlled process in which electricity supply is temporarily reduced to specific sectors or regions to prevent grid failure during energy shortages. In a nationalized Dutch energy system, where the farmers manage electricity production and distribution and storage is managed by the government, load shedding is a strategic tool to maintain grid stability and ensure fair access to electricity.

If preventive measures fail and an energy shortage persists, a controlled, the phased disconnection strategy is activated. This approach ensures that blackouts are distributed fairly while protecting essential services.

PHASE	ENERGY DEFLICT LEVEL (Compared to 2023 Demand of ~2 600 PJ)	ACTIONS TAKEN	IMPACT ON SOCIETY AND GOVERNMENT	DURATION OF THE BLACKOUTS PER AFFECTED SECTOR
Phase 1: Preventive Energy Optimization	0 - 5% deficit (~130 PJ shortfall)	- National awareness campaign to lower household & business consumption. - Flexible industrial demand shifts (nighttime production). - Maximum use of battery storage, pumped hydro and green hydrogen reserves.	**For Society:** Minimal disruption, voluntary participation. **For Government:** Focus on communication & efficiency incentives.	No blackouts; voluntary reductions only.
Phase 2: Non-Essential Infrastructure Shutdown	5 - 10% deficit (~260 PJ shortfall)	- Highway lighting, non-essential government/office buildings and advertisements will be switched off. - Trains/metros operate on reduced schedules. - Large-scale demand response programs for companies.	**For Society:** Minor inconveniences, but essential transport and safety maintained. **For Government:** Coordination effort with local municipalities.	No blackouts; targeted power reductions.
Phase 3: Industrial and Commercial Load Shedding	10 - 15% deficit (~390 PJ shortfall)	- Heavy industry partially shut down. - Shopping malls, corporate offices and entertainment venues cut power usage. - Specific data groups switch to backup generation where possible (non-essential)	**For Society:** Economic slowdown; higher costs for businesses. **For Government:** Requires economic support for affected industries.	Industries experience 4-8 hour outages per day, rotated to prevent total shutdown.
Phase 4: Rotational blackouts in residential and commercial areas	15 - 25% deficit (~650 PJ shortfall)	- Controlled, scheduled blackouts in low-priority residential and commercial areas. - Farms with solar/wind systems feed excess energy into the grid. - Government prioritizes hospitals, emergency services and food supply chains.	**For Society:** Temporary home power loss, increased reliance on private batteries/generators. **For Government:** Need for clear public communication & crisis planning.	Households and businesses experience 2-4 hour outages per cycle.
Phase 5: Grid emergency and essential service protection	25 - 35% deficit (~910 PJ shortfall)	- Full shutdown of non-critical industries. - Selective blackouts in non-essential government buildings. - Public transport and rail systems severely reduced.	**For Society:** Major disruptions to daily life and business activities. **For Government:** Increased public frustration, possible need for energy rationing.	Households experience 4-6 hour outages per cycle.
Phase 6: Critical Blackout State – Essential Services Only	35%+ deficit (>910 PJ shortfall)	- Only hospitals, water treatment plants, and emergency services remain powered. - Severe electricity rationing for households & businesses. - Government takes full control of energy allocation & enforces curfews to limit usage.	**For Society:** Extreme limitations on energy use; food & water security concerns. **For Government:** Implementation of emergency measures, possible military support.	Households and businesses experience 6-8 hour outages per cycle.

To prevent the energy crisis from escalating, the Dutch government will temporarily purchase energy from the European market. *(As times change and global peace comes under pressure, the continued existence of the European energy market or the Netherlands' ability to participate in it cannot be taken for granted).*

The total energy consumption of the Netherlands in 2023 is estimated to be around 2,181 petajoules (PJ). This figure is based on the provisional energy balance data from CBS, which provides insights into the total primary energy supply, sectoral consumption, and energy transformation processes.

STEP 4: EMERGENCY RESPONSE AND LONG-TERM RECOVERY

Even with careful planning and phased load shedding, severe energy shortages can escalate into crises that require immediate government intervention. The emergency response phase ensures that essential infrastructure remains functional, while the long-term recovery strategy focuses on stabilizing the grid, restoring economic activity and preventing future energy crises.

Emergency response

During a critical energy shortage, the Dutch government, in coordination with RijksEnergieStaat, enforces emergency protocols to protect the stability of the grid and prioritize essential services.

These necessary actions will be taken:
- National Energy Rationing.
- Enforcing Blackout Curfews.
- Deploying backup generators and energy reserves.
- Military and Civil Protection Support.

Long-Term recovery

The main goal during this step is restoring stability and preventing future crises. Once the energy shortage is under control, efforts shift towards grid recovery and energy resilience.

This phase focuses on:
- Restoring industrial and commercial power in phases.
- Rebuilding energy reserves
- Expanding and adjusting farmland solar and wind projects.
- Implementing new policies to improve energy security, such as mandatory industrial demand reduction programs during peak crises.

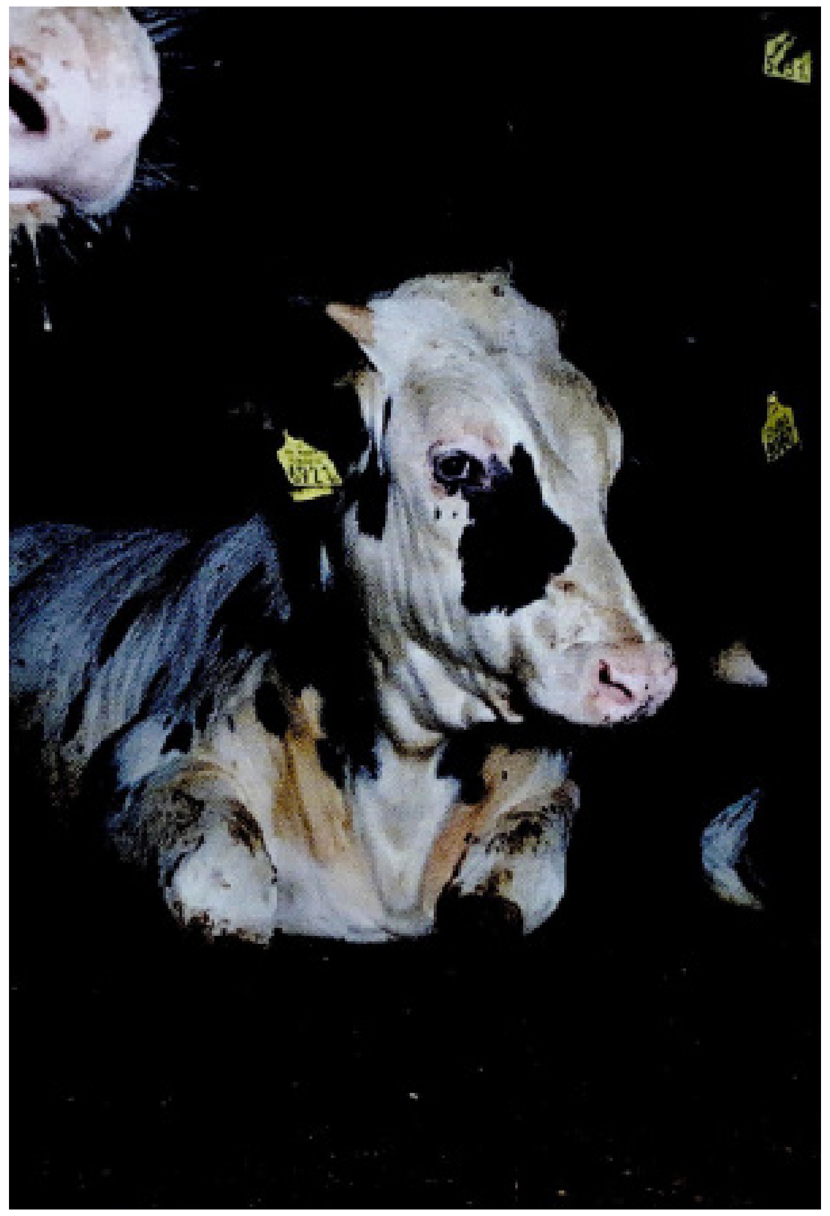
HOW CAN YOU BE PREPARED?

The Dutch government advises citizens to be prepared for emergencies, including energy shortages, by assembling an emergency kit. This kit ensures you can manage the first 72 hours without electricity or other basic services.

List of items recommended by the government include:
- **Water:** At least 3 liters per person per day.
- **Non-perishable food:** Such as canned vegetables, dried fruits, and nuts.
- **Communication devices:** A battery-powered or wind-up radio to stay informed via emergency broadcasts.
- **Light sources:** A flashlight with extra batteries, candles, and matches.
- **First aid:** A first aid kit with instructions.
- **Warmth:** Blankets to stay warm.
- **Signaling devices:** A whistle to call for help.
- **Money and documents:** Cash, copies of identification and important phone numbers.
- **Hygiene items:** Hand sanitizer, toilet paper, wet wipes, menstrual products, toothpaste, and a toothbrush.
- **Specific needs:** If applicable, include medications, baby food, and pet supplies.

Specific for energy shortage:
- Keep a charged **power bank** for your phone.
- **Plan ahead:** Charge devices and batteries as soon as an energy warning is issued.
- **Alternative heating:** Ensure a safe way to stay warm if heating systems fail.

Check local emergency plans via government sources and DenkVooruit.nl.



SPATIAL ANALYSIS

The third focus of the conceptual framework focuses on spatial conditions. Building on the position of farmers and the proposed governance framework, this chapter presents a spatial analysis of the selected region of the Randstad, focusing on Dordrecht as the smallest scale. Based on the findings, a synthesis map illustrates the interrelation between the analyses.

SPATIAL ANALYSIS EXISTING

The spatial conditions of the landscape shape the environment and provide a base for spatial implementation. Focussing on the essence of this project, certain crucial spatial analyses are made. These spatial analyses help determine the bioregions, energy possibilities and spatial restrictions.

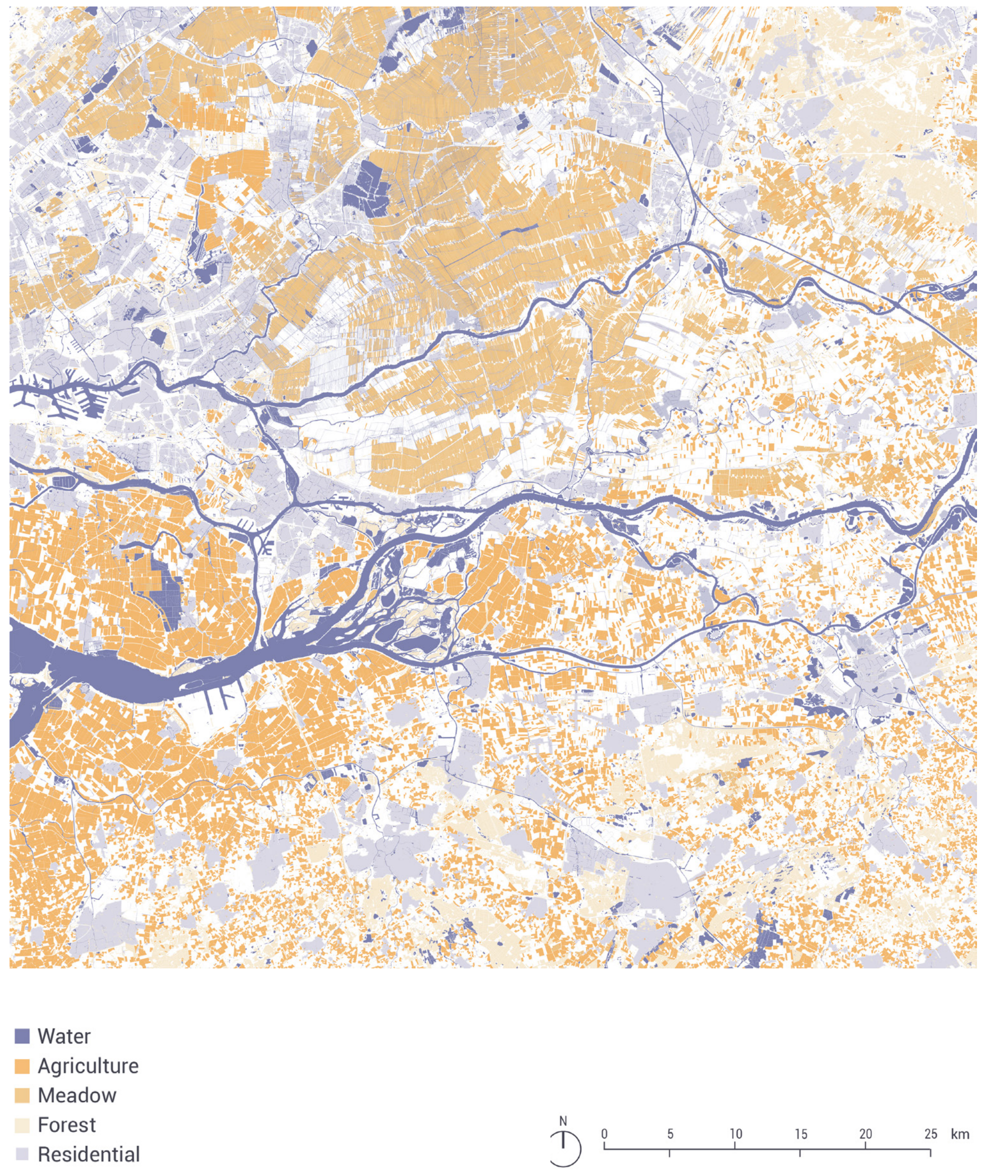
Land use analysis
The analysis uses GIS to create detailed maps that reflect the existing land use patterns. These maps provide insight into the current conditions of the area, which are critical for understanding the potential of interventions. It helps to determine how different typologies of cities relate to surrounding agricultural land, which supports decision making on integrating energy production and land use planning.

The land use map shows that agricultural areas, indicated by yellow, dominate the landscape and are particularly widespread around urban areas. Most of the agricultural fields are concentrated in the central and western regions, while meadow fields are more present in the northern parts. Water infrastructure is also a prominent feature, with water bodies scattered throughout the agricultural zones. This proximity to water resources is crucial for ensuring that the fields receive enough irrigation. However, it is notable that some agricultural areas are poorly connected to the water network, indicating potential challenges in accessing water for those regions. The maps also highlight large amounts of meadow fields, which form part of the ecological network. These areas, while important for biodiversity and ecological balance, also present opportunities for more intensive land use. These fields could potentially be repurposed for energy production, offering a dual benefit of increasing land use while contributing to sustainability goals.

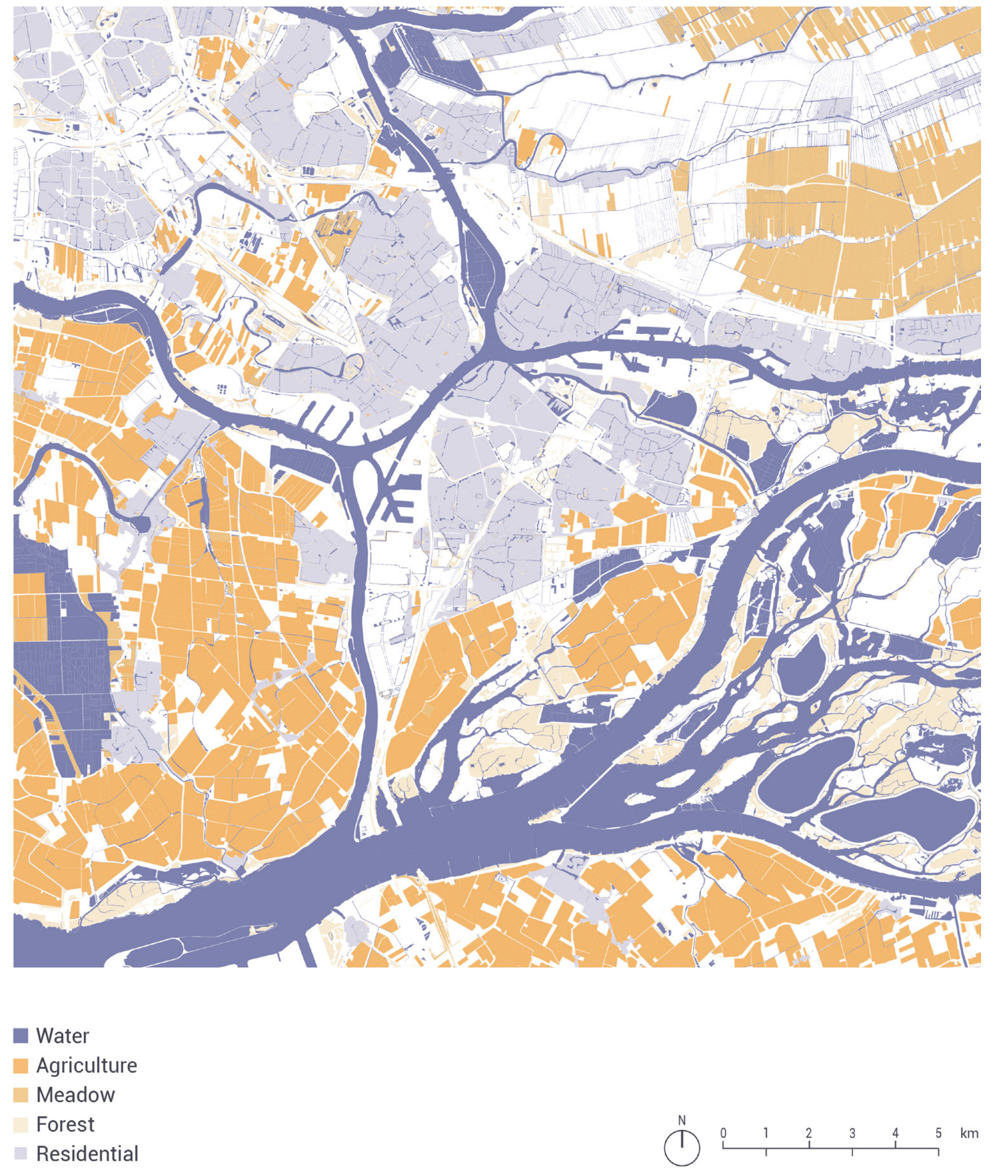
Soil type analysis
The soil type map illustrates the variation in soil composition across the region. In the southern part, sandy upland soils dominate, while the northern and central areas are characterized by low peat soils. The eastern region is primarily composed of riverine soils, and the western areas are predominantly clay-rich, with the land being mostly flat or gently sloping.

This diversity in soil types plays a crucial role in determining how the land can be most effectively used for agricultural activities, renewable energy production, and typologies of rewilding. For instance, areas with sandy soils might be more suitable for certain types of energy production, such as wind or solar farms, due to better drainage and soil stability. In contrast, clay soils in the west, with their potential for water retention, could be better suited for energy production methods that require more stable or moist conditions, such as biomass or geothermal energy. Still, some soil types cause restrictions as they are not suitable for certain forms of energy production and storage. Additionally, certain soil types are more suitable to encourage vegetation growth, making them ideal locations for nature reserves or rewilding.

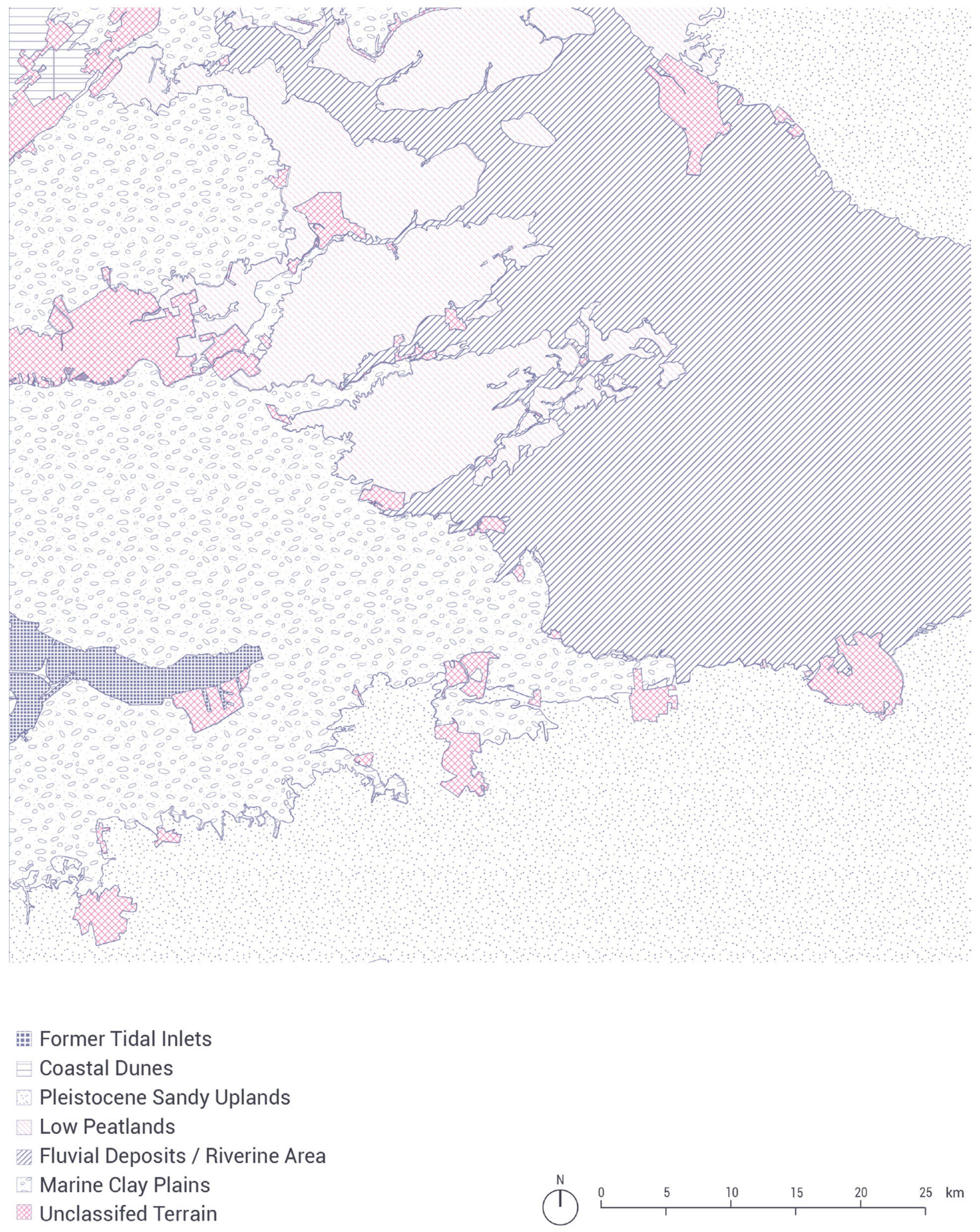
Land use region



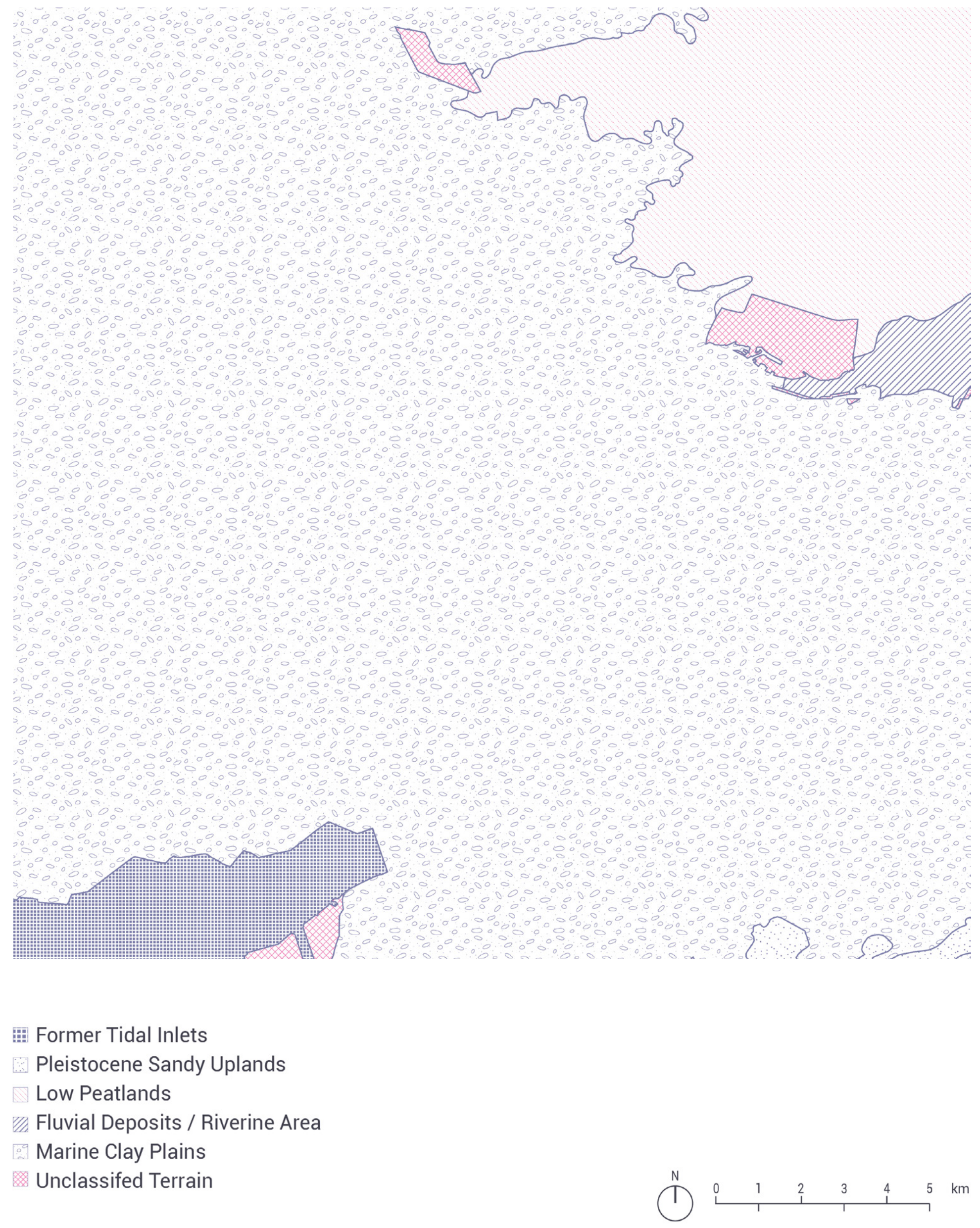
Land use Dordrecht



Soil type region



Soil type Dordrecht



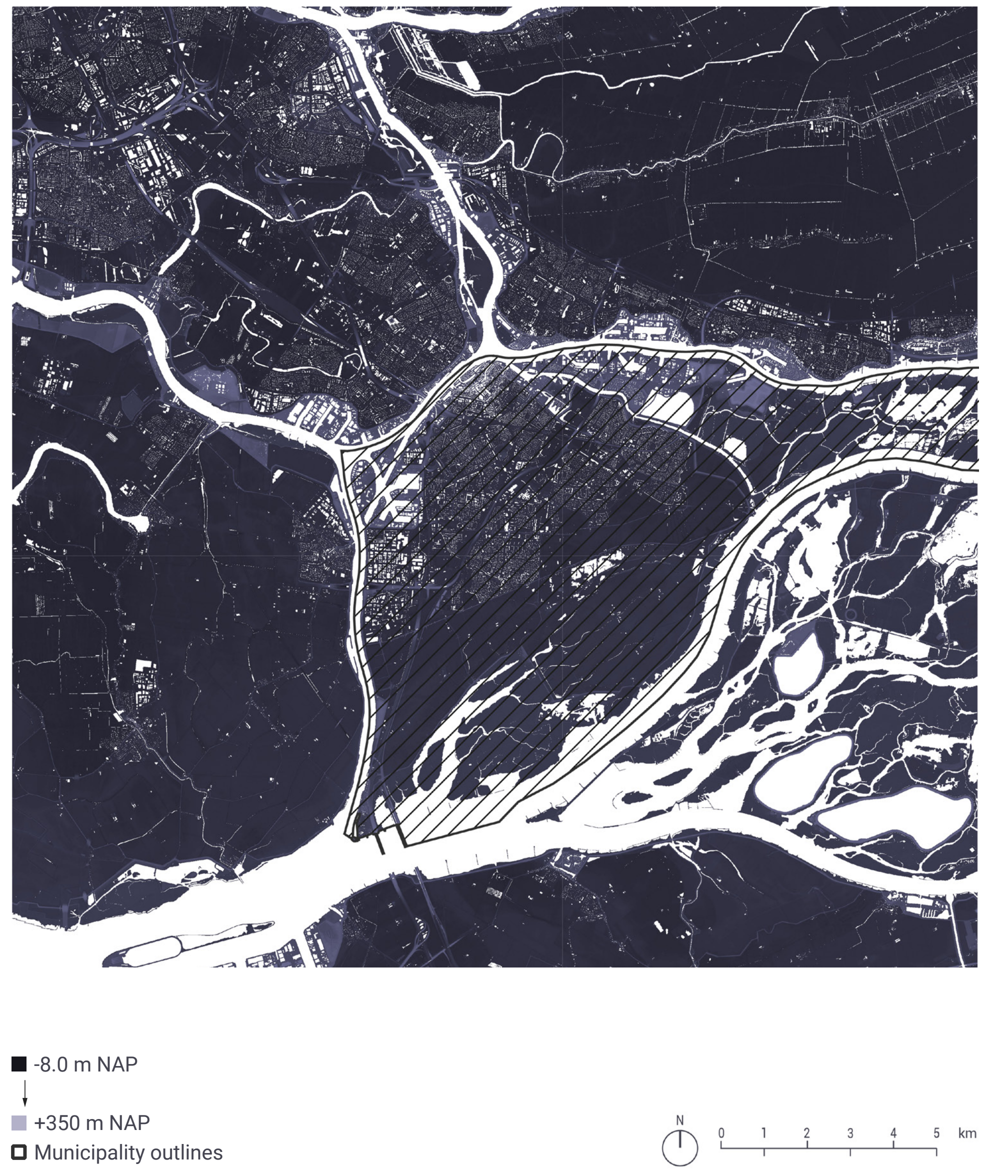
Landscape height
The largest part of the Netherlands is situated below NAP. This causes a lot of influence on the ability to build on the land, and also influences the relationship with water. Therefore, lower wet regions offer different spatial possibilities than higher dry lands. This will be crucial in recognizing different landscape typologies of defining bioregions. This also drives the need to continue with a flood risk analysis.

Flood risk analysis
The flood risk map shows significant variations in vulnerability, with the darkest colors indicating areas that are in highest risk of water overflow. These zones are primarily concentrated in the central and eastern parts of the region, which are located near the big water structures. Interestingly, the northern region, although much lower than NAP, shows lower flood vulnerability. This reduced risk is likely due to the absence of water systems in this area, which limits the potential for river overflow.. Similarly, the western regions surrounding the largest water structures are also positioned below NAP, yet the flood risk is comparatively lower. This may be attributed to the presence of flood control infrastructure or natural features that mitigate the impact of flooding in these areas.

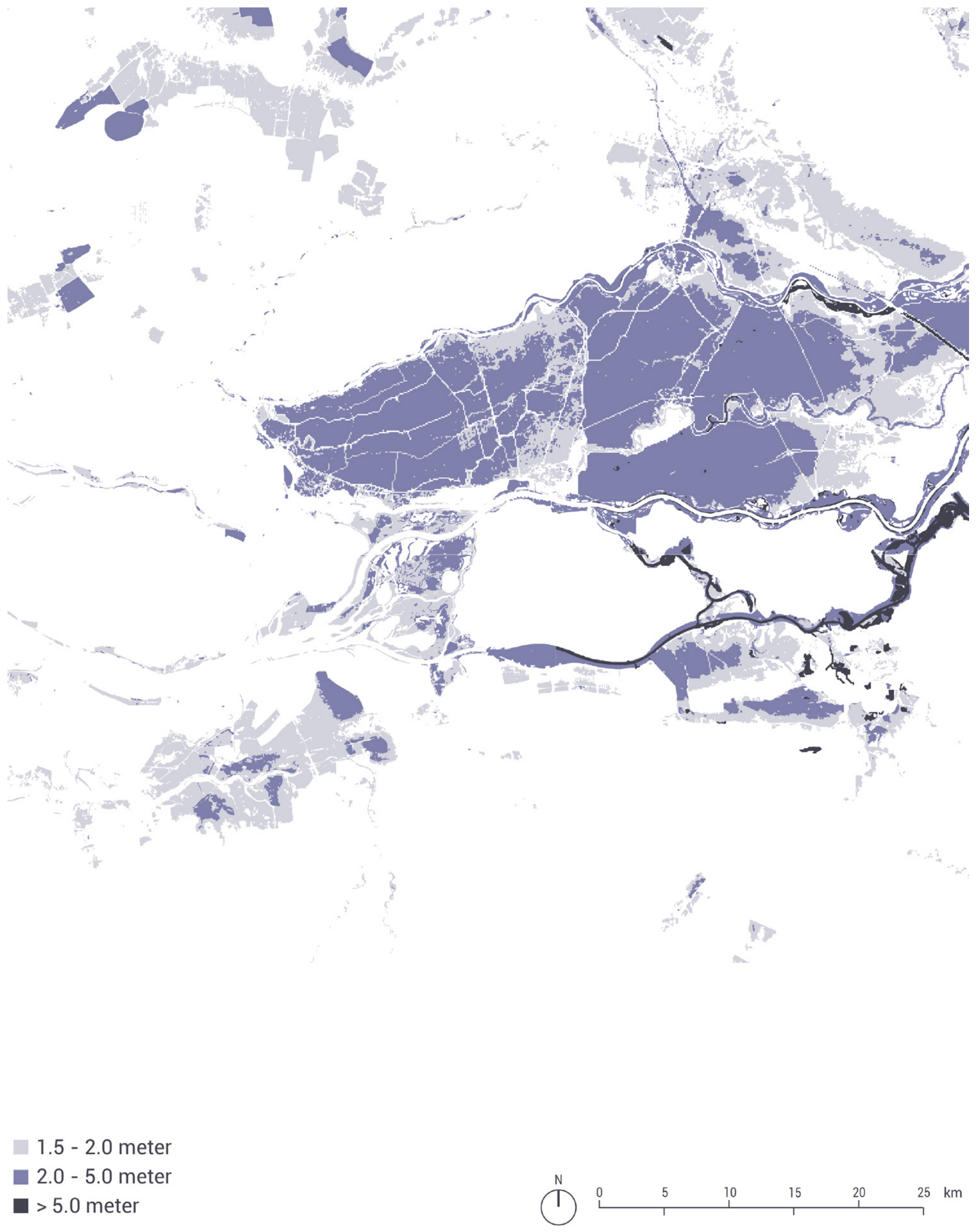
This flood risk map is crucial for strategic planning, especially when considering future land use and energy generation. Since the eastern and central regions are most likely to experience flooding, they could be suitable for wet agriculture, which thrives in conditions with regular water exposure. Additionally, these areas could be used for renewable energy production methods that require such wet conditions, such as hydropower or biomass generation.

Landscape height region

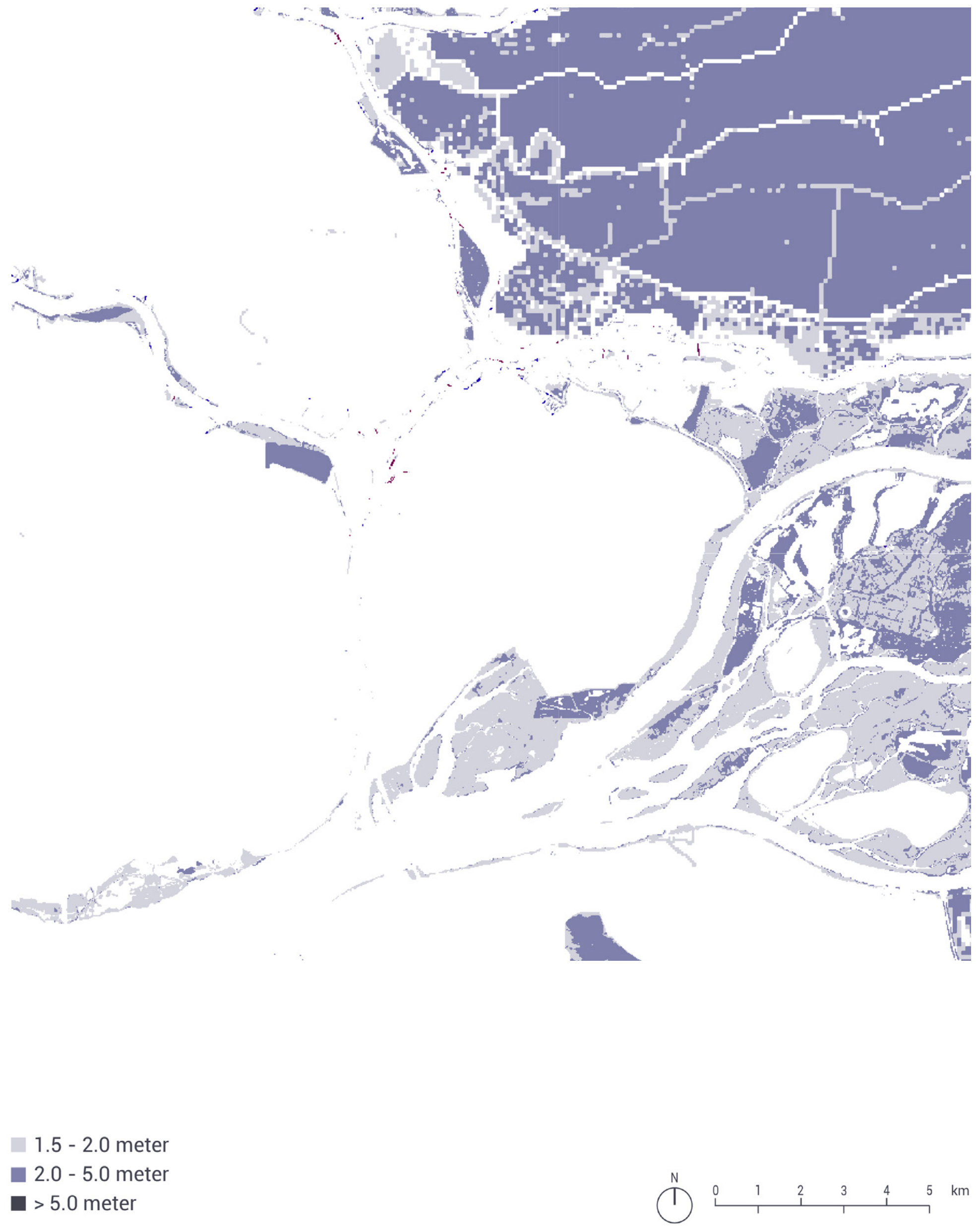
Landscape height Dordrecht



Flood risk region



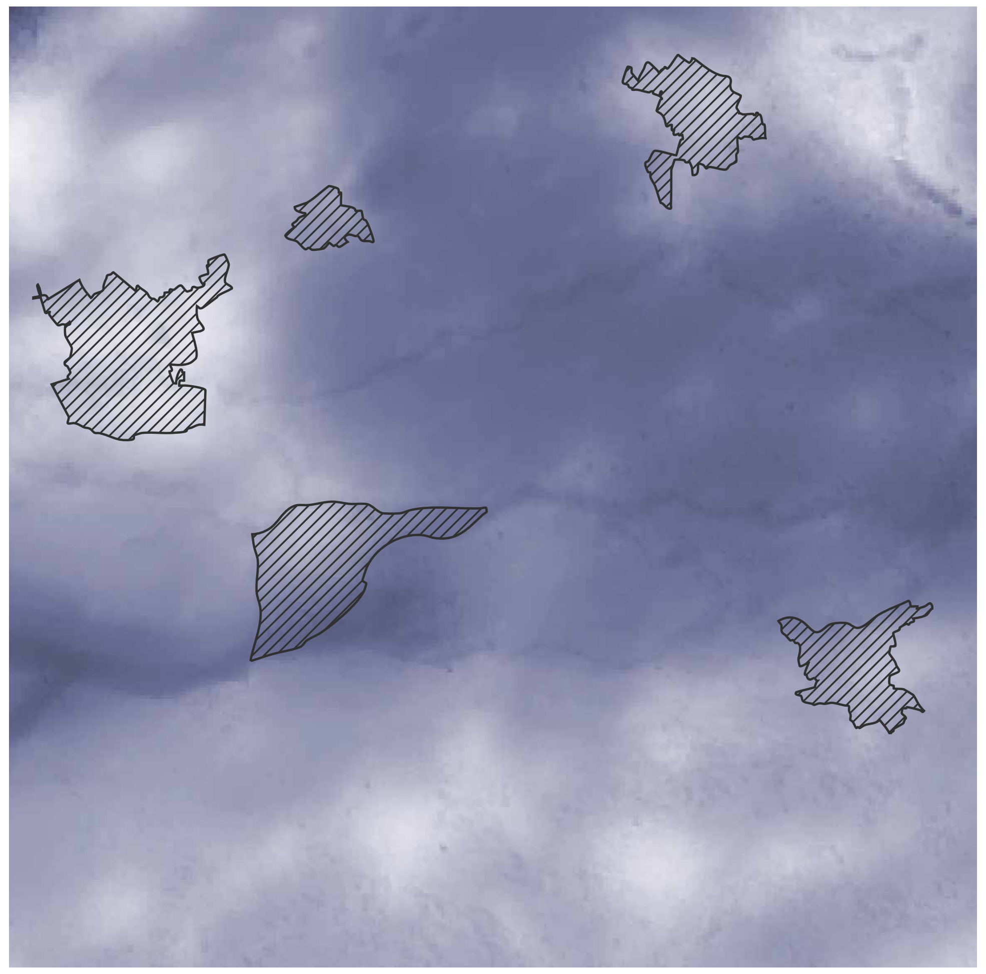
Flood risk Dordrecht



Windspeed
The wind speed analysis provides insights on possibilities for wind energy. The electrical windmills produce energy at around 100 meters high. In the analysis the locations with the highest wind speed at this altitude are darkest, thus being the highest in potential regarding energy production by wind. On a national scale, the water seems to have the highest wind speed (see appendix), still, regionally there are also potential areas where the production of wind energy is possible.

Nature protection policies
One of the bigger spatial restrictions for the potential in energy production can be found in protected areas and environmental restrictions. The Natura 2000 areas and other protected areas are shown in this analysis. These restrictions are valid now, but in 150 years these borders and placements will be different. They are not just restrictions, as they can also serve as a base to preserve and extend natural areas, to define where space can be given back to nature and rivers. The analysis causes the information needed to find spatial proposals to create networked stepping stones for nature.

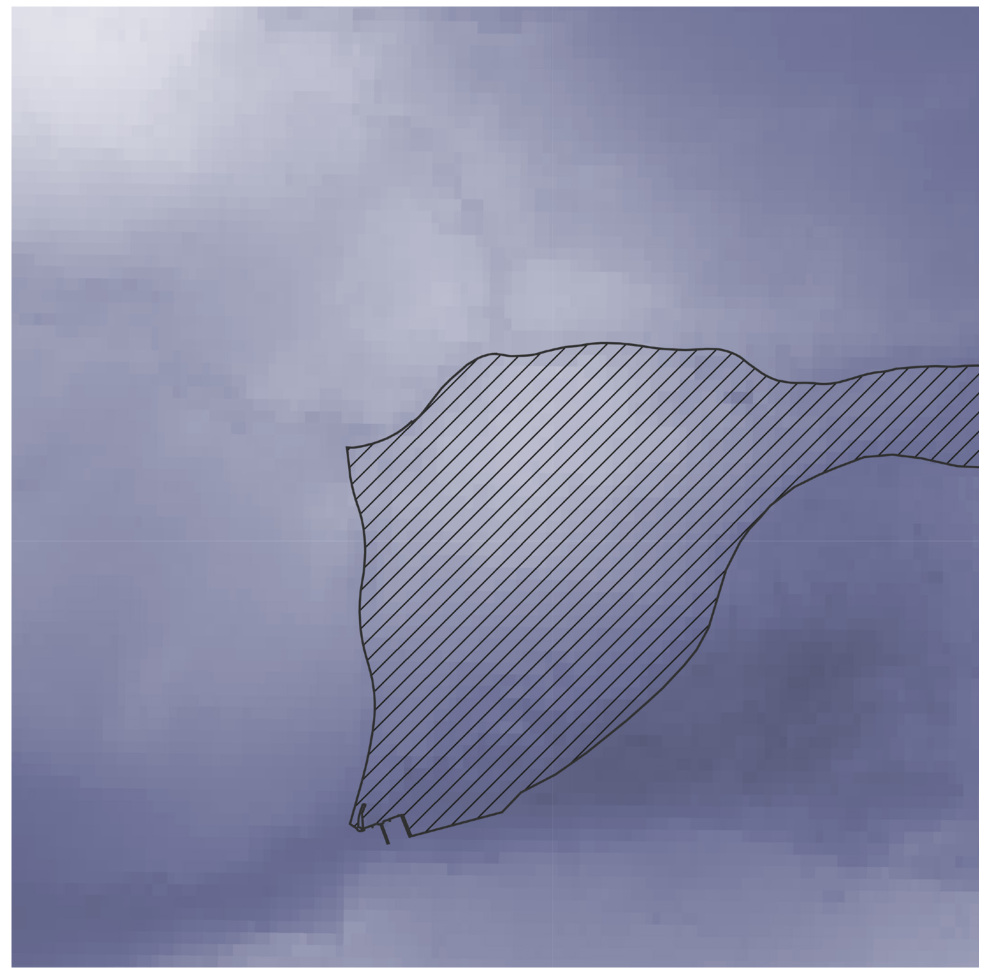
Wind speed region



Lowest windspeed (6,372 m/s)
Highest windspeed (9,952 m/s)
Municipality outlines

N 0 5 10 15 20 25 km

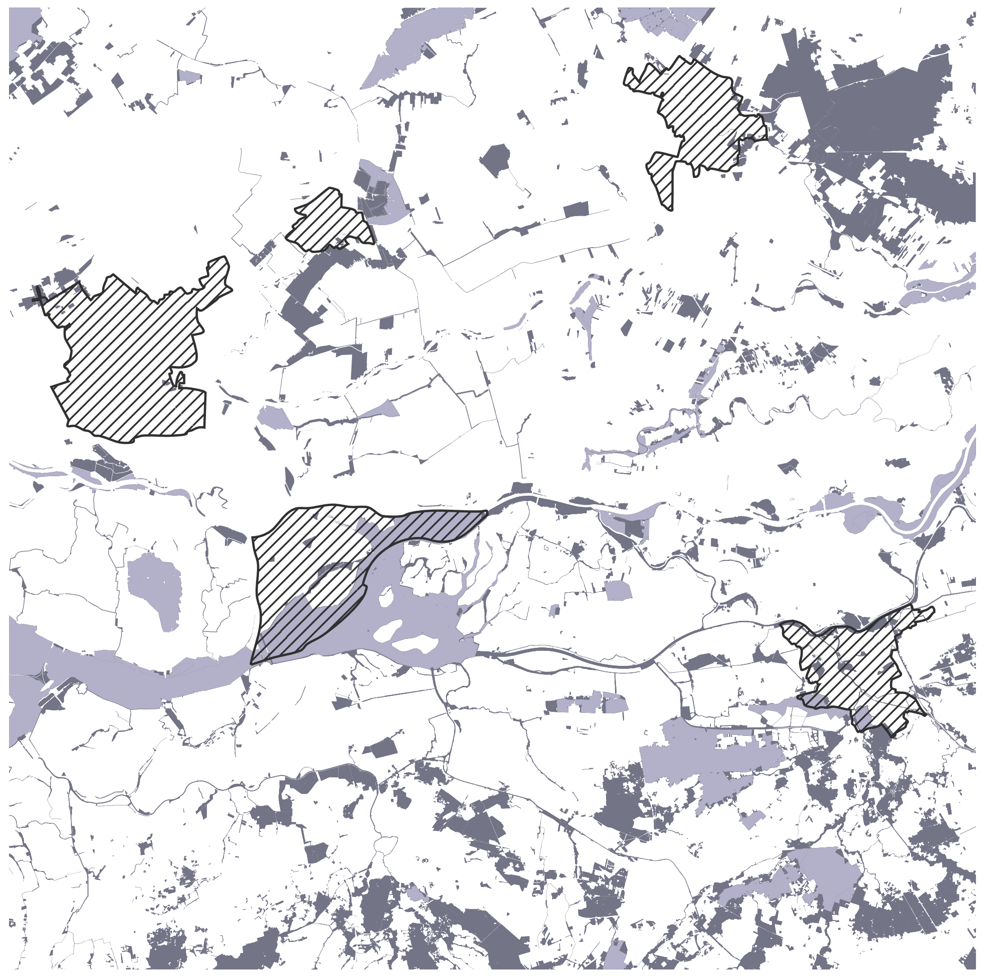
Wind speed Dordrecht



Lowest windspeed (6,372 m/s)
Highest windspeed (9,952 m/s)
Municipality outlines

N 0 1 2 3 4 5 km

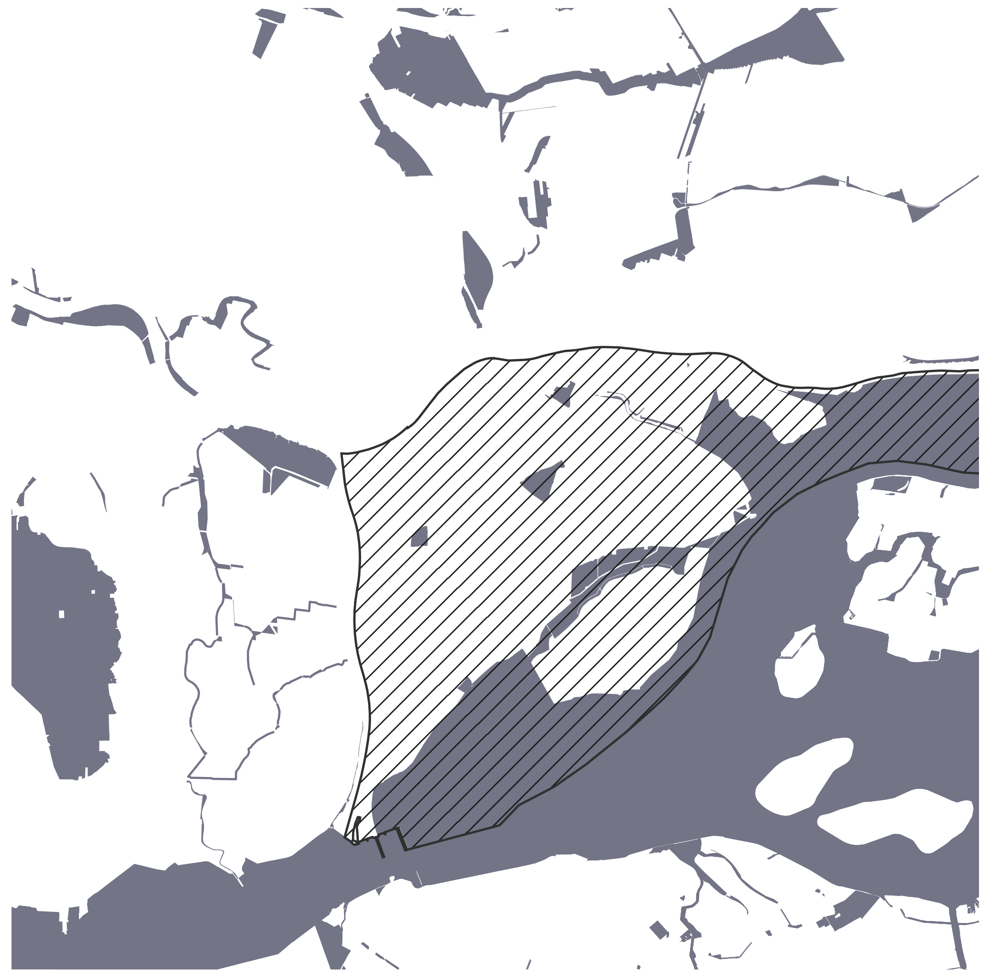
Nature protection policies region



Natura 2000
National protected area
Municipality outlines

N 0 5 10 15 20 25 km

Nature protection policies Dordrecht



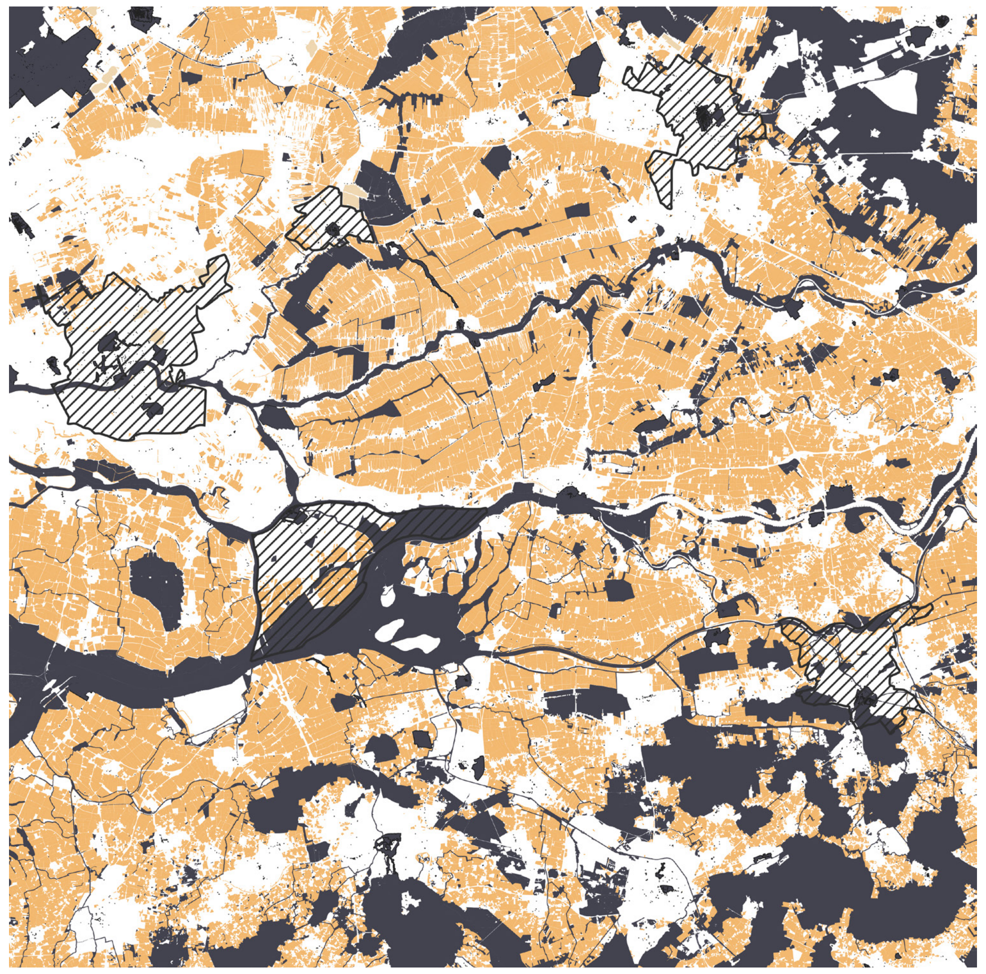
Natura 2000
National protected area
Municipality outlines

N 0 1 2 3 4 5 km

SPATIAL ANALYSIS POTENTIAL

Renewable energy based on wind and sun are the frequently used in the Dutch Landscape. Thesee maps are showing spatial restrictions, areas that are under investigation, and potential locations that seem to fit all the needs and possibilities. Because the project focuses on a timespan of 150 years, even particular restriction areas can change and pose as a possible production area. Areas that need to be investigated to determine if they are fit for production might come out as unfit at this moment of time, but with new technologies, a different societal context or other external effects, such areas can still become a possibility for renewable energy production.

Solar energy potential region



- 'Hard' restrictions on solarfields and use on top of building
- Potential available area: land
- Potential available area: water
- Municipality outlines

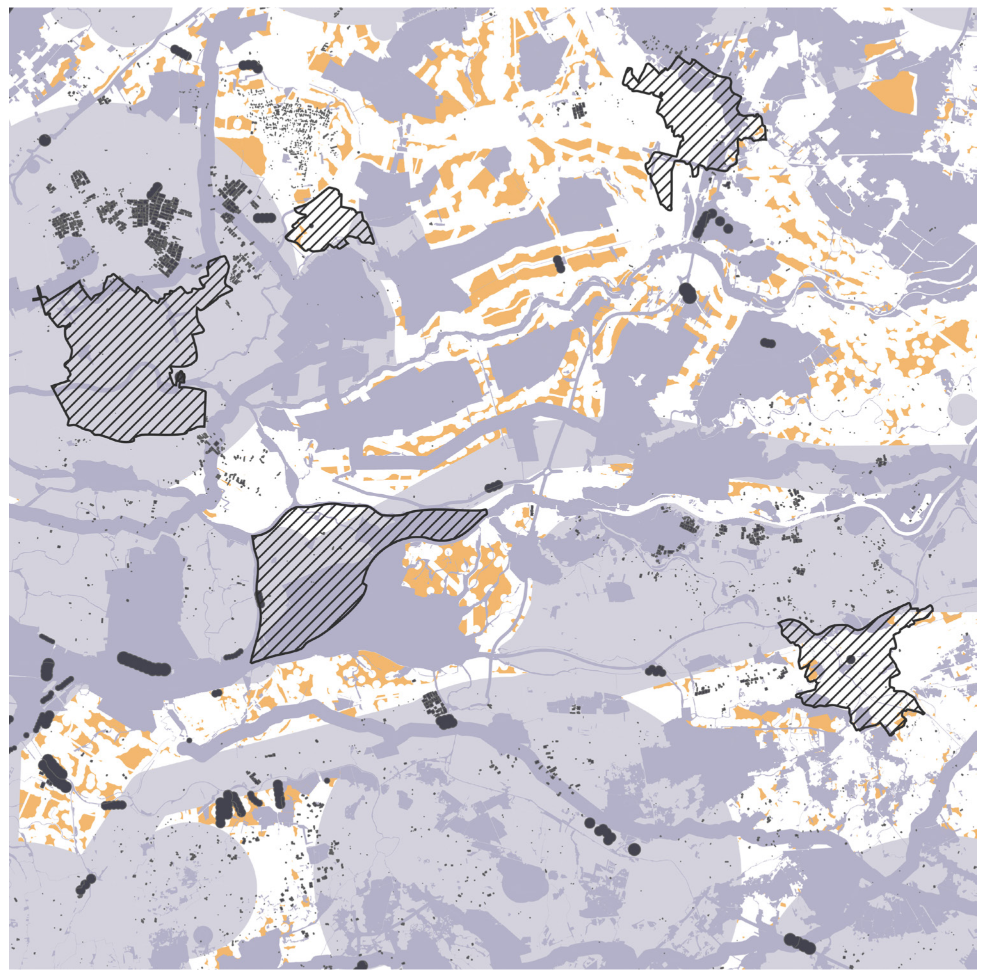
N 0 5 10 15 20 25 km

Solar energy potential Dordrecht

- 'Hard' restrictions on solarfields and use on top of building
- Potential available area: land
- Potential available area: water
- Municipality outlines

N 0 1 2 3 4 5 km

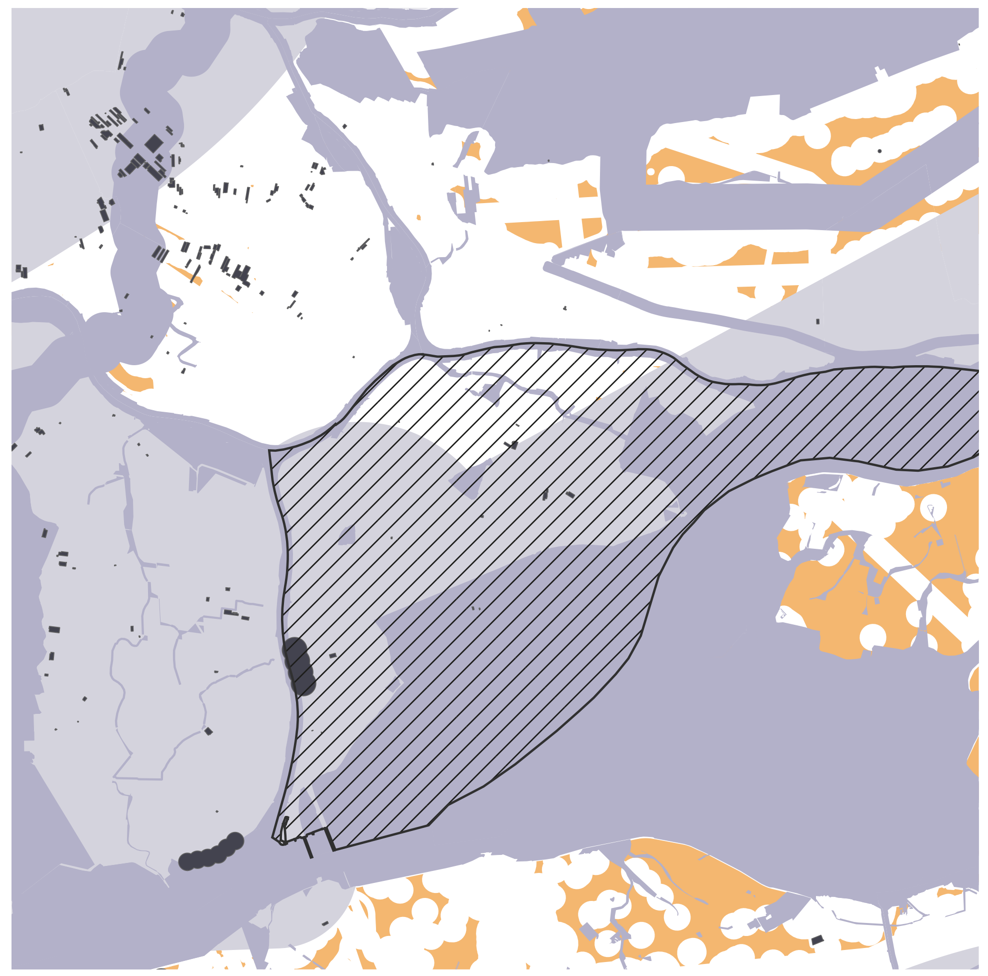
Wind energy potential region



- Potential restrictions due to flight activity
- Potential restrictions due to nature, culture or silence
- 'Hard' restrictions due to excisting structures and governmental water limitations
- Potential available area
- Municipality outlines

N 0 5 10 15 20 25 km

Wind energy potential Dordrecht



- Potential restrictions due to flight activity
- Potential restrictions due to nature, culture or silence
- 'Hard' restrictions due to excisting structures and governmental water limitations
- Potential available area
- Municipality outlines

N 0 1 2 3 4 5 km

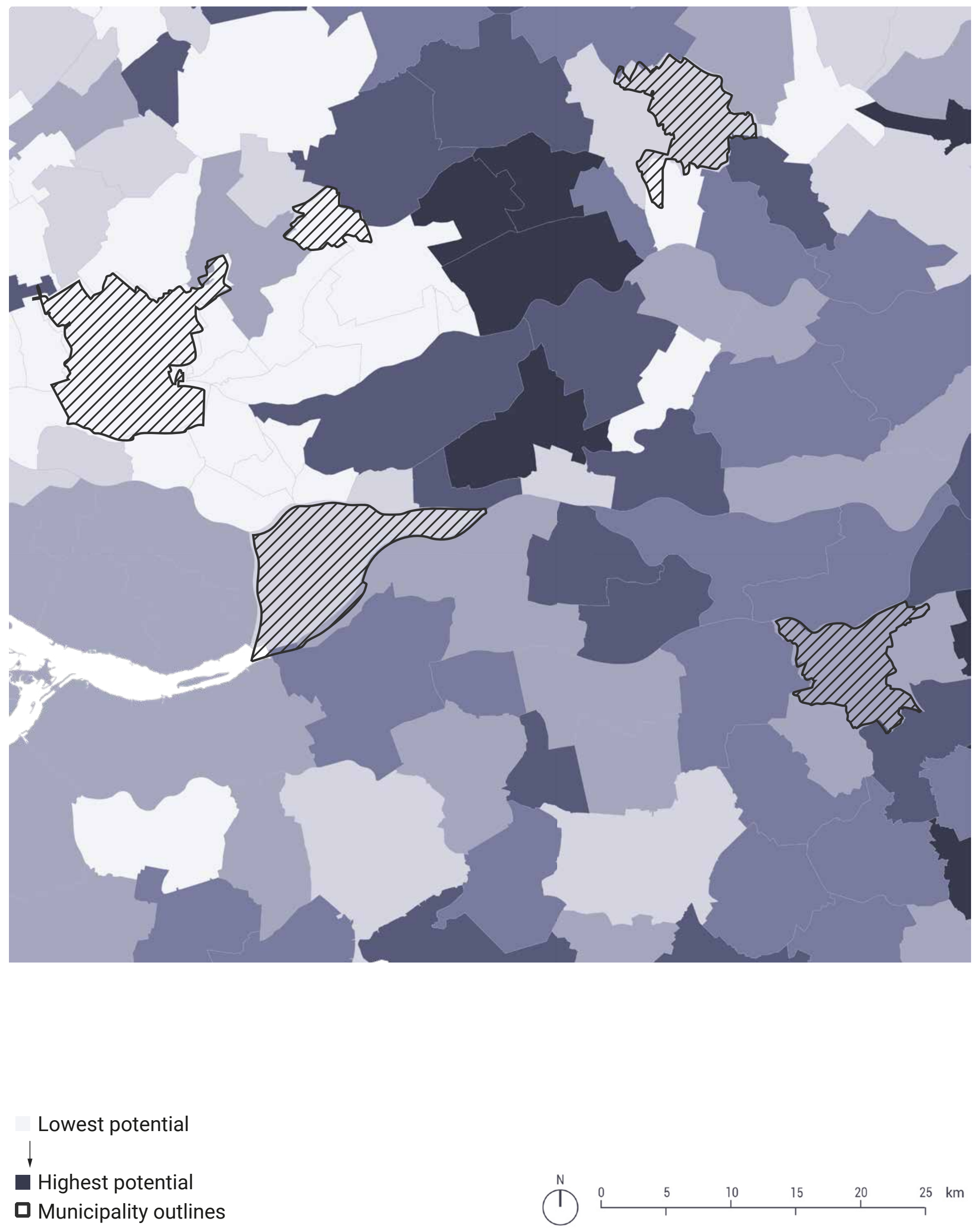
Geothermal potential
Geothermal power is electricity originating from geothermal thermal energy. For this form of energy, the thermal energy is found in the crust of the earth. In the analysis map it is shown that in general in this region there is a low potential for this energy form, except for a few areas. However, a low potential does not mean no potential in this case, but there preferred areas. Analysing the potential for the Dordrecht case study, it is shown that there are a few high potential areas right near the city' borders.

Biogas potential
Biogas is energy is produced with gas that is the result of bioenzymic processes. This can often be found near agricultural sites, which is also shown in the analysis map. Right next to the borders of cities there is a higher potential than within the cities. This form of renewable energy aligns with our strategy.

Geothermal potential region

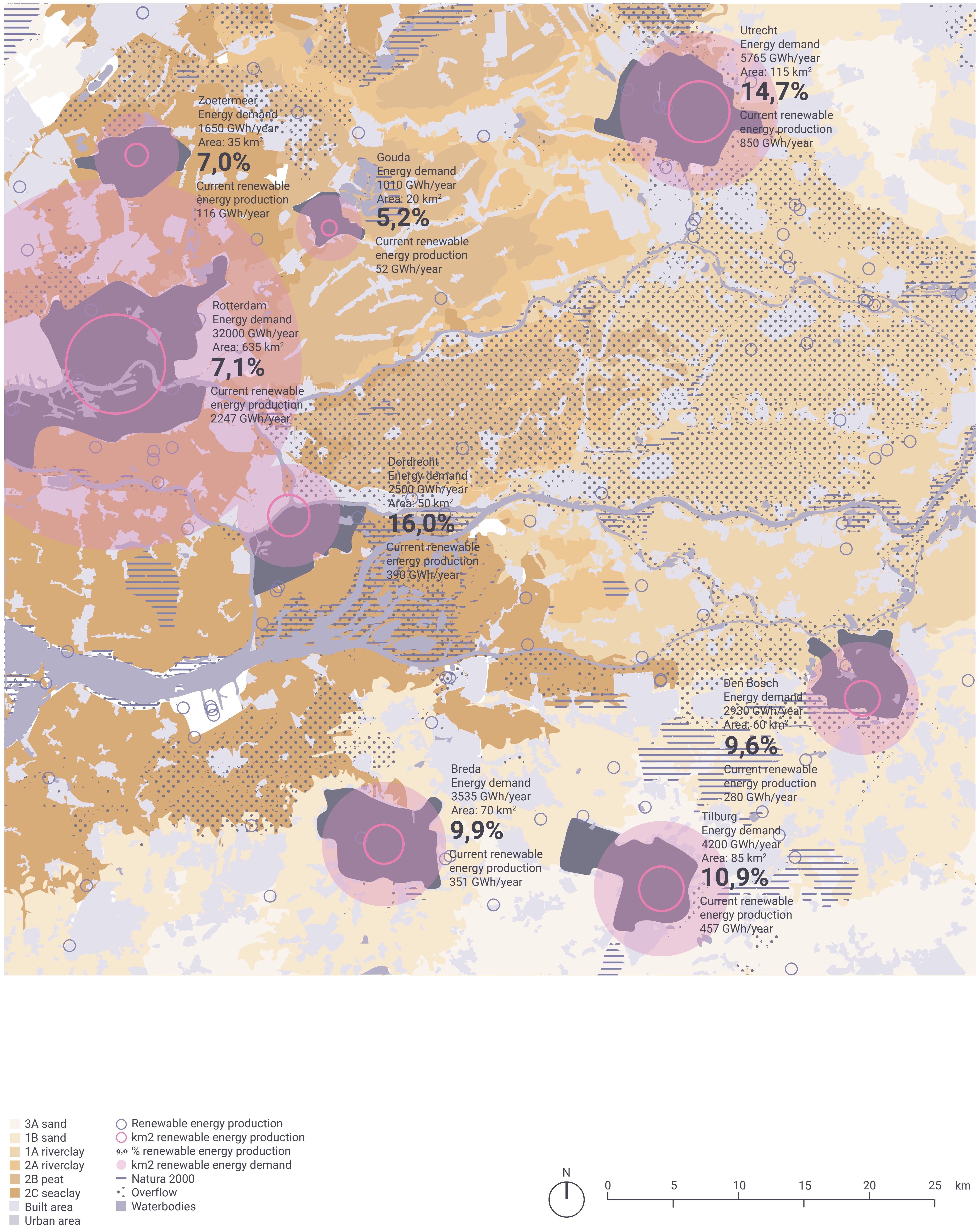
Geothermal potential Dordrecht

Biogas potential region



Biogas potential Dordrecht

SYNTHESIS MAP



The combination of all layers of the spatial analysis reveal the possibilities of creating local energy systems around the cities of the Netherlands. By focusing on one of the more dense urban regions, this synthesis map shows that our strategy needs to adapt within various dynamic spatial conditions.

Firstly, it is important to recognize different landscape typologies. By combining the analysis of soil, height, and water, different bioregions emerge in the landscape (see appendix). These bioregions ask for a different realization of the methods for agricultural production, energy production, and rewilded nature. Some energy production methods benefit from dry sandy soil, where others benefit from wet peat soil. By recognizing these differences in the landscape, farmers all over the Netherlands can easily implement the most suitable use to their land.

Secondly, both the possible overflow areas as the protected nature areas need to be taken into account when repurposing the agricultural land. Both of these areas complement and conflict with the three land uses - agricultural production, energy production, and rewilded nature - in different ways. For example, overflow will shape our future landscape, meaning that some agricultural land will have to make space for naturally fluctuating rivers, whilst other land can experiment with wet agricultural methods.

Thirdly, this synthesis map visualizes the space that is needed to provide the residents of a city both in food as in energy. Currently, about 5 to 15% of the energy demand of Dutch cities is produced with renewable methods. To visualize how much space is needed for renewable energy production, we used a thumb rule of 60 GWh/year/km2 (see appendix). The smaller circle represents the current production of these renewables in space, the bigger transparent circle represents the needed space to produce all energy with renewable methods.

The information of this synthesis map altogether will help in spatializing the Farmer Organization borders, and in the possibilities of repurposing their agricultural land to shift into a secure and leading position in the transition towards a sustainable society.

SPATIAL VISION

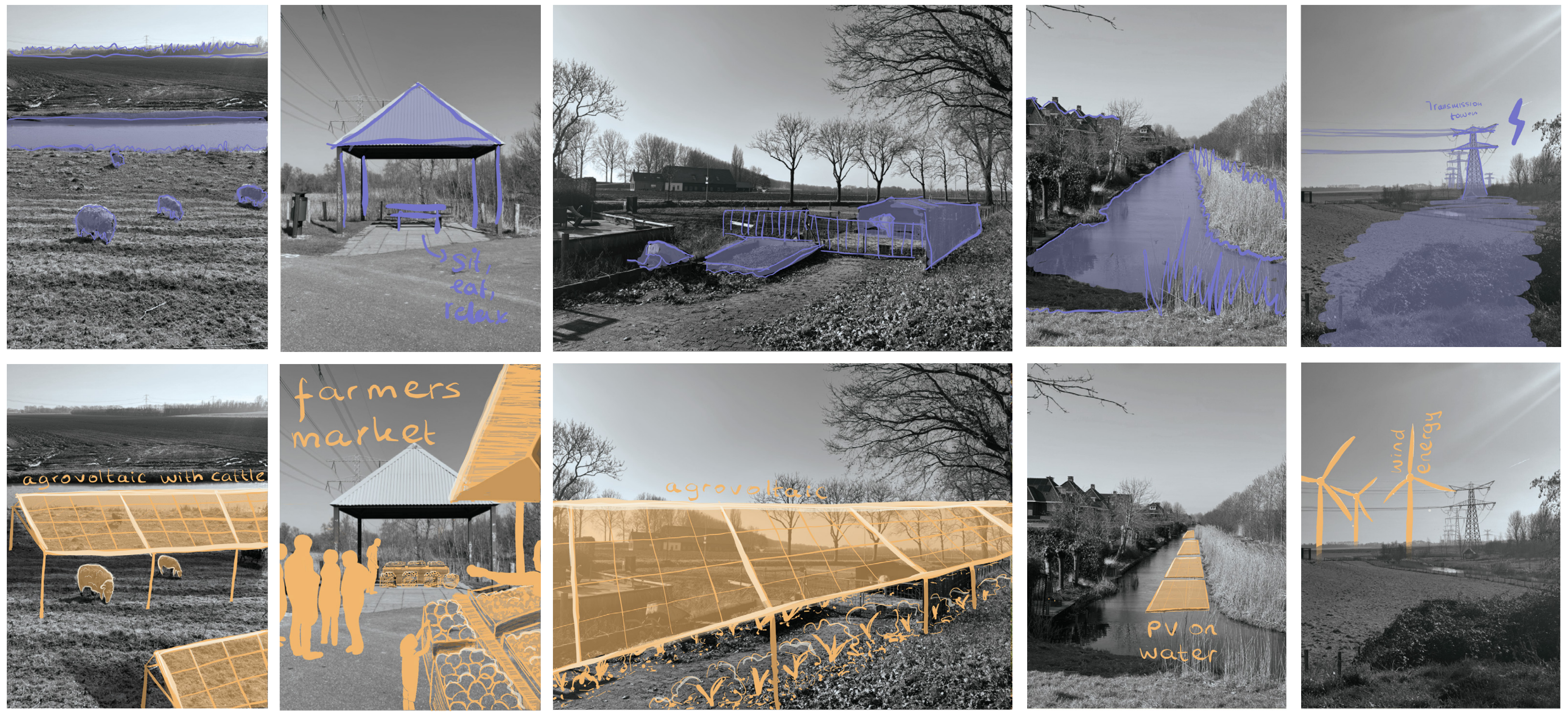
To determine the implications of the center focus of the conceptual framework, this chapter envisions the possibilities of the local energy system. Based on research into the farming community, the energy transition, the governance and spatial analysis, this chapter formulates and elaborates on a vision. The vision is explained through a vision statement, vision maps and toolboxes.

VISION STATEMENT

As discussed in the problemstatement, with the current direction of energy production the Netherlands will not reach the goal of climate neutrality by 2050. Existing methods are insufficient, storage is lacking, and space is scarce. Meanwhile, farmers bear the responsibility of consistently changing climate policies, and the Not In My BackYard mindset blocks drastic transformation of agricultural areas. This also leaves farmers in uncertainty while their land becomes a strategic asset for the green transition. Moreover, the current profit model of energy suppliers demotivates local participation in realising solutions. This conflict is reshaping the Dutch countryside. The pressure to replace farmlands with solar parks, wind farms, and energy storage infrastructure disrupts rural traditions, threatens food production and challenges the identity of the landscape.

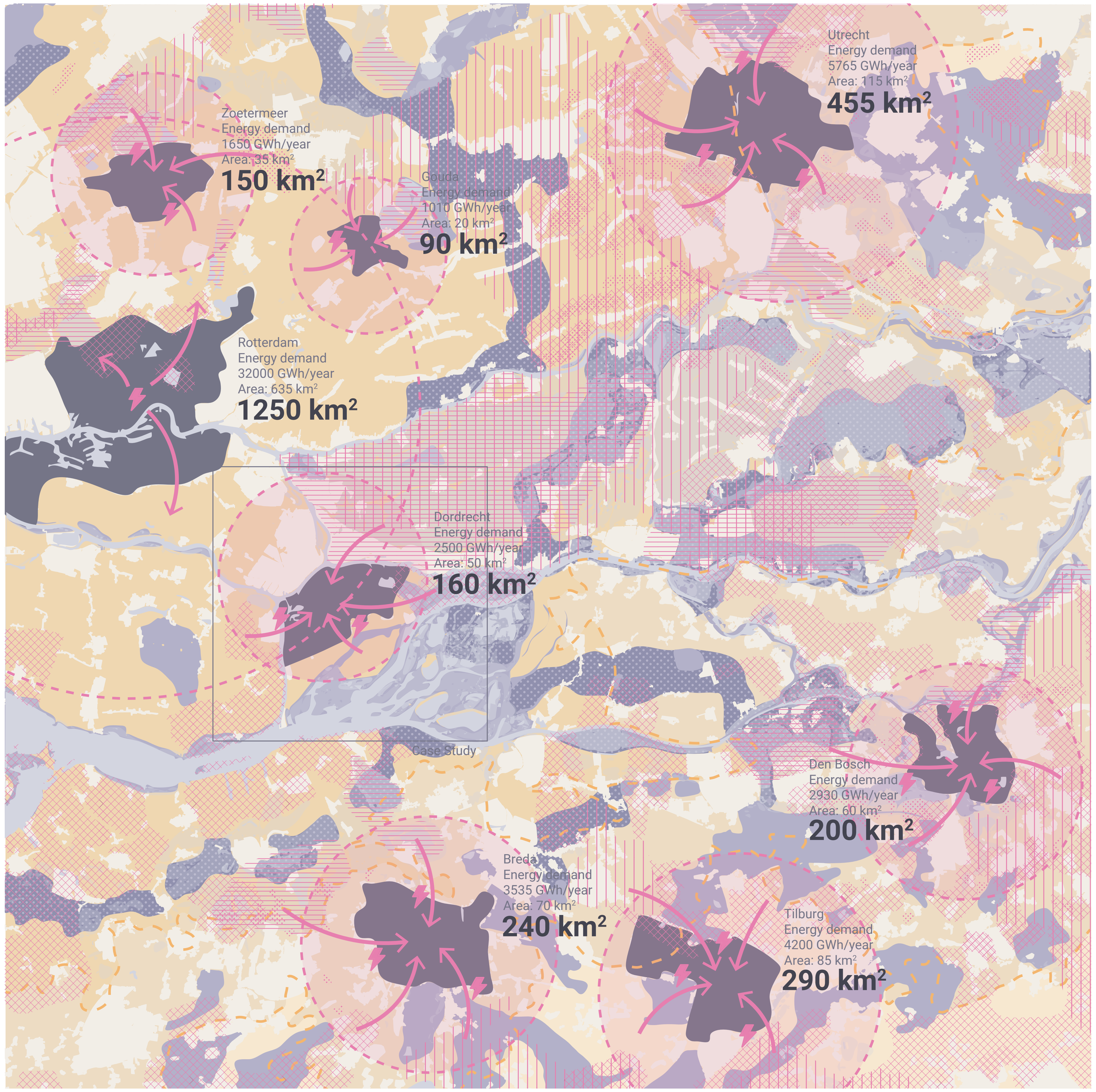
Rethinking the relationship between land, energy, community and politics, can transform these challenges into a bold and innovative approach that bridges these sectors. **By 2125, agricultural land will produce and store all green energy of the Netherlands and farmers will hold a secure position within a sustainable urban-agricultural system.** Eliminating the current profit model of energy suppliers will result in a kickstart for local participation, while balancing the spatial demands of renewable energy and the identity of agricultural land. Building upon these spatial possibilities gives farmers the potential to be the solution in the search for space within an innovative local energy system.

BEFORE



AFTER

REGIONAL VISION MAP



This map illustrates how the strategy can be spatialized in one of the denser urbanized regions of the Netherlands. The basis of rethinking relationships lies in engaging all involved stakeholders, both human and non-human. To plan the most durable restructuring of the landscape, which is resilient for unforeseen events, the knowledge of these diverse stakeholders is crucial. The vision is a combination of wishes from farmers, responsibilities of governmental bodies, and environmental demands, that lead to a better understanding of the possibilities of the local energy system. In this vision, farmers are posed as the solution towards the energy transition. To stimulate the shift to this secure position, the spatial integration of the strategy is flexible to different needs, as it asks farmers to shape their own desired future.

FARMERS. This means that the vision is based on preserving the identity of the agricultural land and its activities. We envision a future where farmers still perform agricultural activities, but balance this with the production of the local energy demand. Together we can experiment with innovative multipurpose solutions to restructure the agricultural land around cities. Thus, there is no need for a drastic shift to complete energy production on their land, as it can be complementary to the preservation of agricultural qualities.

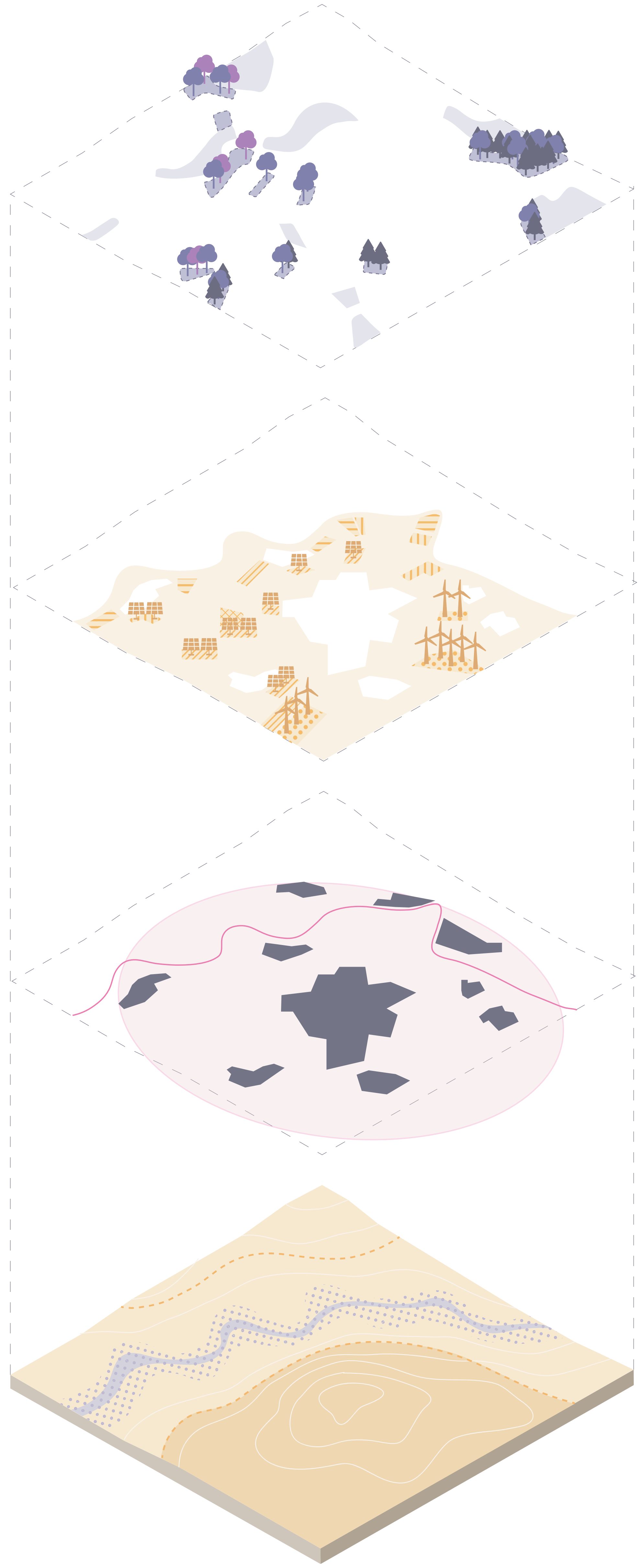
GOVERNANCE. Farmers do not have to face this shift alone, as the farmers around the cities united within the Farmer Organization. Together with the RijksEnergieStaat, the farmers rearrange their land to realize the division for food production, energy production and rewilded nature. Since each individual farmer holds a different position within the strategy, the organization sustains participation in different manners. Through the management of the Farmer Organization, the outcome of these different positions will still provide the energy and food demand of a city, whilst also making space for rewilding nature.

SPATIAL CONDITIONS. The boundaries of this organization are not led by administrative boundaries, but by bioregion boundaries. These regions are determined by categorizing spatial conditions, based on a variety of data on soil typology, topography, water bodies and water overflow. This approach leads to harmonizing human activities within the ecosystem of the surrounding landscapes, to ensure long-term sustainability. The bioregions define which agricultural lands should be united, as they naturally deal with similar spatial dynamics.

LOCAL ENERGY SYSTEM. Together, these three concepts set the foundation of the local energy system. The size of this system is dependent on a city's energy and food demand. In the vision map, the sum of this demand is represented with circles. To get a better understanding of how the division of the land can be determined, two components are spatialized in the vision map. Firstly, the bioregions influence the shape of the organization, the variety of agricultural activities, and the suitable energy production methods. Secondly, not all methods of energy production can be implemented anywhere, and thus it is crucial to process the data on the potential of different energy production methods.
By combining these components with existing spatial qualities of the built area, waterbodies, overflow areas and natural areas, the different Farmer Organizations can derive conclusions to repurpose the land in the most suitable manner.

STEPS IN SPATIALIZING VISION

Simply drawing a circle around a city will not be sufficient to explore the spatial implications of our vision. A couple of clear steps will help the Rijksenergiestaat and the municipalities to create an operating local energy system.



4.

Expand natural areas
Lastly, some land within the organization will be rewilded and given back to nature. Stepping stones for nature can arise almost anywhere, but it is most interesting to see if they can reduce distances between *existing natural areas*. Moreover, agricultural land that is *prone to flood* could be transformed into a natural retention zone.

3.

Built energy production
Thirdly, the organization has to repurpose the land to produce the needed energy. For this, they can rely on the spatial data of *energy production potentials*. This data makes the choice for the most suitable production method simpler.

2.

Establish Farmer Organization
Secondly, the size of the Farmer Organization depends on the *sum of energy demand and food demand* of the specific city. Moreover, the surrounding *built environment* needs to be extracted. With this, the right amount of agricultural land is united in the organization, whereafter the farmers can divide ratios of the total food production, energy production, and rewilded nature to their own wishes.

1.

Define bioregions
Firstly, we need to define the bioregions. As explained before, this is done through overlapping *soil typologies*, *topography*, *waterbodies*, and *overflow areas*. The Farmer Organization will not be shaped by administrative borders, but by bioregion borders. This is because the farming sector is dependent on environmental conditions. By uniting farmers that have to deal with similar conditions, it will be easier to, for example, share knowledge on the transition.

3 Dry forests
1 Dry grassland
2 Wet marshland
Bioregion boundary
Built area
Urban area
Waterbodies
Medium overflow
Least overflow

km² renewable energy production and food production
250 km² renewable energy production and food production
Energy distribution
Energy hub
Existing nature
New nature

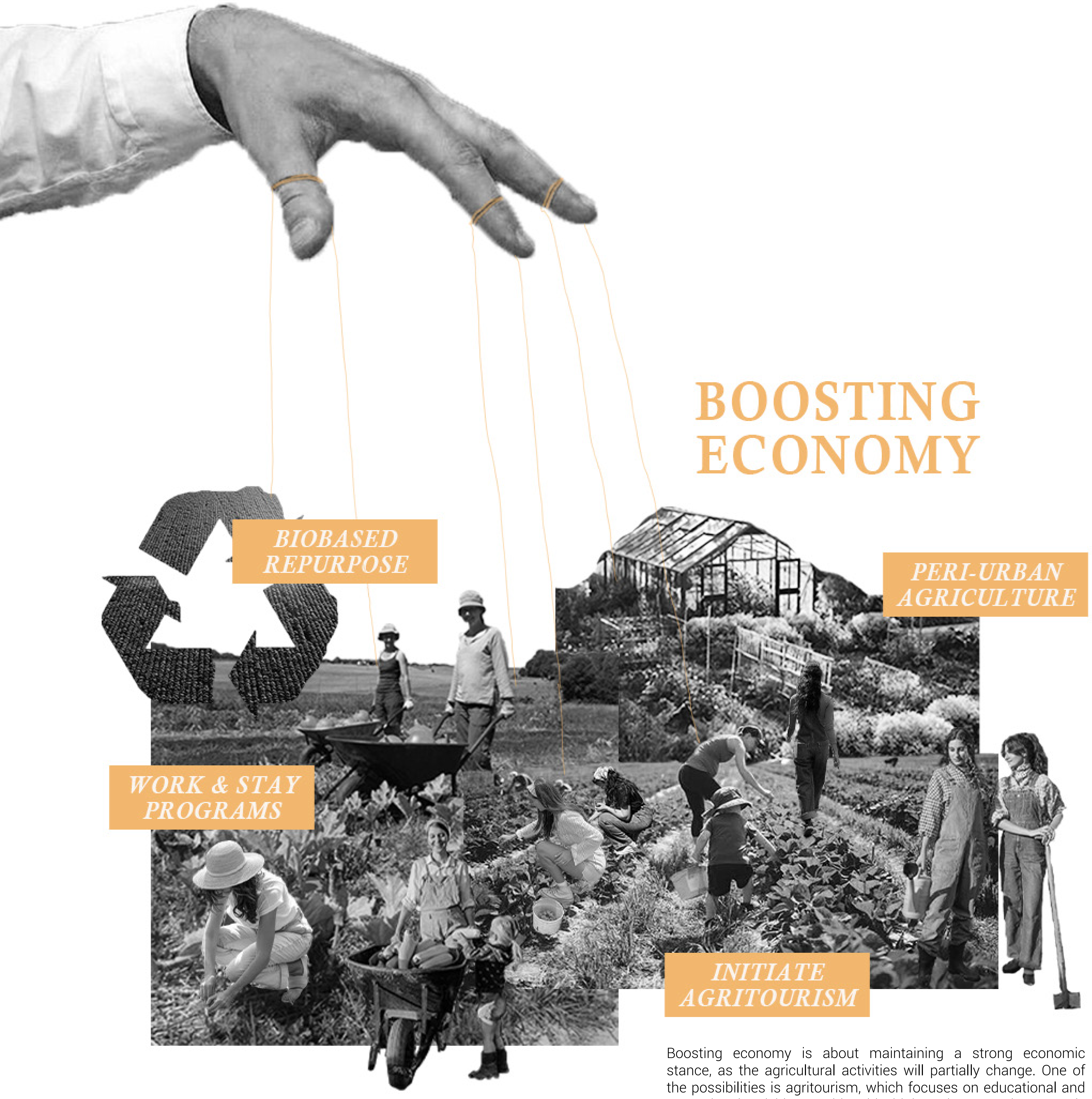
Algae energy
Biomass energy
Geothermal energy
Wind energy
solar energy: all open land

N
0 5 10 15 20 25 km

COMMUNITY INITIATIVES

Transforming the landscape cannot be done by only following a couple of regulatory steps. A resilient local energy system depends not only on the technical and administrative aspects of distribution networks, energy hubs, and production fields, it also depends on a supportive mindset within our society. We cannot expect the farmers community to participate in our strategy, when some of them still feel misunderstood. Therefore we need to explore how to promote mutual understanding and respect. It is vital for the local system to create a sense of community of the urban and rural as a whole. Besides the importance of improving access to services and protecting environmental qualities, we distinguish three manners of societal initiatives to strengthen the bond of different people within our society, to develop a vibrant local system (Hogonext, 2024).

BOOSTING ECONOMY



Boosting economy is about maintaining a strong economic stance, as the agricultural activities will partially change. One of the possibilities is agritourism, which focuses on educational and recreational activities. Besides this, biobased repurposing not only minimizes agricultural waste, but also stimulates creative minds to explore different uses. To preserve a smooth transition from urban and rural landscapes, peri-urban agriculture promotes agricultural activities in these fringe areas. Lastly, farmers can be helped out with their activities through work & stay programs, where people get temporary employment in exchange for residence on the farm.

Sharing knowledge is about educating both within and outside the farmers community. To lower the threshold of transitioning, a farmer-to-farmer platform provided by the Farmer Organization can help farmers to share experiences and knowledge. Moreover, it is important to keep innovating and experimenting ideas by connecting experts in different fields, including farmers, researchers and scientists. Most importantly, farmers need to be offered advice on how they can shape their energetic agronomy in the most suitable manner, within agro-energy academies. Lastly, farming knowledge should be shared with children, through youth farm programs, with educational and playful activities. This will grow understanding and respect for the natural world from a young age supporting the envisioned long-term societal change.

SUPPORTIVE COMMUNITY

Supportive community is about initiatives that connect people culturally. The most simple way is hosting a weekly market out in the rural landscape, where local farmers sell their products. Moreover, agri-cultural events, such as seasonal harvest festivities facilitate a moment to get together. Other than this, farm-to-table restaurants should be promoted, as these rely on the seasonal ingredients through the collaboration with local farms. Lastly, community-supported agriculture programs help farmers with an upfront payment by locals in exchange for collecting a share of the harvest.

DEVELOPEMENT STRATEGY

As the final component of this project, this chapter addresses the spatial implementation of the vision through a strategy. The project provides a framework for a radical approach to the energy transition across the Netherlands. To demonstrate how the transition can be executed locally, this chapter presents a phased timeline of the strategy and designs at the smallest scale. This is illustrated through a case study of Dordrecht and its surroundings, complemented by recommendations at the national scale level.

Completing the vision of a functioning local energy system is made feasible through three crucial movements that are established within the initiation phase. These movements evolve and stimulate other shifting dynamics within our environment, which will take place during three phases of the energy transition: initiate, execute, restructure. As these three initial movements are implemented within 25 years, we can state that the strategy causes intragenerational justice. Within our generation, we will encourage societal change, introduce a new electricity law, and root environmental benefits.

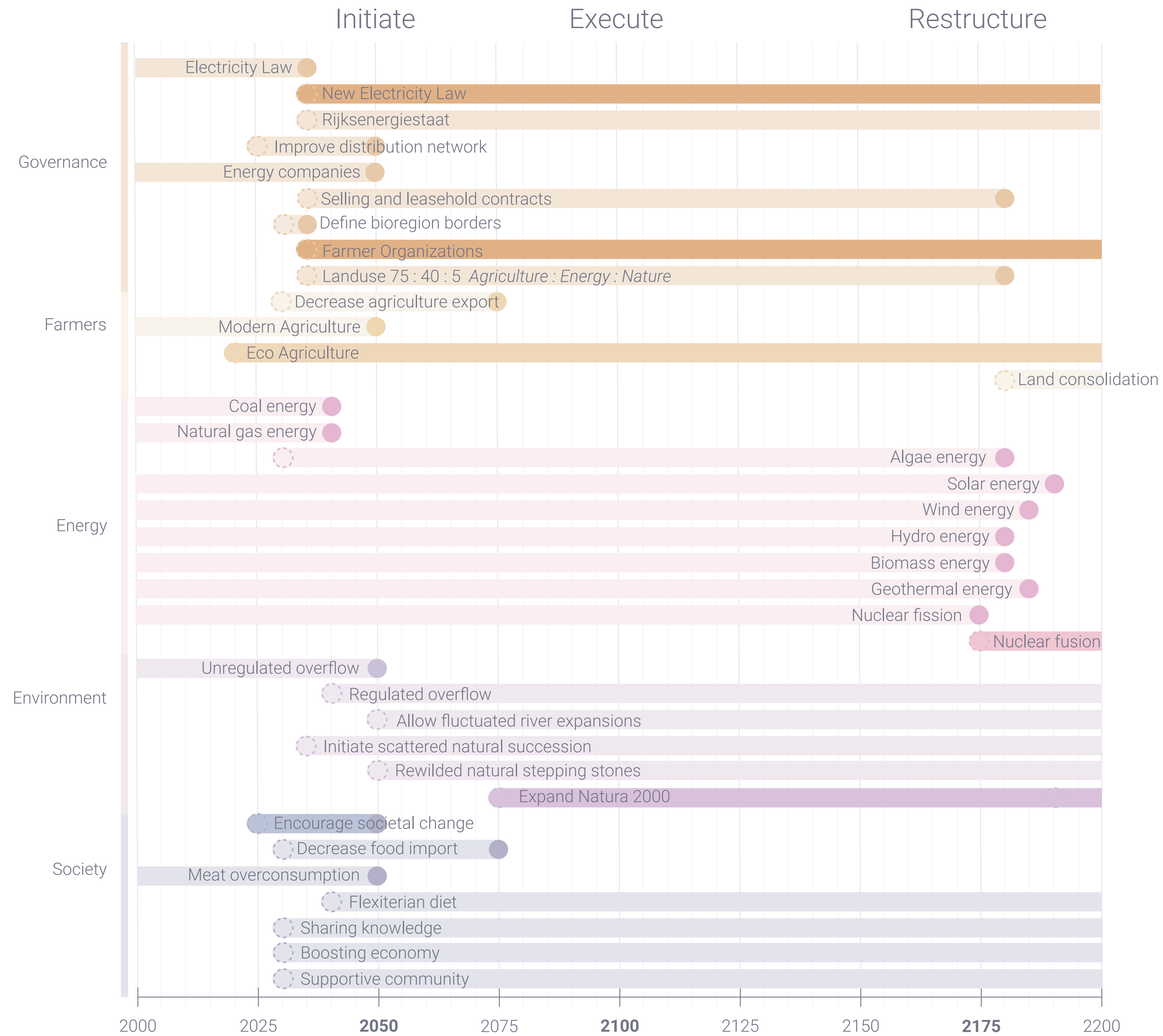
The first crucial movement contributes to sustainability through social structures. Encouraging societal change is essential to counteract a polarizing society, to stand up for vulnerable groups and to grow mutual understanding and respect. Through the community initiatives we can stimulate sustainable relationships between urban and rural societies. Moreover, to decrease our current footprint of food production, our mindset on consuming meat daily needs to change. A shift to a flexitarian diet means that we can decrease our food import, resulting in needing less space for food production.

The second crucial movement contributes to sustainability through the economy. The New Electricity Law is founded in the ideology that energy is seen as a basic necessity of modern life. It causes a fairer system of the distribution of energy through the Rijksenergiestaat and the Farmer Organization, and lowers the energy costs for each citizen. Moreover, it creates financial security for farmers, as they will profit from the production of energy. Despite the advice to decrease food export, farmers will still be able to sell their food production, only in future this will happen more locally.

The third crucial movement contributes to sustainability through the environment. The modern western approach to agriculture weakens the qualities of our landscape. Thus, we need to introduce ecologically responsible techniques to agriculture. Besides this, we will have to work with the water to mitigate fluctuating events. Whilst creating the local energy systems, parts of the land will be given back to both water to increase retention zones, as to nature to initiate natural succession, which will result in expanding Natura 2000.

Within 75 years, we expect to be in the middle of the execution phase. This phase embodies the strategy of a fair system of sharing burdens and benefits, since the elements as described above will be rooted in our environment. The Rijksenergiestaat will manage a fair distribution of energy, and together with the Farmer Organization, the production of energy, food, and rewilded nature will have taken shape. Through the leasehold sites and sold land, the landscape is resilient to spatial needs of future developments. Moreover, the execution phase offers future generations of farmers a secure and strong position within our society. The time period of this phase is undetermined, and can alter from 50 to over 150 years. Because of the sustainable and resilient character of this phase of the strategy, it establishes intergenerational justice.

In about 150 years or more, we expect to face unforeseen challenges, and integrate unforeseen innovations. One of the possibilities we explore is the realization of nuclear fusion. This would entail that we can phase out renewable energy methods, cancel leasehold contracts, and initiate land consolidation. Because of this, we can restructure the land to the spatial demands of the future.

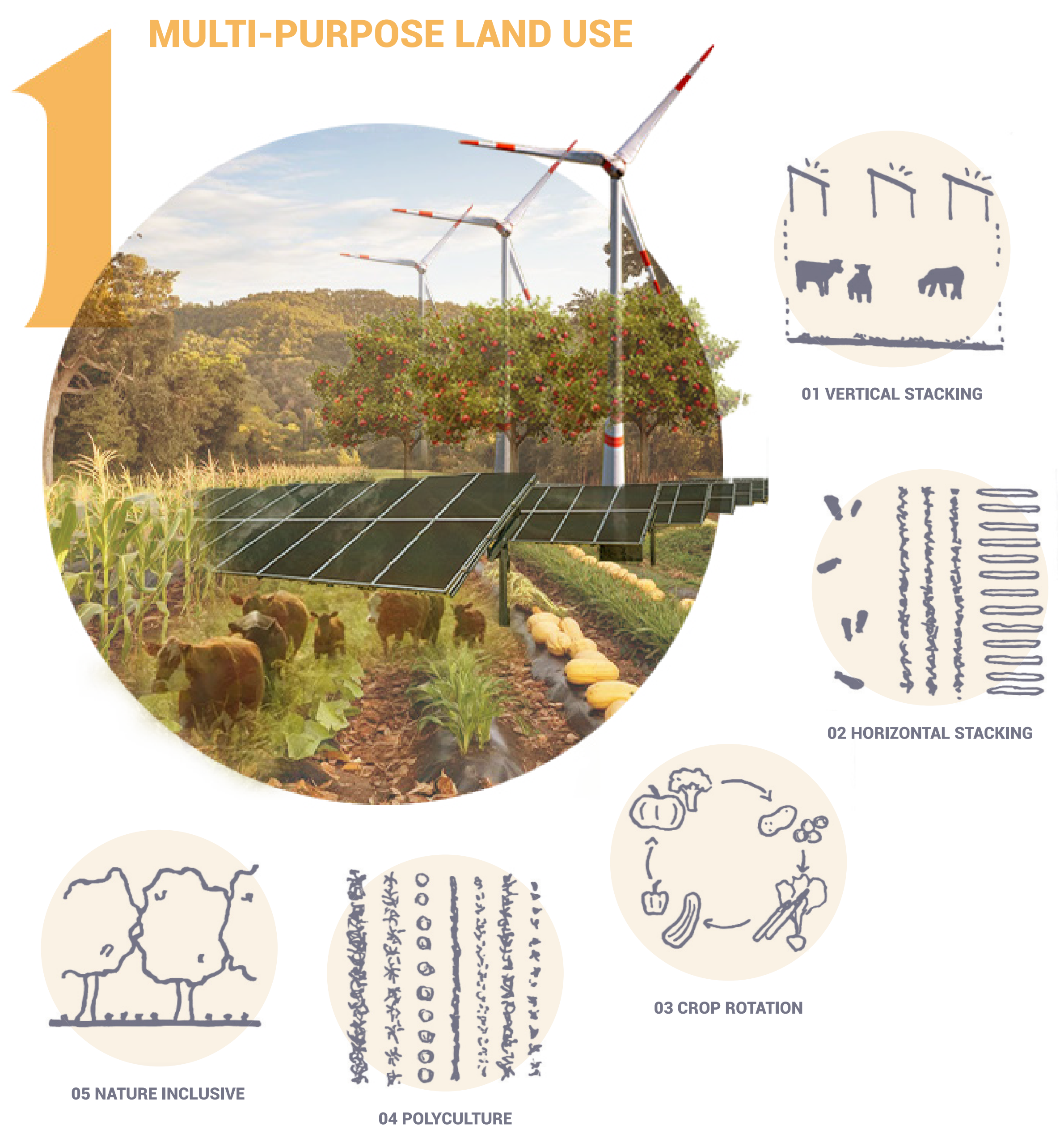


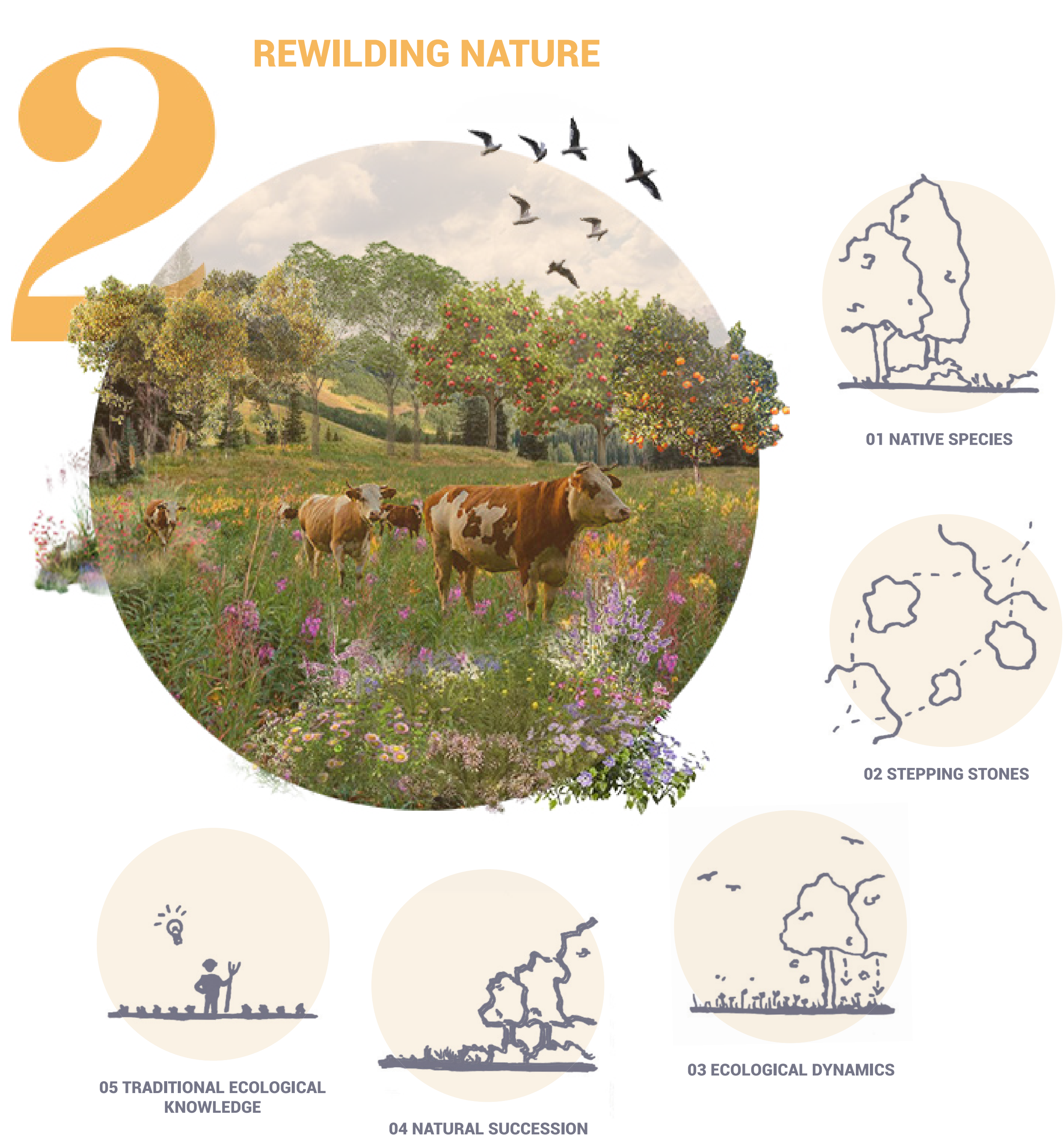
Toolbox development

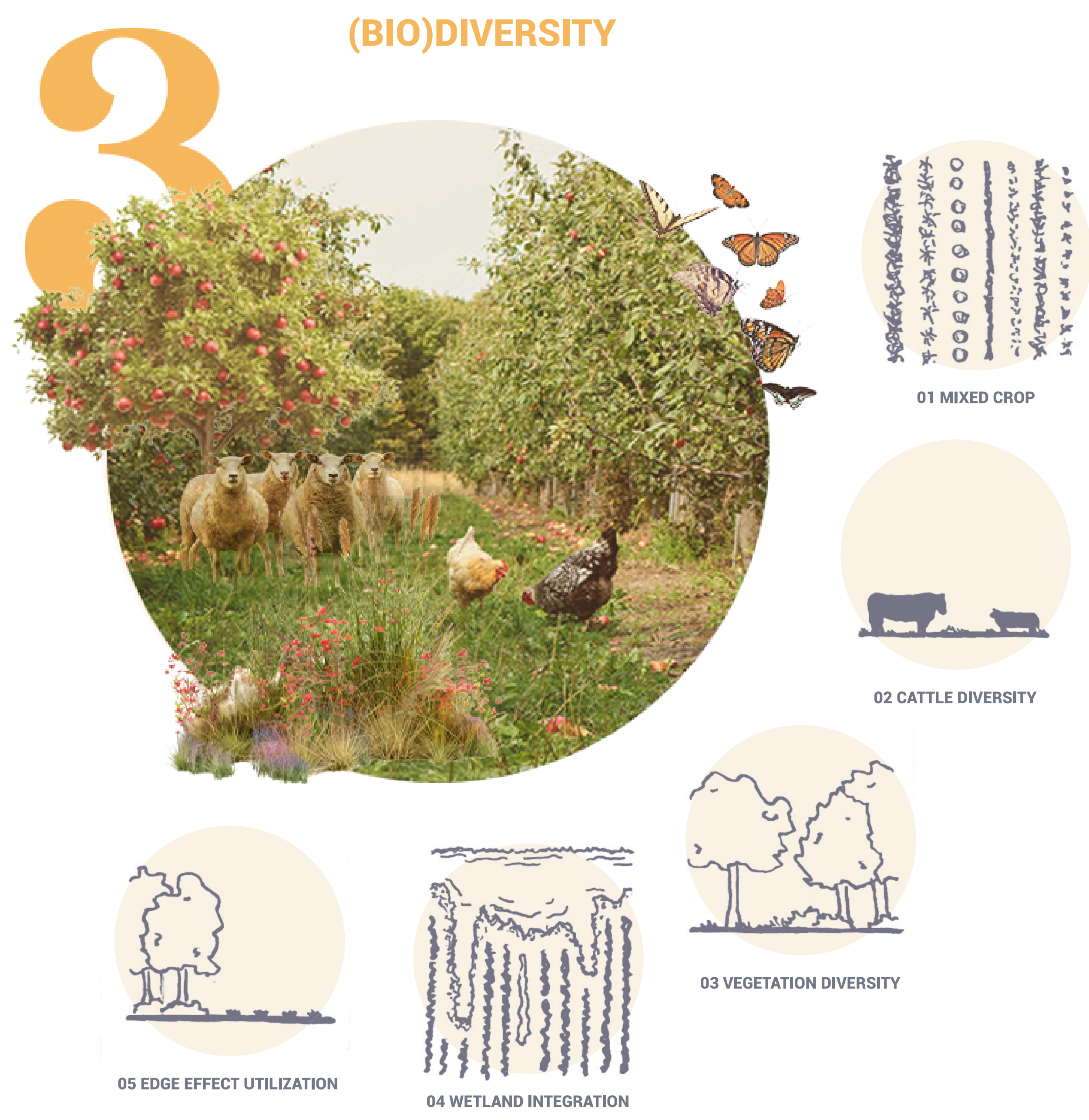
To apply spatial interventions, five foundational ecological methods have been established: multi-purpose land use, rewilding nature, (bio) diversity, circular land use, and regenerative agriculture. These approaches serve as strategic frameworks that guide the transformation of landscapes toward ecological resilience, food security, and long-term adaptability.

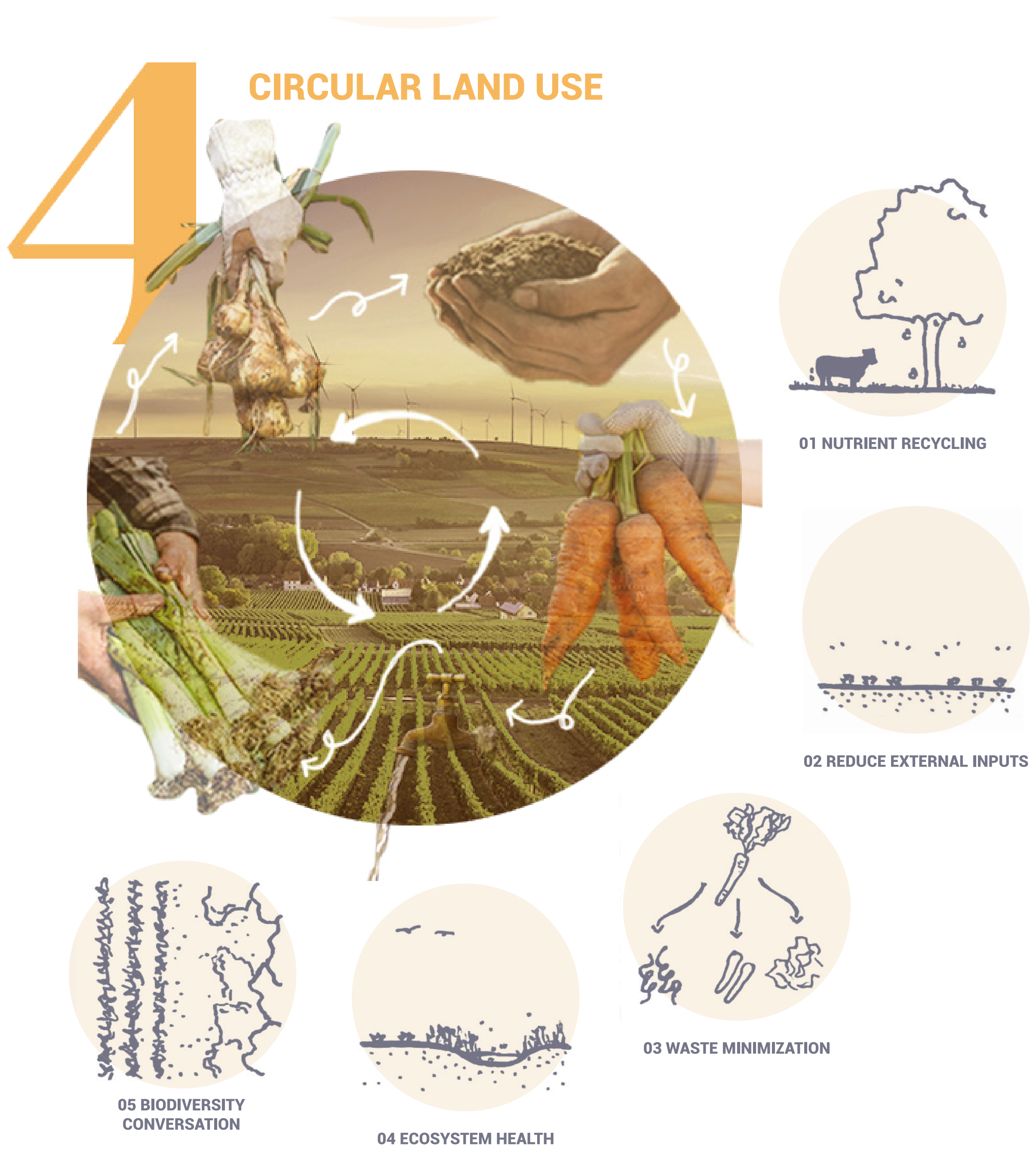
Each method is supported by five spatial principles, represented visually in the toolbox. These principles break down complex ecological goals into tangible spatial design tools. The matrix structure ensures that the interventions are not only conceptual but also operationalizable, making them measurable and scalable across different spatial conditions.

To support the decision-making for site specific interventions that respect the identity of the rural land, a complementary matrix on the next page explores the compatibility of different renewable energy production and storage methods in relation to farming, water, and landscape typologies. Each combination is evaluated based on its potential suitability, visually represented through varying sizes of circles: the larger the circle, the more favorable the combination.



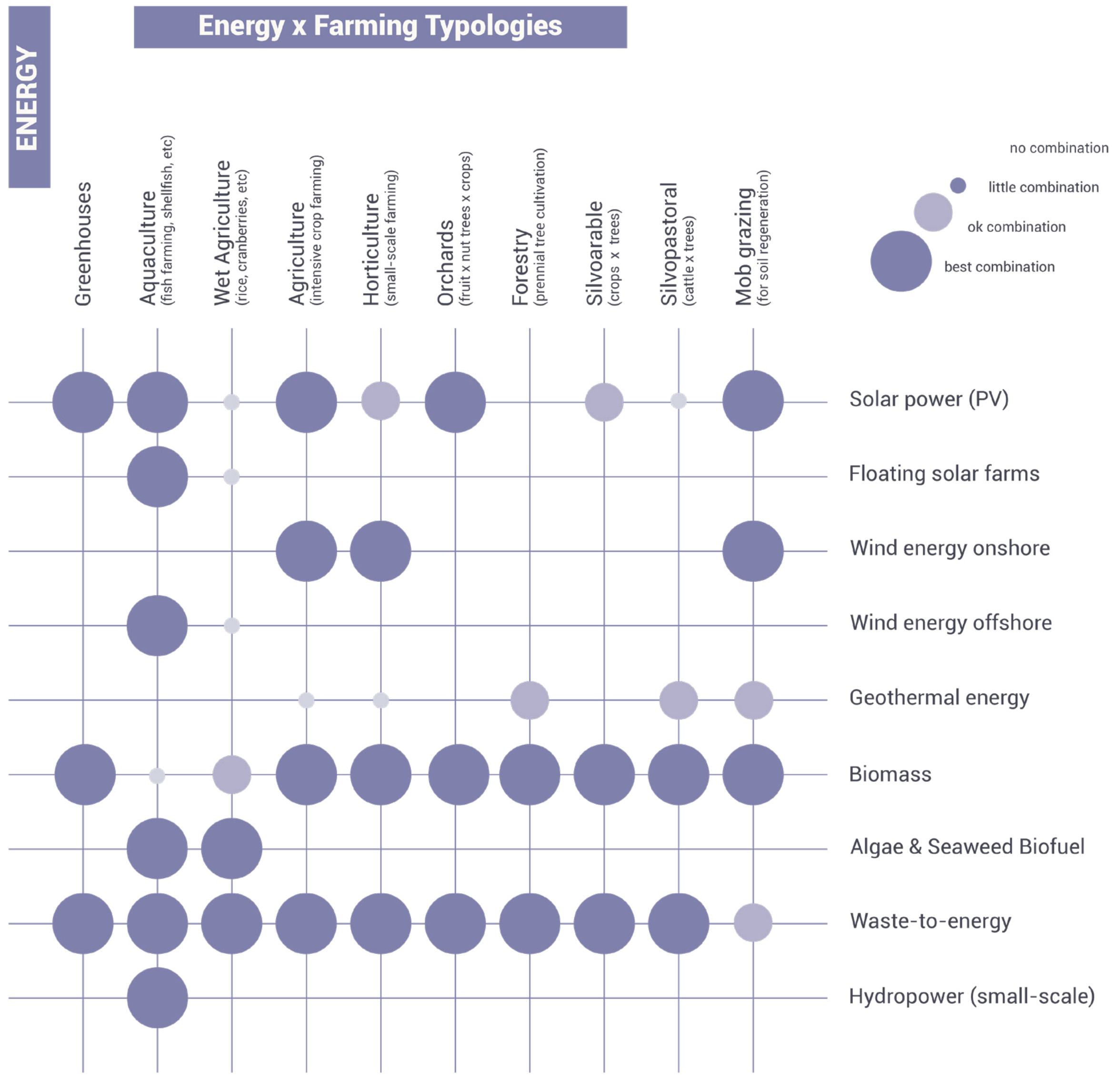




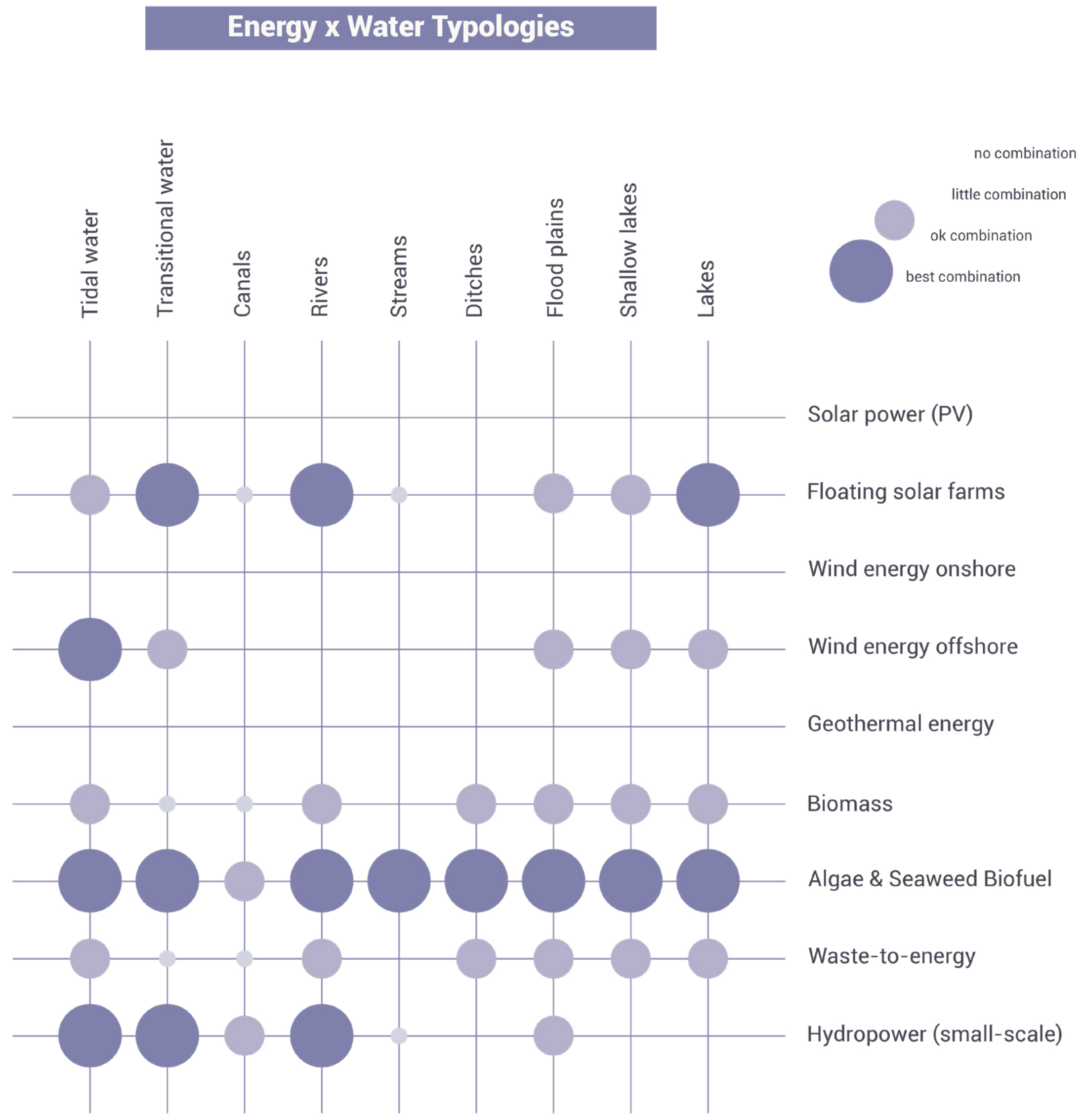


1. The *multi-purpose land use* method emphasizes vertical and horizontal stacking, crop rotation, polyculture, and nature-inclusive practices to maximize land efficiency without sacrificing biodiversity (Talerico, 2023).
2. *Rewilding nature* introduces principles such as restoring native species, creating stepping stones and ecological dynamics, and fostering natural succession; essential for enabling species migration and resilience under climate stress (Carver et al., 2021).
3. The *(bio)diversity* method focuses on mixed cropping systems, wetland integration, and vegetation diversity to support genetic variation and ecosystem services (Waelt & Spuhler, z.d.)
4. In *circular land use*, nutrient recycling, minimizing waste and external inputs, and enhancing biodiversity conservation create feedback loops that reduce dependency on finite resources (Kotyal, 2023).
5. Lastly, *regenerative agriculture* prioritizes soil health through methods like maintaining living roots, minimizing disturbance, and integrating livestock, enhancing both productivity and CO^2 retention (Barclay, 2024).

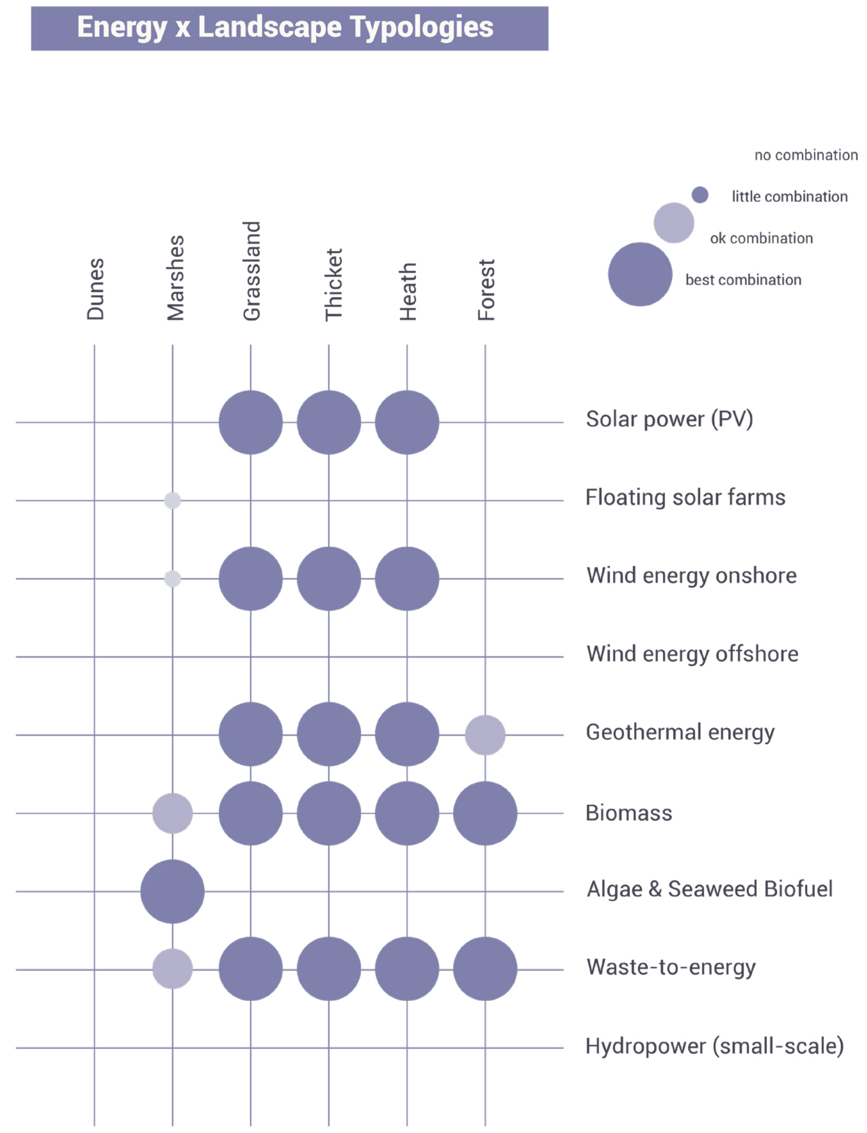
Complementary matrix



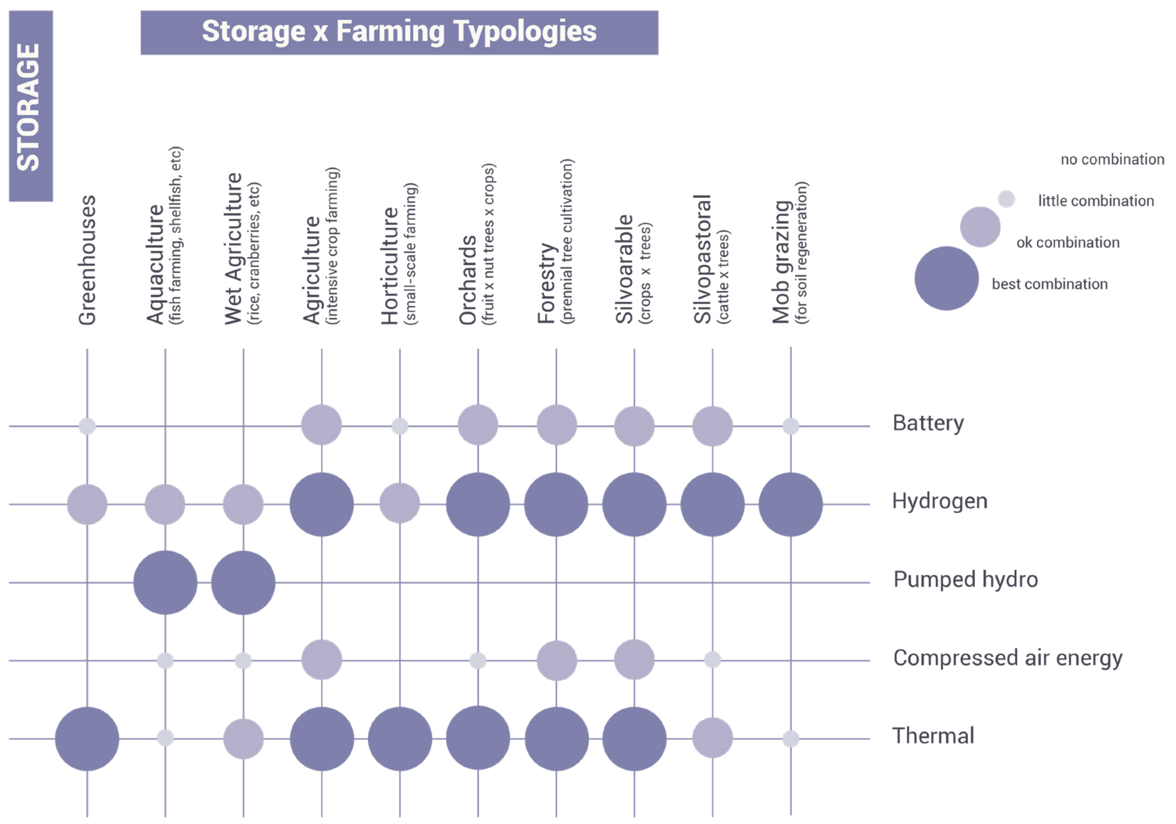
This matrix shows that solar power, biomass, and waste-to-energy present strong synergies with a broad range of farming typologies. These combinations support decentralized energy strategies, especially in rural and peri-urban settings. In contrast, options like geothermal and floating solar farms show limited applicability within agricultural contexts, likely due to spatial, infrastructural, or subsurface constraints.



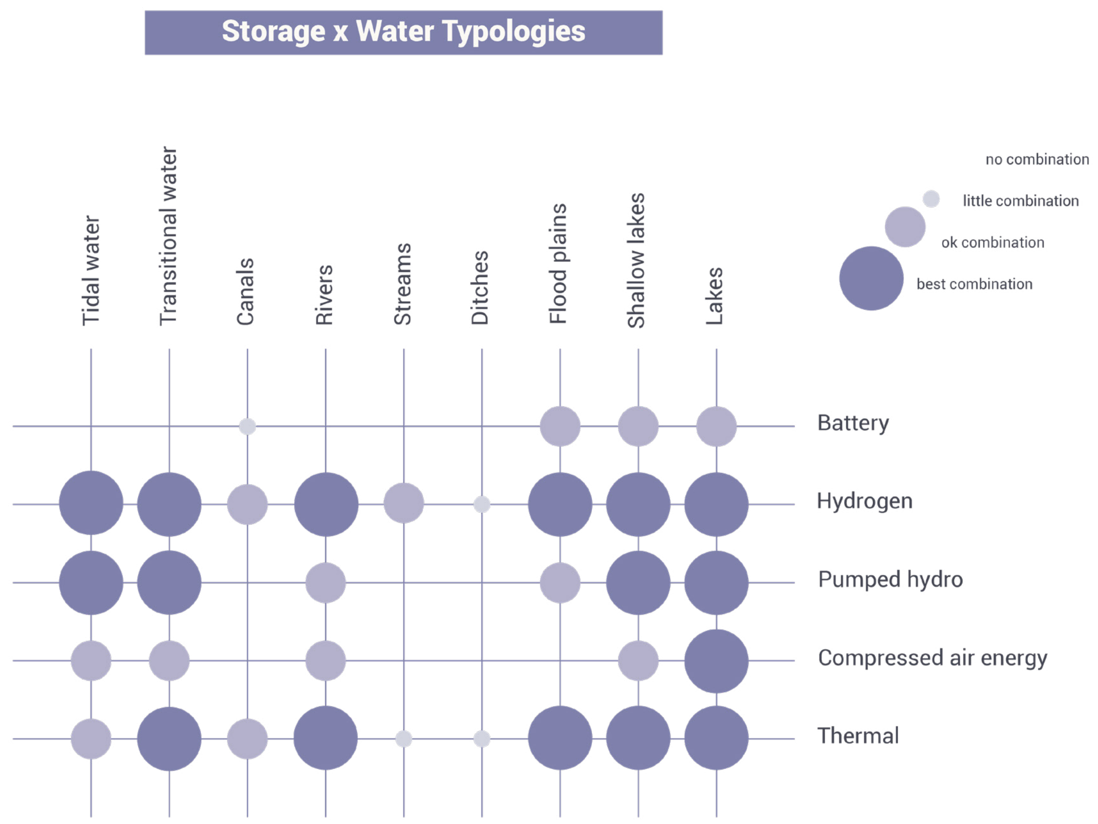
In the water-based matrix, algae and seaweed biofuel and floating solar farms emerge as highly compatible with water bodies such as lakes, canals, and tidal zones. These methods align well with aquatic ecosystems and could co-exist with existing hydrological functions. In contrast, geothermal energy appears less suitable, possibly due to its land-anchored infrastructure.



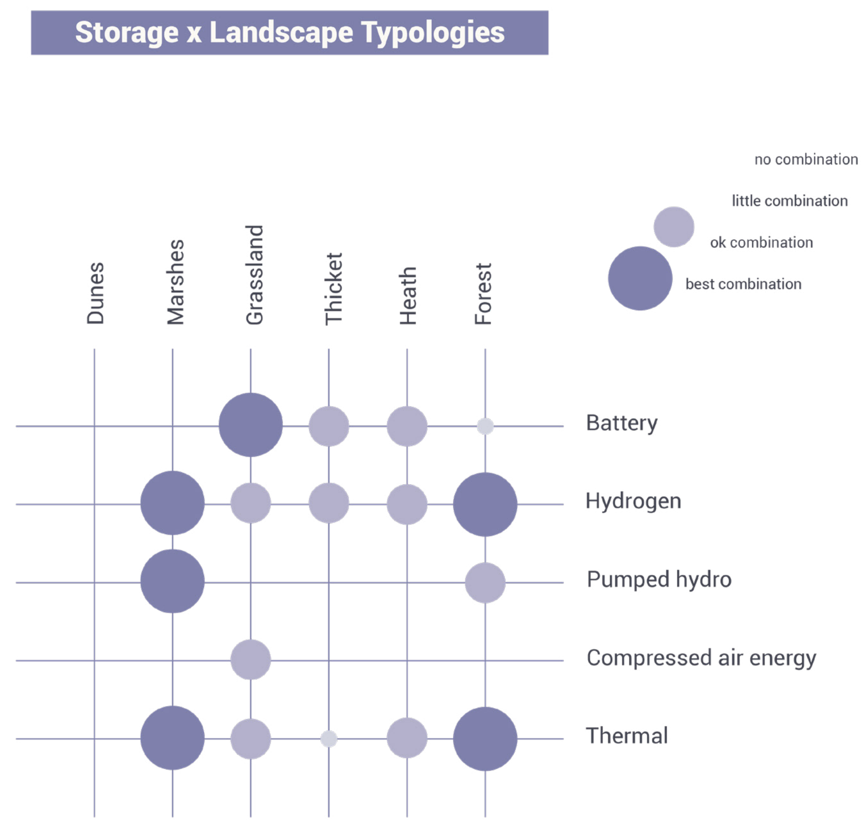
Landscape analysis indicates that grasslands, thickets, and heathlands offer better integration potential with renewable energy infrastructure, especially for wind and solar applications. Dunes, on the other hand, show minimal compatibility due to their ecological sensitivity and protected status, making development in such areas highly restricted.



Regarding energy storage within agricultural settings, hydrogen and thermal storage systems show broad applicability across various farming typologies. These systems may be more flexible in terms of spatial and infrastructural integration. In contrast, pumped hydro and compressed air energy are more constrained, likely due to their specific geographical or topographical requirements.



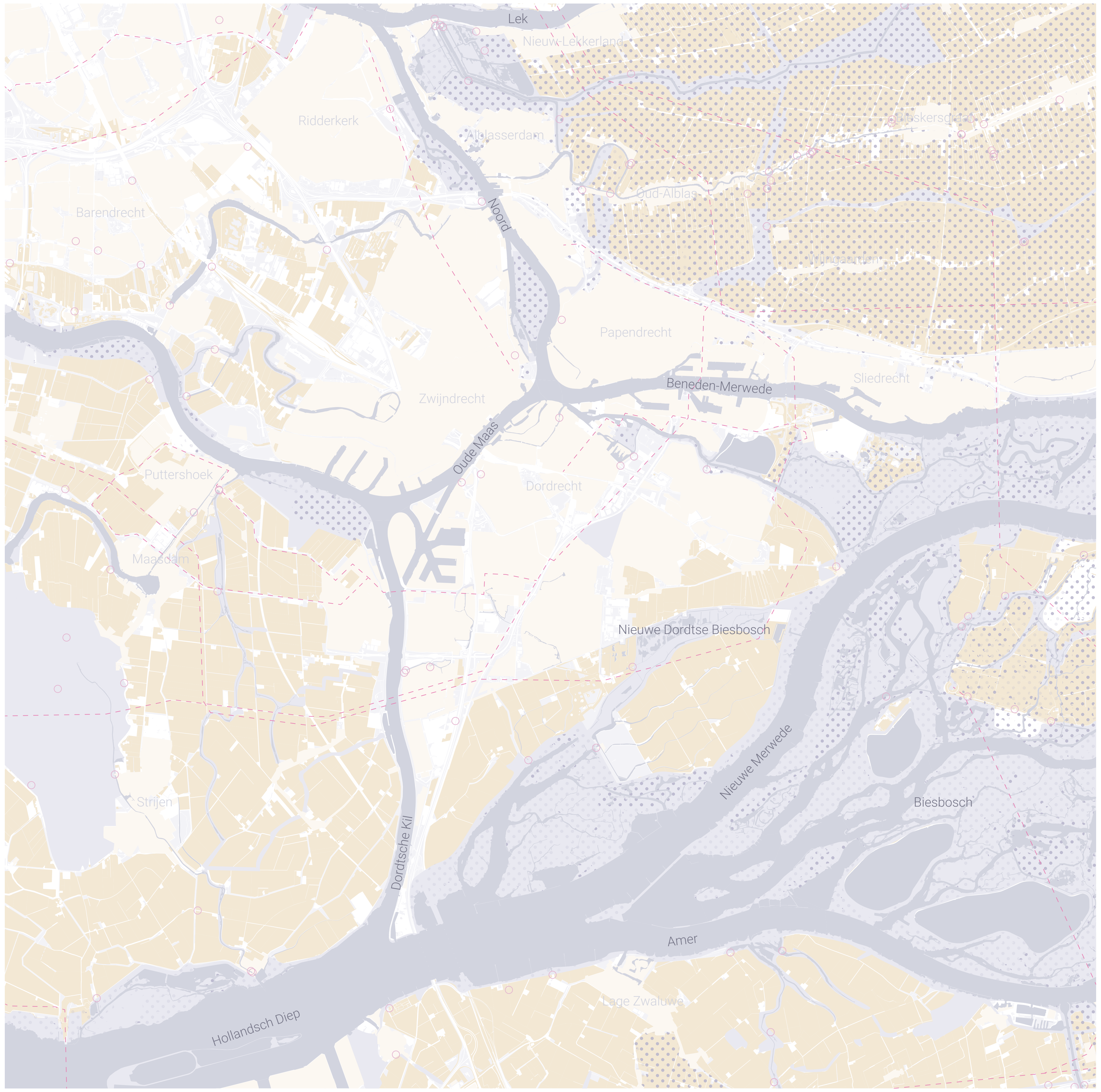
A wide array of water typologies shows compatibility with hydrogen, thermal, and pumped hydro storage systems, offering flexibility in designing hybrid systems. Battery storage, while still viable, appears slightly less optimal, possibly due to space, maintenance, or ecological concerns near sensitive water environments.



In the landscape-based matrix, storage options like hydrogen and thermal systems are applicable across multiple typologies. However, pumped hydro and compressed air energy systems appear limited in suitability, especially in natural landscapes like forests and dunes, where topographical or environmental constraints dominate.

SPATIAL IMPLEMENTATION

Dordrecht 2025



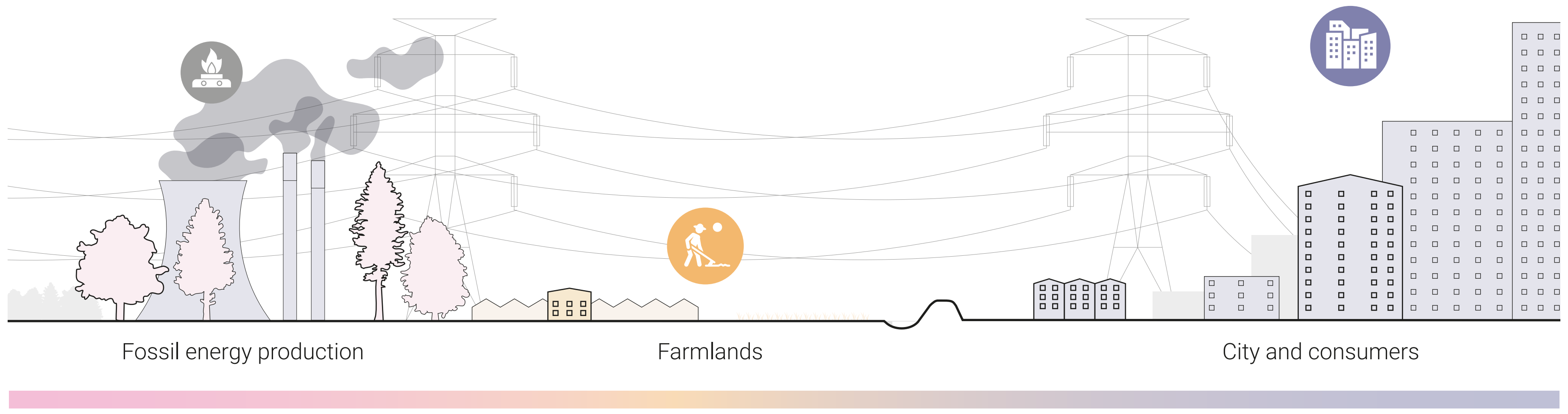
- Eco agriculture
- Built area
- Waterbodies
- Overflow medium
- Overflow least
- Existing nature
- Water pump station
- Energy distribution

N

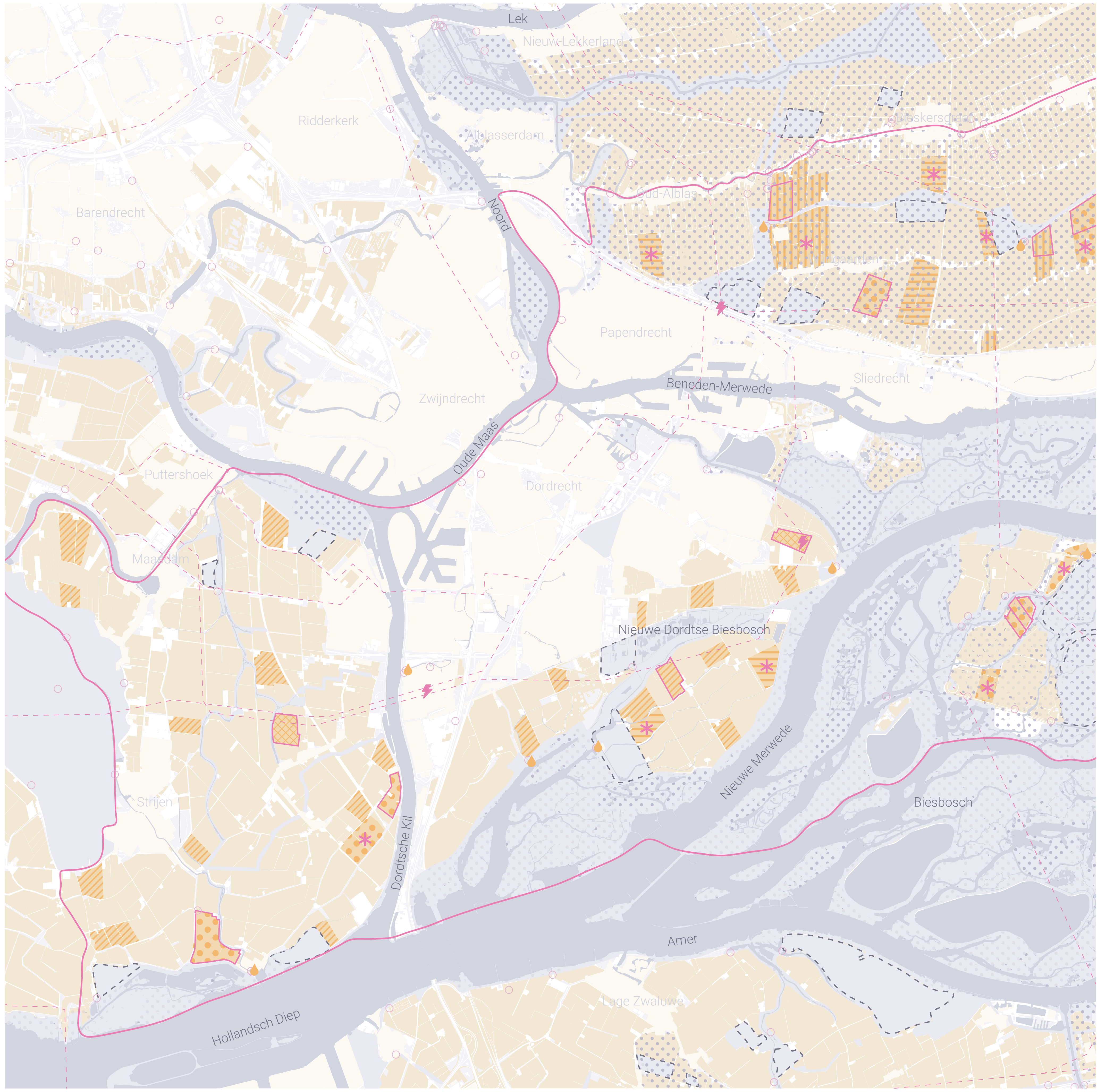
0 1 2 3 4 5 km

To take the imaginaries of the proposed strategy of the local system into tangible interventions, the spatial impact of the three phases are illustrated through experimenting with Dordrecht as a case study. Driven from the insights of the analysis in chapter 5, which investigated a region that contains great spatial varieties, the implementation of the local energy system is explored into depth. Dordrecht is one of the cities within this region, situated in the transition zone between the urbanized Rotterdam and the natural Biesbosch, representing the complexities of the differences in spatial characteristics.

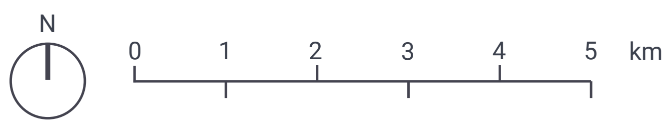
As of today, Dordrecht is a city of about 122.000 citizens. The city is surrounded by several rivers, and is situated in a transition zone between the urbanized region of Rotterdam and the national park Biesbosch. Scattered around these diverse landscapes are agricultural fields, some of which are prone to uncontrolled floods. With almost 60% of our energy produced with fossil fuels (CBS, 2024), the Netherlands will not reach the climate goals of 2050. In our current society, only some farms produce energy, and even less are completely self-sufficient. Moreover, the dynamics of natural processes are limited due to spatial constraints and environmental pollution.



Dordrecht 2050

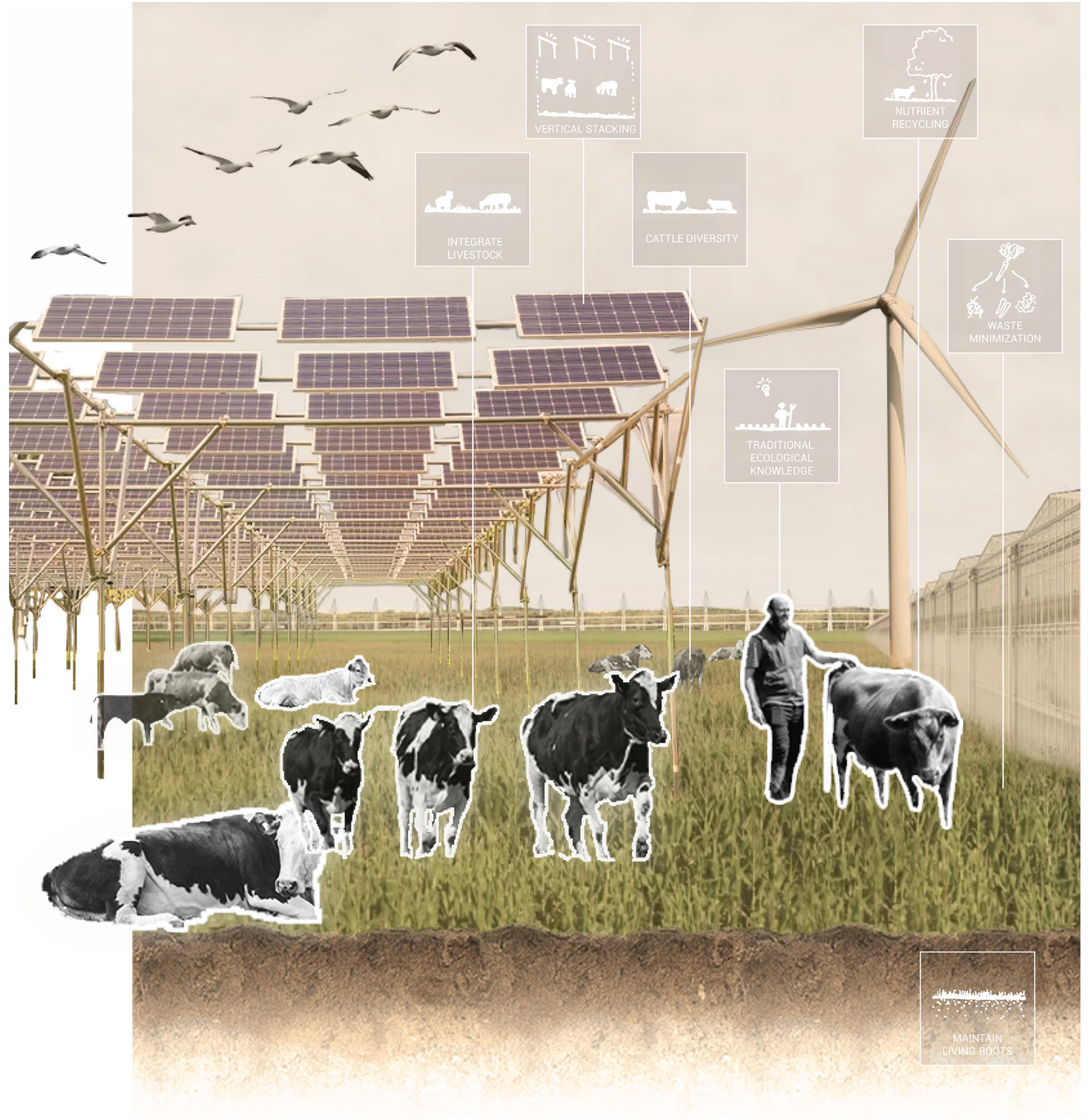


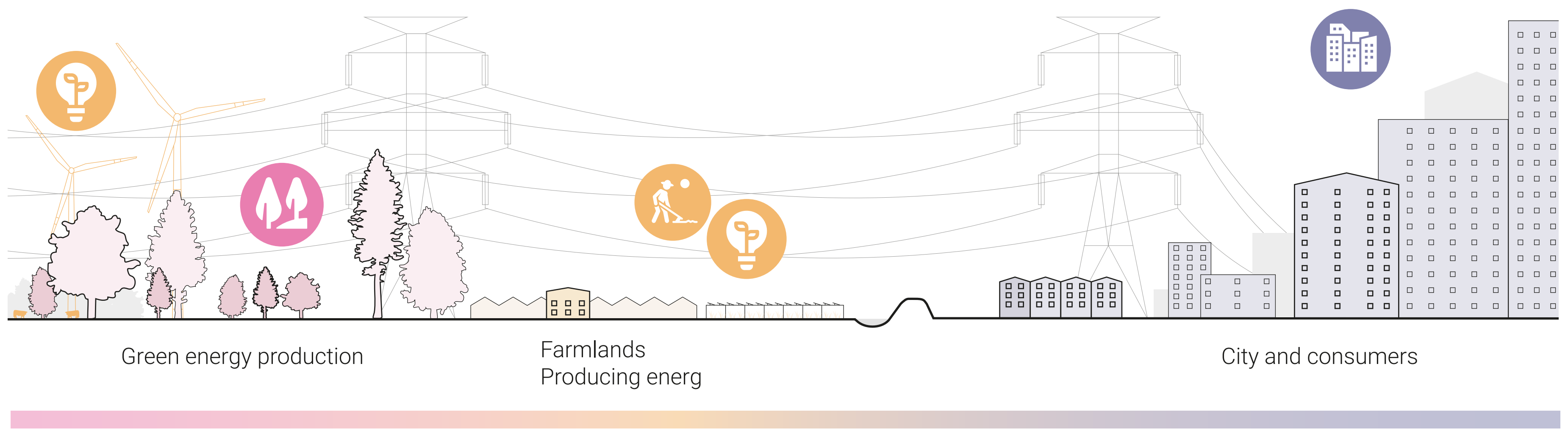
- Eco agriculture
- Sold farm
- Leasehold farm
- Built area
- Waterbodies
- New waterbodies
- Overflow medium
- Overflow least
- Existing nature
- Rewilding nature
- Farming organization
- Algae energy
- Biomass energy
- Geothermal energy
- Wind energy
- Solar energy
- Hydropower energy
- Water pump station
- Energy distribution
- Energy hub



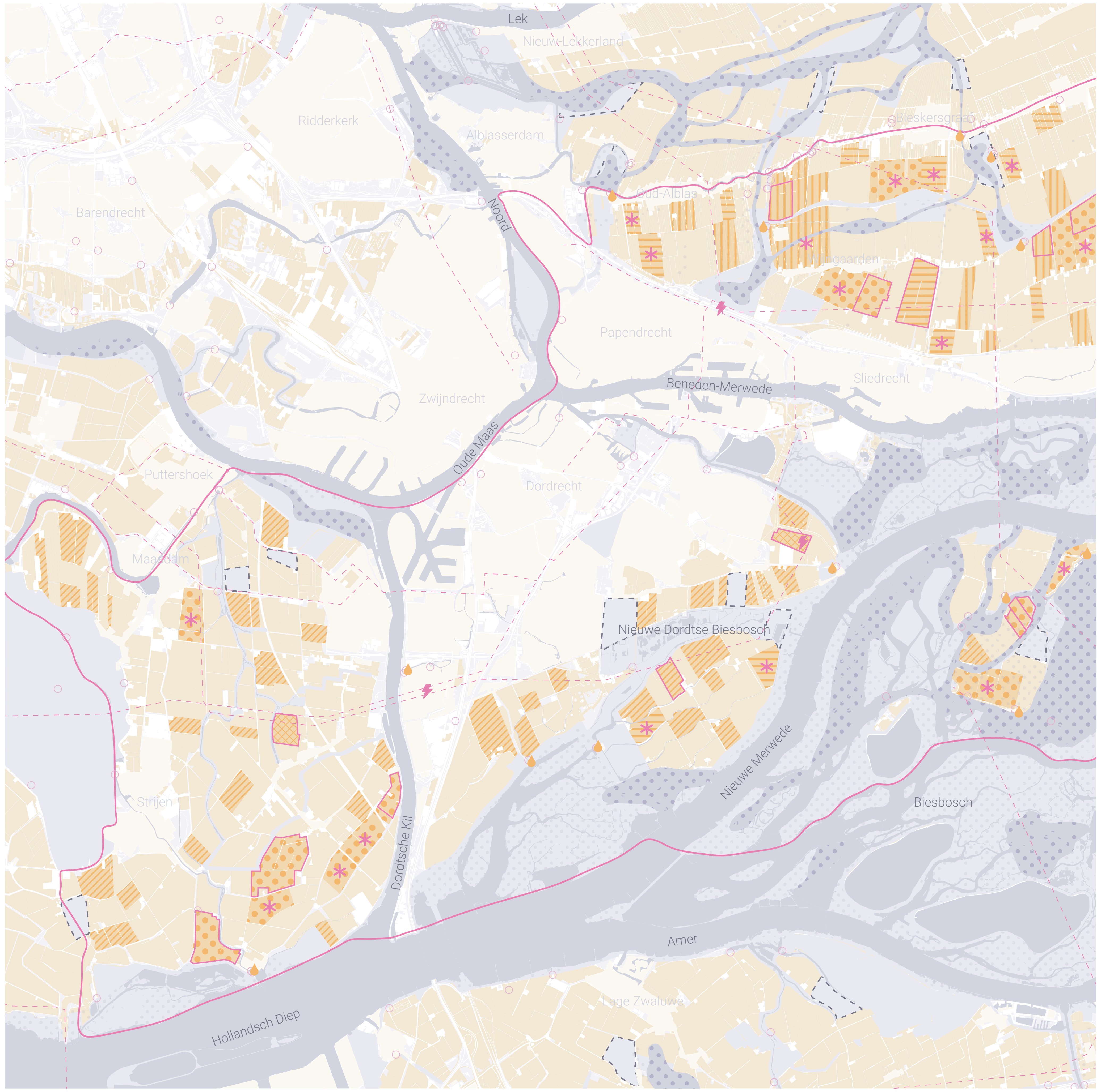
In 25 years, the New Electricity Law, along with the Rijksenergiestaat and the Farmer Organization, will have been introduced. This means that contracts of sale and leasehold have been set up, and that the image of agricultural landscape has begun to change, whilst cities are densifying within their borders. Still, many farmers continue their normal agricultural activities, although they are altering their practices to more ecological responsible methods. Most farmers that do produce energy, will most likely use agrovoltaic and windmill methods to maintain their food production. The lands that are managed by the Rijksenergiestaat will have more intensive methods, such as geothermal energy or innovative sustainable methods of biomass and algae energy. The local distribution of energy is regulated through new energy hubs at the fringes of cities, and the agricultural sector is becoming a significant contributor of energy production. Because of this development, the Netherlands will be fossil fuel free. Simultaneously, agricultural land will make space for rewilded nature and floodplains.

This collage illustrates how strategies for bioregional planning and flood resilience could play out 25 years from today. Farmers have embraced vertical stacking; producing food and energy simultaneously, allowing multifunctional land use while farmers keep farming. Livestock diversity boosts biodiversity and supports healthy soil through year-round living roots and better nutrient cycling. Traditional ecological knowledge (TEK) is being revived and taught, guiding regenerative practices rooted in local knowledge. Waste is minimized through closed-loop systems: composting, natural water filtration, and circular resource use create a resilient, self-sustaining rural landscape.





Dordrecht 2100



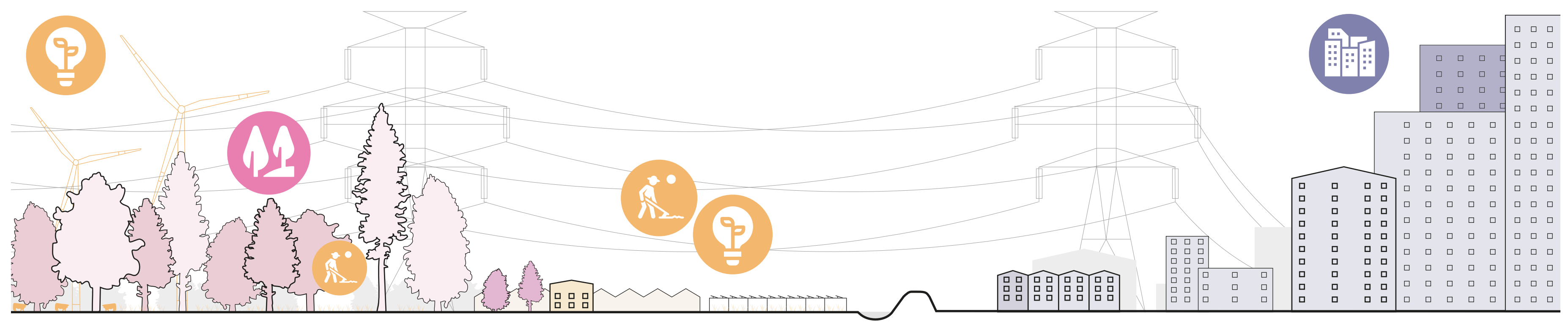
Eco agriculture	Farming organization
Sold farm	Algae energy
Leasehold farm	Biomass energy
Built area	Geothermal energy
Waterbodies	Wind energy
New waterbodies	Solar energy
Overflow medium	Hydropower energy
Overflow least	Water pump station
Existing nature	Energy distribution
Rewilding nature	Energy hub

N

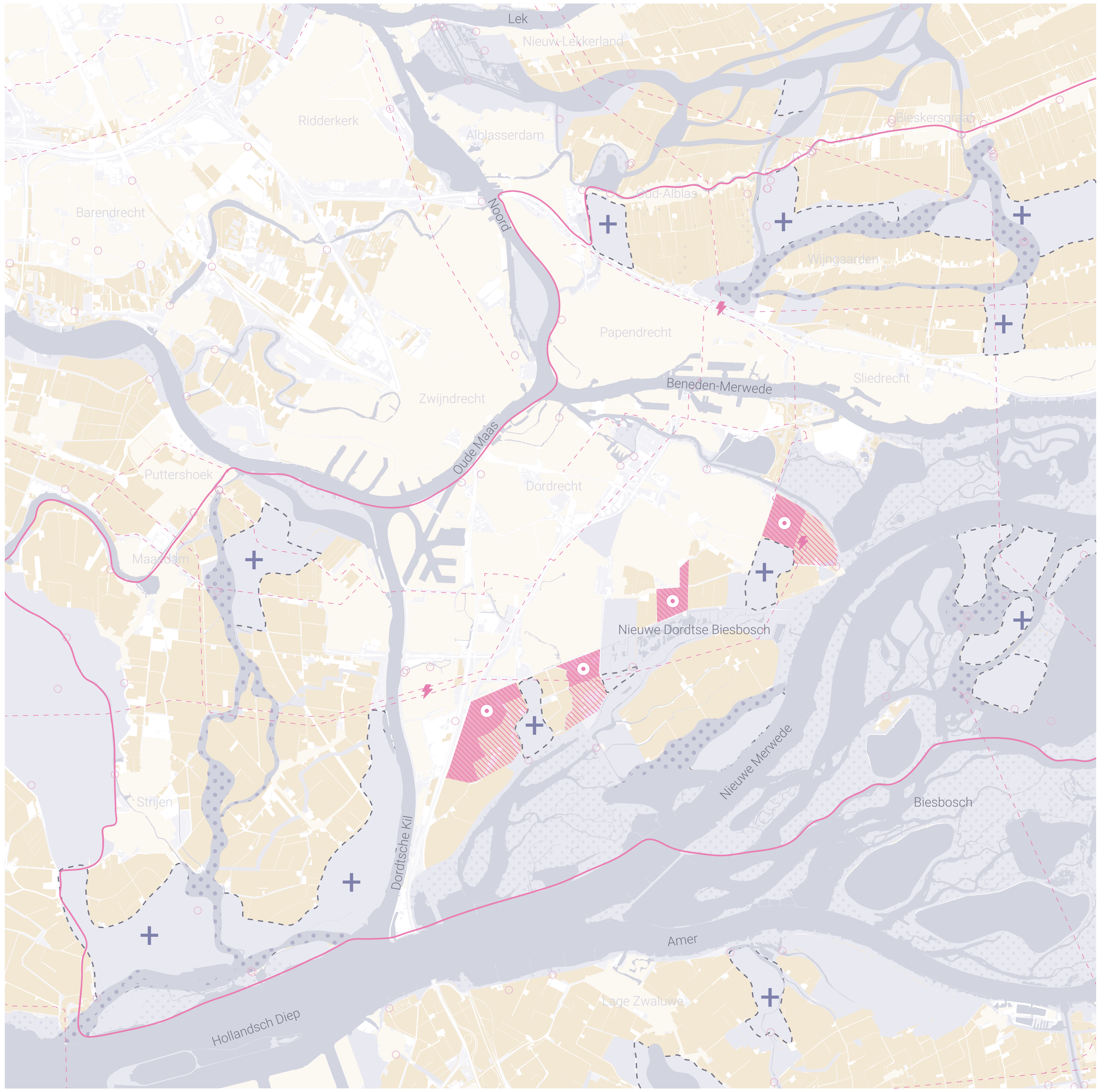
0 1 2 3 4 5 km

By 2100, the agricultural sector will produce all green energy and farmers hold a secure position within the local system. The Farmer Organization maintains the shifting wishes of different farmer generations who want to keep their agricultural practices, who need resources to produce energy, and who want to set up leasehold or sale contracts. All in all, the organization will regulate the division of land use ratios and will remain the representative of local farmers in regard to the Rijksenergiestaat. Besides this, the whole sector will have shifted to eco agricultural methods, to preserve the environmental qualities of the land. More and more, these practices are intertwined with nature, such as agroforestry or wet agriculture. The transition towards local systems is completed, and a new balance between the urban and the rural has been established. Whilst the rural produces energy and food, the urban keeps sustainable innovation and vibrant community life going. Meanwhile, the increasing dynamics of water are intertwined in our environment, to ensure resilience in climate events.

The collage visualizes how bioregional planning and flood resilience strategies take shape 75 years from now. Farmers now use both horizontal and vertical stacking; combining crops, livestock, and energy production on shared land. Polyculture and seasonal crop rotation are implemented, supported by rich soils and applied traditional farming knowledge. Crop diversity strengthens resilience, improves yields, and boosts soil health. Floods are more frequent, but the wetlands are used as productive landscapes, growing rice, algae, and other water-growing crops. Biodiverse ecosystems thrive, shaped by a deep ecological awareness and harmonious interaction between species and their environment.



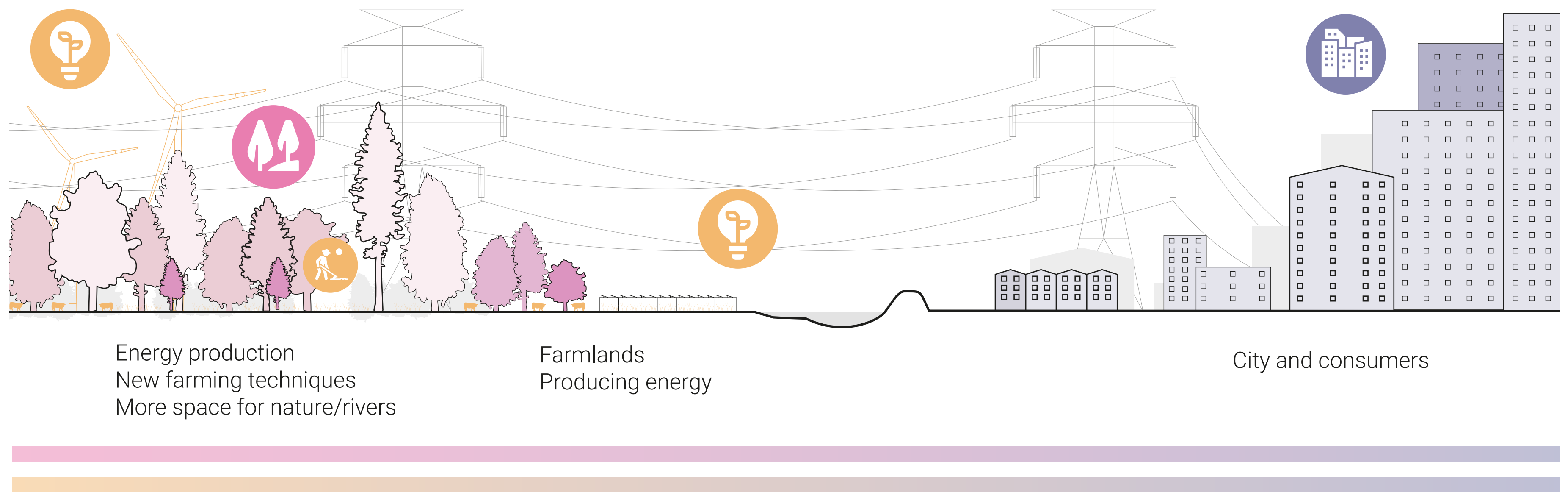
Dordrecht 2175

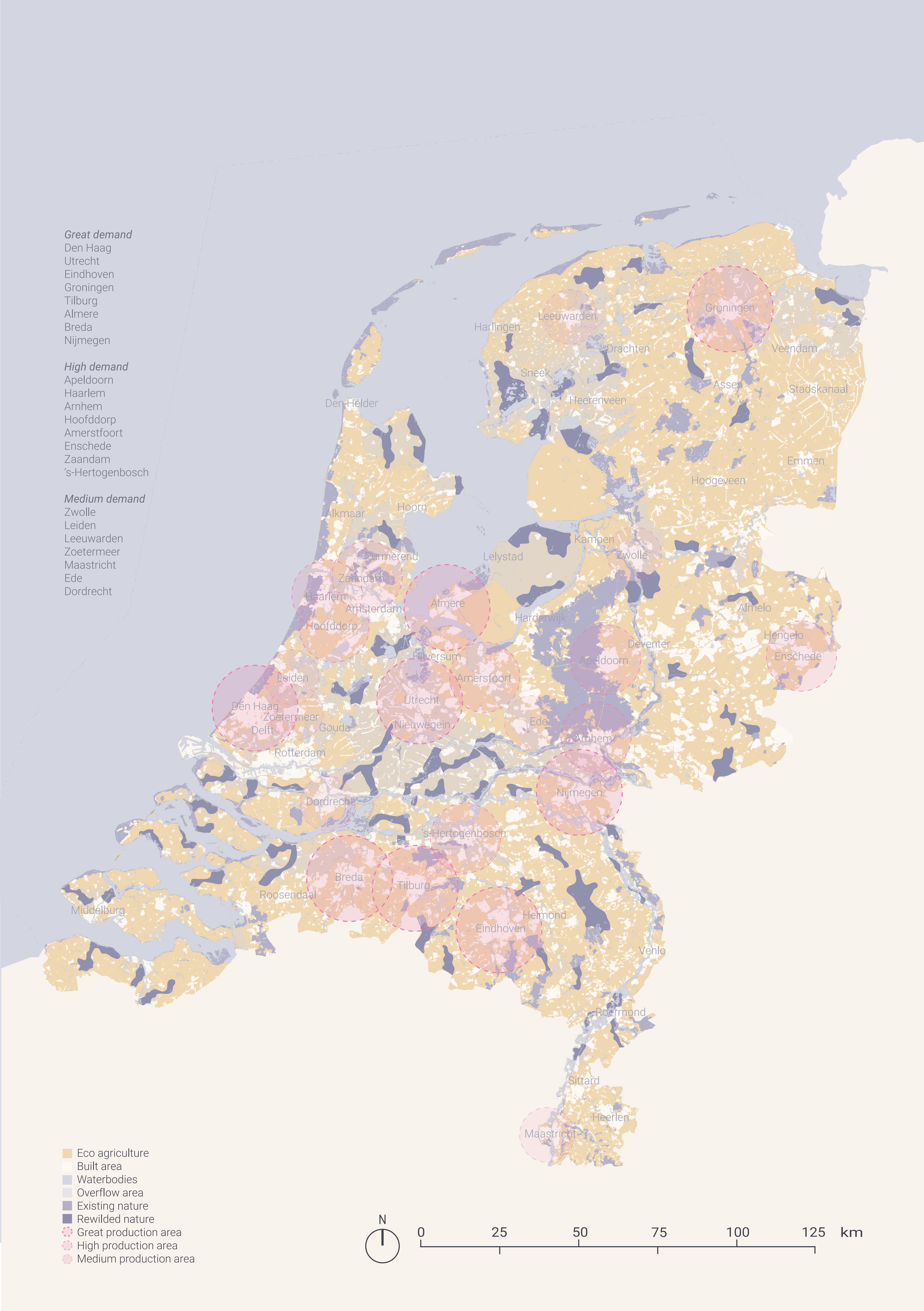


- Eco agriculture
- Built area
- Dense built area
- Natural built area
- Waterbodies
- New waterbodies
- Existing nature
- Rewilding nature
- Farming organization
- Water pump station
- Energy distribution
- Energy hub
- Overflow medium
- Overflow least

In 150 years or more, scientists have accomplished nuclear fusion. A crucial moment of restructuring the landscape will take place, as the agricultural sector can be phased out as an energy producer. This results in scattered fields that are in need of a new purpose. Most fields will still be in the hands of farmers themselves, and as leasehold contracts will end, the future generation can decide whether they want to retake their land or sell it to the state. With the state holding and gaining some of these fields, land consolidation creates spatial possibilities to adapt to the demands of our future society. This means that cities can expand, landscapes can be rewilded, and more space can be given to rivers.

While this visual hints at the presence of nuclear fusion technology, its exact location remains speculative. This energy source makes the renewables disappear. The focus lies on a deeply integrated and ecologically rich environment. Nature is fully embedded in the urban fabric. Ecological corridors and stepping stones support biodiversity conservation, allowing species to move freely and thrive across the landscape. The edges of the city are no longer neglected, instead, they are strategically used to maximize the edge effect, where diverse habitats meet. Native species have returned, and natural succession processes are respected, allowing ecosystems to regenerate over time without constant human intervention. External inputs like fertilizers have been reduced, and soil disturbance is minimized through regenerative practices.





RECOMMONDATIONS

Recap to the disclaimers

As we have experimented with the possibilities of spatial interventions of the energetic agronomies, wider imaginaries of putting the strategy into practice can be made. The methods for the proposed transition, the vision steps, the compatibility matrix and the design toolbox are applicable for the Netherlands as a whole. To assess differences in production demands, spatial conditions and site-specific possibilities, further research is needed. This conceptual map of the Netherlands offers a start for further research. It highlights all agricultural land, which would shift to eco agriculture, the expanded water bodies and overflow areas, and existing and rewilded nature. Moreover, it categorizes the eight largest cities (excluding Amsterdam and Rotterdam) as local systems with the greatest production demands, descending to eight high demand cities, and seven medium demand cities. All other cities, towns and villages demand only a small production area. With this conceptual map, we can begin to imagine the Netherlands in transition towards a sustainable environment. However, applying the strategy to the Netherlands requires more considerations. A critical reflection on the claims that are made is crucial, to explore the uncertainties that have to be researched in more depth.

Claim 1: Farmer Organization. The radical approach of this strategy puts farmers in the center and poses them as the solution to the energy transition. It relies on participation of the sector as a whole. However, it is possible that the organization cannot come to an agreement on the division of 75:40:5, as too many farmers want to continue their normal agricultural activities. A quick solution would be expropriation, as the repurposed land use is of societal importance, although this is undesirable as it would neglect the wishes of the already vulnerable community.

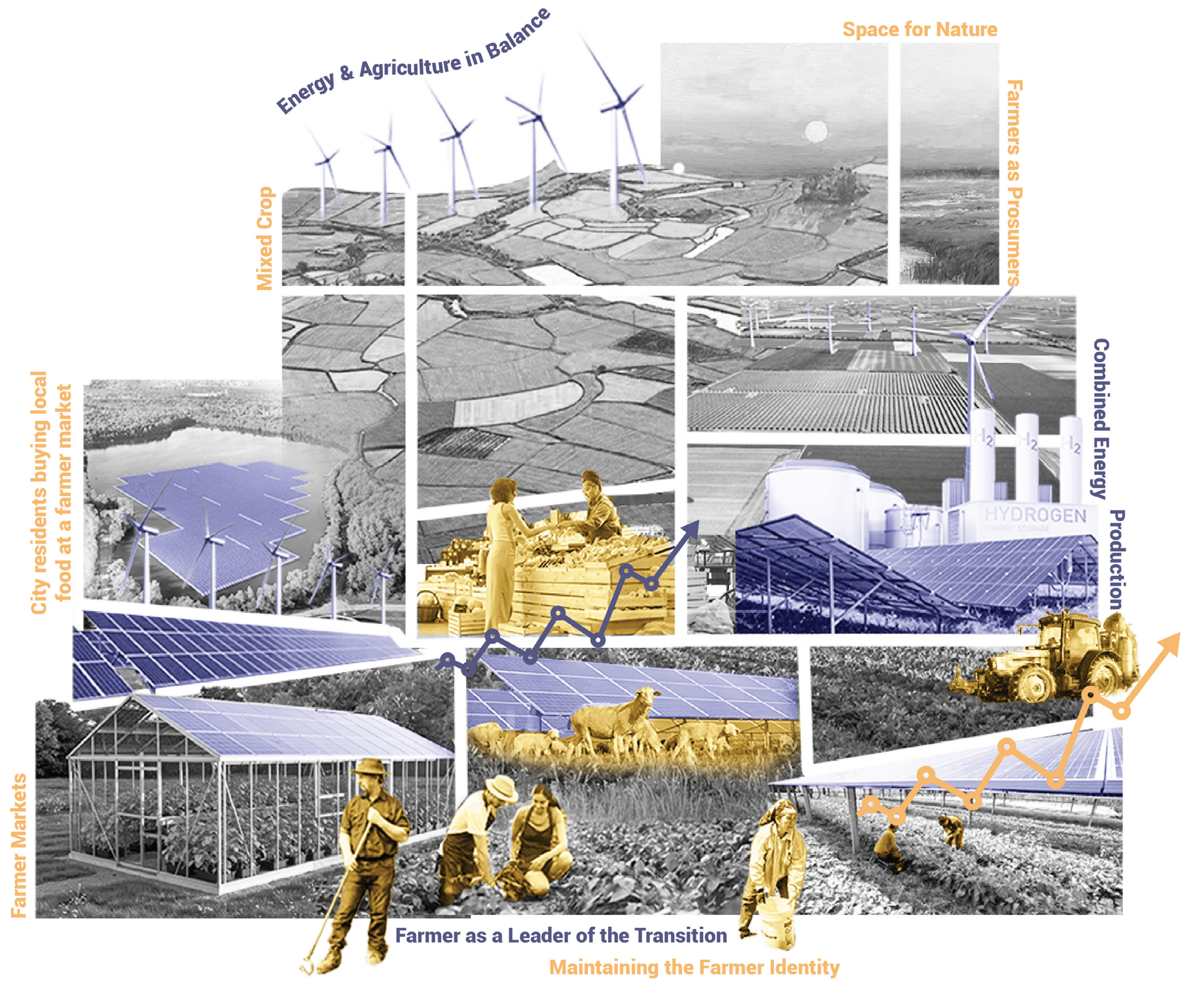
Claim 2: Eco agriculture. Expecting a complete cultural transition towards ecological responsible agriculture could get resistance, as the agricultural community already deals with accumulating regulations. To prevent this, an open minded approach that respects the values of Dutch farmers, explores traditional ecological knowledge, and invites experts to the table could lower the possible aversion.

Claim 3: Nuclear fusion. Despite the ongoing theoretical research and in-practice experiments, it is speculative if energy from nuclear fusion will happen. Since it could mean access to unlimited energy, the capitalist mindset has to be redirected to ensure free energy for everyone all over the world. Moreover, it could take longer than 150 years to get theory into practice, expecting that it can. Nevertheless, the proposed strategy of a transition to renewable sources is suitable for decades, and contracts and agreements can be altered and renewed to the shifting needs of future societies.

Claim 4: Fluctuating overflow. In this strategy, the overflow risks of rivers, caused by heavy rainfall events, is taken into account. Despite the fact that this is the greatest water risk the Netherlands faces, the strategy should also consider the consequences of rising sea levels, and other dynamics of subsidence, salinization, water tables, seepage and more. Possibly, the strategy has to put into a further extreme of restructuring the landscape, where cities are protected through engineering and nature. Moreover, this extreme stimulates innovations on water based methods, both for settlements and production.

Claim 5: Flexitarian diet. As we already experience, it is difficult to convince the society to change their diet. For many people, the current diet with meat consumption is ingrained in their culture. Expecting our society as a whole to shift to a flexitarian diet might be too naive. A simple solution is importing more food or energy from abroad. Another way to adapt to these differences is executing the ratios in a more flexible manner. This would mean that in some regions, more than 20% of the agricultural land has to be multipurpose, to produce the local food demand.

Overall, it is important to acknowledge that there are more constraints than we have considered within this report. Therefore, we recommend to not only rely on a local energy system where farmers are responsible for the complete production. By interweaving production both on agricultural land as within urban areas, a resilient local system can take the lead in the challenge of the energy transition. Most importantly, this strategy is not just about driving the transition, but about encouraging a fair system for what we consider as a public good. This research proposes a drastic systematic change to manage energy within a democratic process that benefits every individual. The commons of producing this good should be shared over our society, based on a local system that integrates economic prospects, environmental improvements and that strengthens relations between all groups of our society.



REFLECTION

The ability and willingness to reflect on projects, collaborations and personal contributions is an important skill with lifelong benefits. In the following pages, a group reflection on the project and team dynamics is presented, along with individual reflections on the project, group interactions and personal roles within the project.

GROUP REFLECTION

As the final component of this project, a critical reflection on the impact of the work on both present and future societies is essential. This includes reflecting on how we have experienced the project and what we have learned throughout the process. By engaging in reflection on these themes, meaningful connections can be drawn between what we have observed, researched, thought and ultimately done. Finally, we take a moment to look back on the group dynamics and the collaboration we experienced over the past weeks. This reflection allows us to better understand the strengths and challenges of working together and how this has shaped the outcomes of this project.

Roles and impacts of regional design
The newly developed strategy implies a societal transformation and impacts multiple generations. It is difficult to address regional design in a way that fairly meets the needs of one single community while also responding to the broader needs of society. In this project, we aimed to make energy more affordable and fairer within a new framework. Our approach reframes energy not as a market product, but as a public good. In today's society, shaped by the climate crisis, farmers are often portrayed as part of the problem. This project however, positions farmers as a part of the solution and encourages them to become producers of green energy. Although this project focuses on one specific community and location, we have developed a framework that extends beyond this context and can ultimately benefit a broader group of both humans and non-humans. The regional design offers the opportunity to cross administrative boundaries and to recognize the region as an ecological system. Within the project, we strive for a site-specific and nature-inclusive approach to agriculture, site-specific multipurpose production of green energy, and the fair production, distribution, and consumption of that energy.

At the same time, we remain critical of our approach to the energy transition. A radical approach to a large and complex issue is likely to face significant resistance and will require a broader societal mindset shift before it can be implemented effectively. The succession of this project depends on several factors, including the participation of farmers. As we have noted earlier in the project, there is a deep mistrust between farmers and the government, with both parties often in direct opposition. We took this into account by incorporating flexibility into our frameworks, allowing farmers to determine their position within this transition. This ensures that the impact of our plans remains minimal for farmers who may not yet be ready to adapt, and it postpones more drastic decisions about the future of farming to the generations to come. For now, this means that current farmers retain a sense of security and continuity, while future generations have the freedom to shape their path based on the conditions of their time.

Morals affecting our community and strategy
Reflecting on the design and considering the effect on the farming community, we tried to strengthen their marginalized role. By providing a new framework in which this community plays a key role in our energy transition, we could state that we respond to the needs of the farmers strategically. There is a need for security and by positioning them as a driver in renewable energy production, they will have a strong foundation whilst maintaining their farming activities. However, the complexity of the energy transition, our governance and society results in the discussion on responsibility and dependency. By giving the farmers a significant role in the production of energy, one could state that the responsibility of farmers and the dependency on their participation in the functioning of our society is something too great. It could be considered a risk, giving power to a single group in society.

This possible risk of great power dynamics is counteracted through the proposed governance framework, as the power would be divided over the public with the Farmer Organization. Instead of imposed regulations, this strategy makes farmers empowered stakeholders as they can make autonomous choices within a framework of requirements from the Rijksenergiestaat. These requirements and choices can be translated by the farmers themselves into spatial interventions, using the spatial toolboxes that are presented to them. With the insights of interview and research executed in the project, the possibility of participation of our community in the spatial implementation of the proposal is feasible.

Through this strategy our society will change its view on the farmers, positioning them no longer as the scapegoat of climate change, but as the driver behind renewable energy production. It cultivates virtues such as justice (spatial and societal), moral responsibility, and a fair distribution of public goods like energy. Farmers become resilient within the process of climate change and the energy transition.

Scientific contribution
The foundation for this research is found in scientific contribution in both of the courses that ran simultaneously during this quarter. With the Research and Design Methodology, the theoretical background, research methods, reference projects, and discussions challenged us to approach the project with a critical view by questioning choices through different lenses. Temporalities, rhythms and coexisting synergies were discovered and investigated by approaching them with scientific research and references. Besides providing knowledge, the methodology course helped structure this process. Assignments for structuring the report, lectures on theoretical dilemmas and insights on societal processes through booklets gave us a broader critical perspective rethinking the effect of our project within society. The thematics of these parts of the methodology course perfectly matched the studio process, explaining necessary theories in the supporting role to the whole studio.

During the studio, our tutors, Irene and Caroline encouraged us to approach the problem radically. This radical approach was used to reimagine the systems of society, focusing on changes at the root. The push from our tutors to imagine the strategies and vision radically, pushed us to work on a long-term timeframe and think out of the box, not being stuck in conventional design methods and imaginaries. To base the radical approach scientifically, further research was conducted to support our claims and choices. We would consider the radical approach as a success in our research, based on our critical position, proposed frameworks and overall suggested role to the farmers' community. This radical strategy also caused multiple temporalities, rhythms and futures to coexist, as the stated claims relate to different concepts for governance, farmers, energy, environment and community. Unfortunately, these multiple concepts also resulted in a complexity that we could not investigate into depth, due to limited time. If we had the opportunity, entire new graduation projects could be deducted from our research.

Capita Selecta and SDS sessions
During this project, we attended several lectures and workshops to guide us through the complexity of the energy transition and the left behind communities. We received valuable insights on how to position ourselves within the problem, how to create engaging visuals and how to approach topics such as communities, spatial development and governance. In this project, we integrated this information through three lenses: the community lens, the socio-political lens, and the spatial conditions lens. These perspectives are represented in chapter 3, 4, and 5, and synergized in chapter 6 and 7, communicated visually with methods such as tables, diagrams, collages and maps.

The most important takeaway from this quarter has been the ethical responsibility of the designer when engaging with complex societal challenges. It is not necessarily about the designer's personal opinion or vision, but rather about understanding and addressing what is important for society as a whole. One of the key steps we took early in the project was to engage with the Sustainable Development Goals (SDGs). This review provided us with a framework to assess whether our choices aligned with the needs of the Dutch and global society.

Group work and group dynamics
During this project, we were challenged to carry out a complex project as a team. Considering the complexity and the amount of research and visual representations required, the group setting proved to be essential. Working in a team allowed us to be exposed to different ways of thinking, working and being. This collaboration resulted in open and thoughtful discussions that shaped our shared vision and strategy. Each team member contributed from their strengths and played a meaningful role in the project. We therefore look back on our teamwork positively. A more detailed reflection on this experience will be included in the individual reflection.




INDIVIDUAL REFLECTION

SODABA KHALILI

In reflecting on my design process and group experience, I've come to understand that reflection is not about evaluating what was "right" or "wrong" or listing every action we took. Rather, it's about becoming aware of how my perspective and growth have shaped my experiences. The book A Handbook of Reflective and Experiential Learning by Jennifer A. Moon (2004) was essential in clarifying this distinction for me. Moon explains that reflective writing differs significantly from descriptive or evaluative writing; it requires an awareness of how our internal lens influences our engagement with a project. This mindset has guided how I approached this reflection.

Responding to societal challenges
Our project tackled the complex societal issue of the energy transition; something I initially had very little knowledge or interest in. As the project progressed, I began to understand that the energy transition is deeply intertwined with many other societal challenges, such as the uncertain future of farmers, housing shortages, and the need for innovative energy storage solutions. These connections revealed just how multidimensional and deeply rooted this transition is.
Although I found the topic difficult at first, working in a team of four with diverse skills and perspectives allowed us to divide tasks efficiently and investigate the topic in depth. Through this collaborative dynamic, I not only learned a lot about the subject, but my attitude toward the energy transition shifted. I began to see it as not only urgent but also as something that affects us all; something we must engage with thoughtfully and creatively.

Transition communities and radical thinking
One of the most valuable takeaways from the course for me was learning about radical thinking; not as an extreme approach, but as a deep and meaningful way of addressing complex issues. I've learned that radical thinking can also exist in the process itself, not just in the final design. It encouraged me to challenge assumptions, explore root causes, and stay open to unexpected solutions.
Equally meaningful was working through a community lens. Our project focused on a group that is often overlooked, and it felt empowering to center this community not as passive recipients of change, but as key actors in shaping solutions. To me, this is also radical thinking; reframing the problem by shifting the perspective. I now believe that by consistently looking at challenges through this lens, we may discover potential where others only see obstacles.

Teamwork and group dynamics
Working in a team of four with complementary abilities turned out to be one of the project's biggest strengths. I recently read the book Surrounded by Idiots (Erikson, 2019), which explores how diversity in personality and strengths makes for more effective teamwork. While the title is cheeky, the core message resonated with me: teams thrive when members bring different strengths rather than all trying to excel at the same things.

I'm someone who tends to express my opinions clearly and take initiative. I enjoyed this aspect of myself during the project, and I learned a lot not only from our tutors but also from my teammates; especially those with strong knowledge of policy and systemic thinking. However, looking back, I also recognize a challenge I faced: letting go.

I naturally gravitate towards creative and conceptual tasks, especially visual work. I love doing them; and perhaps I took on too much in this area, unintentionally limiting others' involvement. It's partly due to my perfectionist side, which became clearer to me during this course. I sometimes struggle with trusting others with tasks because of past experiences where I was let down. That said, I've come to realize that true collaboration means sharing responsibility and making space for others to grow and contribute; even if things don't go exactly as I imagined.
I want to be an ethical urbanist; someone who inspires others, pushes boundaries, and encourages collective effort. That means learning to step back sometimes, even when it's hard. While I'm still figuring this out, I'm committed to improving, and I hope to finish this project having taken meaningful steps toward that goal.

ALISHA CHOURTI

Quarter 3 has been an eye-opening experience for me within the field of Urbanism. My prior education was a Bachelor's degree in HBO Building Engineering at the Hogeschool Rotterdam. While I enjoyed this study, I felt it lacked a certain societal depth. This led me to pursue a Master's in Urbanism at TU Delft. Over the past year, I have been exploring what Urbanism really entails and what my role within the discipline could be.

Reflecting on the courses
During this course, I gained a broader understanding of what it means to be an urbanist and which topics need to be considered when making plans or designs. This became even clearer when our tutors, Caroline and Irene, challenged us to search for radical solutions to the energy transition. The emphasis on radicality, and the way it was introduced to us, gave me the freedom to express my unfiltered opinions on topics like capitalism, energy and the Dutch government, and to connect them to larger societal issues. I naturally have strong opinions and enjoy expressing them, but the methodology course gave me the tools to structure, support, and further develop these ideas.

Through various workshops and lectures during the methodology course, I discovered again how urban questions can be approached from multiple perspectives. I received valuable insights into how to position myself within complex challenges, how to create strong visuals and how to approach themes as communities, spatial development and governance. What intrigued me most was the diversity of perspectives from which urban issues can be understood. This shows me that Urbanism goes beyond spatial design. These sessions helped me see myself in the role of someone who strategically develops frameworks aimed at creating positive impact, ideally in collaboration with communities.

My position and role in the project
In this project, I found my strength in shaping radical visions and strategies by building frameworks used for spatial implementation. This was a new role for me and I had never realized that creating governance-specific frameworks could be part of urbanism. It turned out to be a good fit, allowing me to use my critical mindset to reflect on current policies and making the assignment feel genuinely relevant. One main insight was realizing that many of the energy transition's core challenges are already embedded within Dutch policymaking. I enjoyed researching this and suggesting transformative alternatives. Although I'm satisfied with my role and contribution, I would have liked to be more involved in the development of visual materials such as maps and graphics. Since I'm still exploring where I stand within urbanism, I would have appreciated the opportunity to learn more in this area as well.

Group dynamics
At the start of the quarter, Irene and Caroline grouped the students based on shared interests. This meant that Sodaba, Susanne, Wies, and I entered the project with similar motivations. I experienced the collaboration as very positive, even though stress and time pressure led to some tensions toward the end. Nonetheless, I worked with great enthusiasm alongside my teammates. Some weeks were filled with more laughter and casual moments, but we always remained focused while communicating about important matters. I believe that we created a positive working environment, by communicating openly and honestly and we made sure that everyone could contribute from their own strengths.

The result
Despite the complexity of the task, I believe our final outcome matched the level we aimed for. What impressed me most was that our strategy extended beyond our region and could potentially be applied across the Netherlands. I have learned a lot about myself, society, community design and Urbanism as a discipline. I believe our project holds real value and based on the knowledge I gained during the methodology course, I think this project could make a meaningful impact if realized in practice.

SUSANNE STULEN

Starting this course, I was not experienced with the regional scale. In the master our main focus has been on the smaller and city scale, so I imagined that this course would become a new challenge that would require the gain of new knowledge. Furthermore, this would be the first course fully based on group work, which brings its challenges and possibilities. However, by approaching this course within a new scale, a broad knowledge throughout the urbanism discipline is created, resulting in personal development as an urban designer.

Reviewing the course structure and approach
Focussing on a community while developing a spatial regional vision made me realize that sometimes as designers we can lose track of the effect of our spatial design and made me focus on the relationship between spatial design and society. This new approach within urbanism introduced design based on transition communities.

Our tutor group had a unique perspective on the course and its challenges, due to the radical approach suggested by our tutors. This approach was new for me, as normally we would often be restricted by short-term reality and its limited possibilities. By engaging radically and focusing on tackling the problem by its roots, my personal imagination and the one of the group was sparked, resulting in thinking out of the box. It showed me the necessity of imagining change radically and how we often have to make concessions in design. Starting out radically helps to stimulate structural change.

The methodology course really supported the group process, but also the process of structuring our vision and strategy. Sometimes I would miss the orientation on communities in the methodology course because of the new structure of the course itself.

Reflecting on the results and groupwork
Working on the regional scale showed me the complexity and multilayered character of societal changes and policies. At first this was overwhelming and sometimes relations within the research became complex, but the result is in my opinion a full and complete assessment. I gained a lot of insight in policies and governance, something I would not have expected. New urban design strategies and theories have been introduced to me, sparking new personal interests for future projects.

Starting the assignment, self-assessment and personal interests were the foundation for the making of the groups by our tutors. This resulted in groups that had common interests concerning the thematics and issues that we wished to investigate. Within the group, each member came from a different background but with similar interests. This broadened our perspectives and combined different approaches. Working within such a collaboration helped to break free from the already known, challenging my personal knowledge. We had an open, positively critical and challenging attitude. Spirits were high and beside a strong motivation to focus, produce and perform we maintained a positive sentiment. Only in the final week, some stress and fatigue resulted in tensions, which were easily settled.

Personal development and learning objectives
Reflecting on my personal role, I developed thorough knowledge on community perspectives and how these are affected by regional design. Urban design is in my opinion a spatialized vision for society, affected by stakeholders, processes and change. Focusing on transition communities is a necessary tool in this process. It highlights the importance of understanding their position. Participation and voicing their dreams is key. This was my main focus during the research, focussing on storytelling and communal justice. My strengths were structuring our workflow and focusing on relations throughout the research. I would have liked to be more involved in producing the visual products. Starting this course, I stated that my personal challenge was letting my enthusiasm not take over and overloading myself with work. I think this was overall a success, but my peers have to be complemented in this. Their creative, active and high-quality driven attitude has made this and the a result to be proud of possible.

WIES KOSTER

Tackling a radical approach
Generally reviewing this quarter of Urbanism in comparison to the R&D Studio of the first two quarters, I appreciate that I have now explored three different scales in the field of urbanism. This quarter has been the most insightful, as I have never worked on a long-term strategy in such depth before. Compared to other projects, this was the first time I was pushed to dive into an approach of changing the system at its core, while other studios mainly focused on spatial planning and design only. Because of this new approach, the beginning of the course was quite overwhelming, as it was difficult to oversee where the project would go. Moreover, it increased the awareness of the complexities of the field of urbanism, by getting a better understanding of the 'mediator' position of the urbanist between all concepts of human and non-human stakeholders, spatial conditions, environmental challenges, governance and politics, culture and society, ethics and more.

Envision the project collaboratively
Despite these overwhelming complexities, I am glad that we were asked to develop a project within a group, as the different perspectives increased an understanding of the possibilities of approaching a project like this. It is difficult to change your personal approach to a project, but with the input of different individuals in the group I got stimulated to explore new ideas. Overall, I am thankful for the cheerful group dynamic of this quarter. We all tried our best to be respectful and kind, listen to each other, learn from each other, and continue to work as a team. The positive attitude sustained a space where we could be honest and straight-forward with each other, to prevent and overcome issues, and grow understanding and respect.

However, simply having a positive attitude is not enough for good collaboration. I also think it is crucial to share personal values, set out clear responsibilities and define collective expectations. By combining this with moments for discussions throughout the process, we could align our vision for the project, and redirect each other to maintain our priorities. Fortunately, this group had a complementary vision from the start, which contributed to a sense of freedom as we trusted each other in executing individual interests of research. Moreover, everyone naturally had diverse qualities to contribute to the group work, with differences in steering the process effectively, developing comprehensive content, creating communicative graphics, and using flexible skills. I believe everyone tried to contribute to the group work in their own manner, balancing studies with personal responsibilities.

Acknowledging different values
All in all, one of the main outtakes of this quarter is both personal and professional. As an undergraduate urbanist, I feel obligated to develop well-considered strategies and designs, as I hold the strength to make interventions in our environment imaginative. Moreover, I have a growing urge to understand the values and behaviours within society, and learn about history, culture, politics and environment, to be confident in making ethical decisions. Understanding all these dynamics thoroughly is quite challenging, but with an open, assertive, and critical attitude I can gather the different values and participate in a meaningful way towards an equitable environment that supports ecosystems as a whole.

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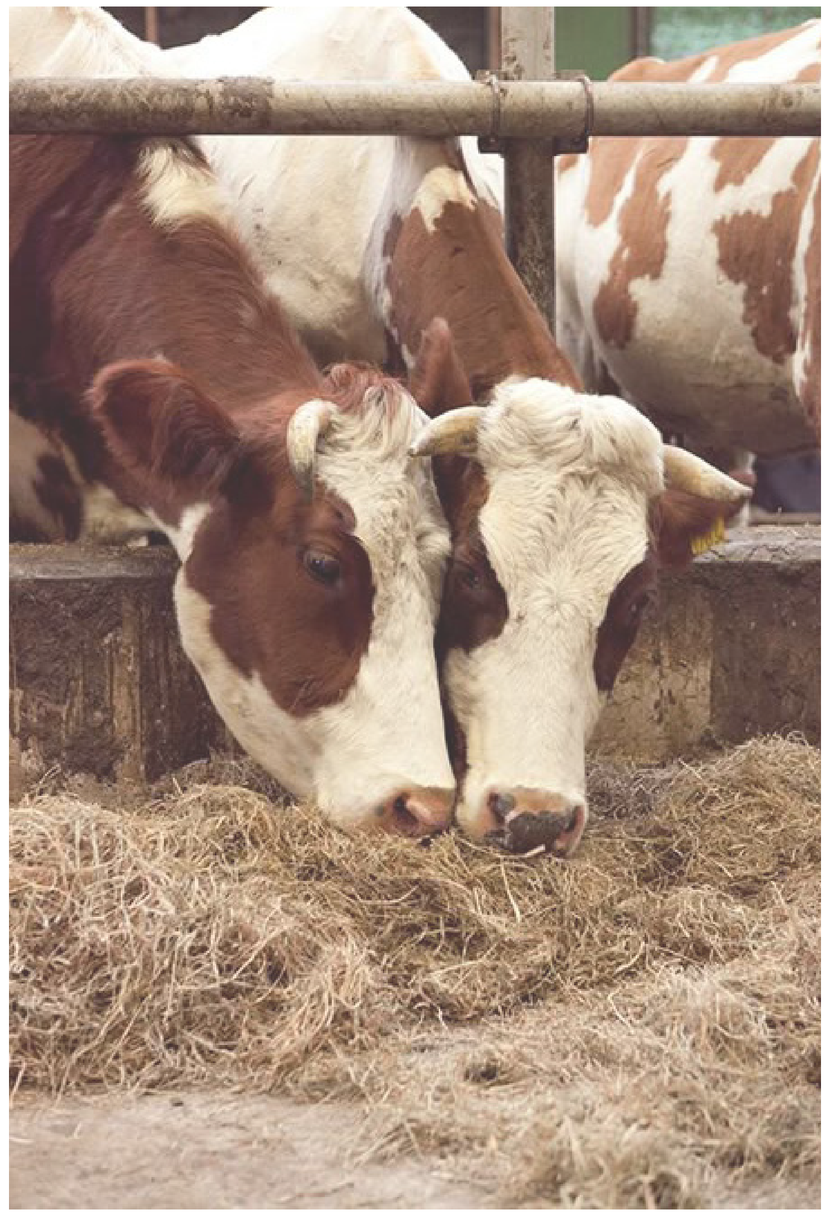
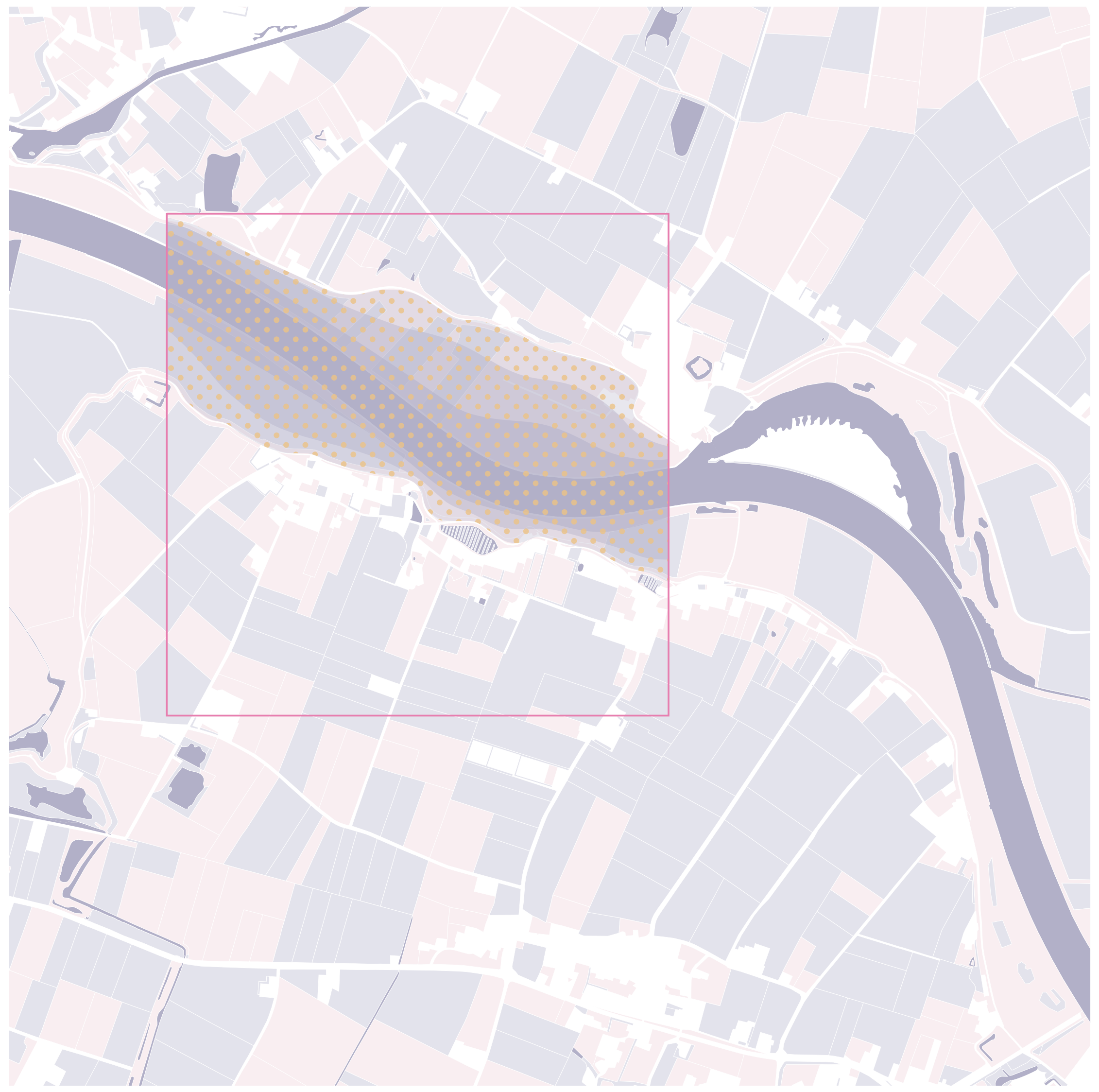


APPENDIX

Additional information and clarifications.

Recognizing bioregions



Water overflow

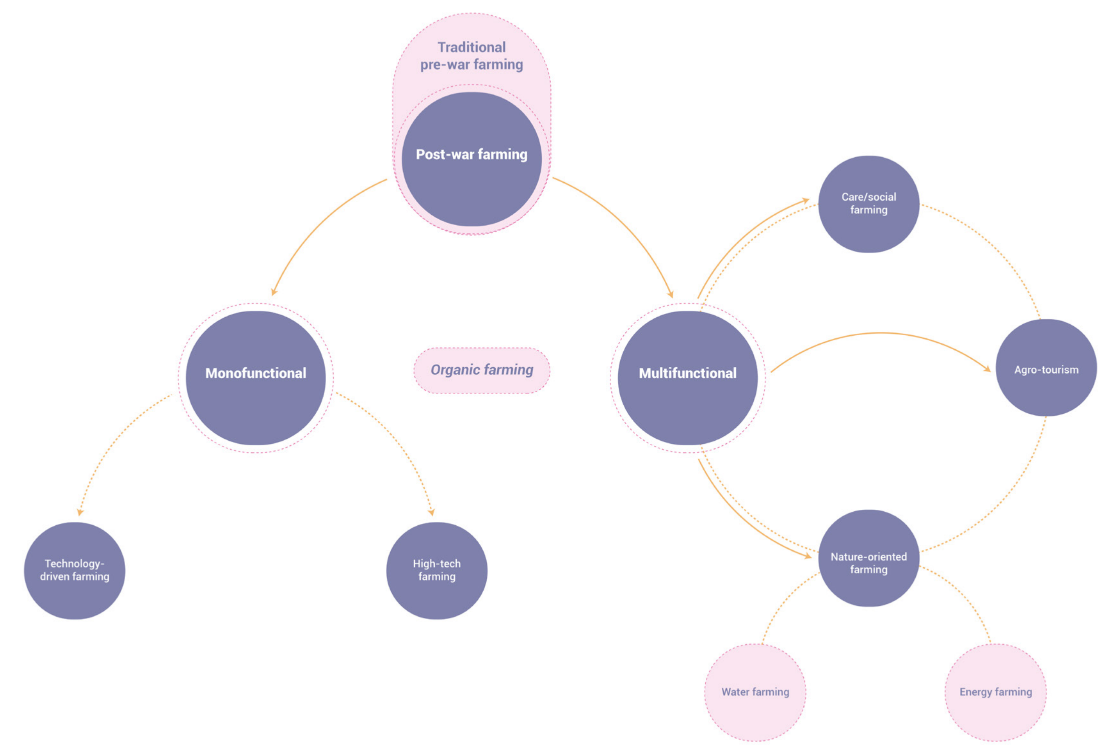
Berekening energie productie en voedsel productie				
Nederland	*Energieverbruik*		*Energieproductie*	
	PJ	GWh	km2	
totaal	2600	722228	14445	
minus industrie	1560	433337	8667	
Nederland	18066340		*Voedselproductie*	
	/inwoner	ratio	km2	
huidig dieet	1800		32519	
lokaal	360	20%	6504	
import	1440	80%	26016	
flexitarisch dieet	1200		21680	
lokaal	900	75%	16260	
import	300	25%	5420	
plantaardig dieet	900		16260	
Source	https://www.clo.nl/indicatoren/nl005225-energi			
	https://www.pbl.nl/publicaties/dagelijkse-kost-h			

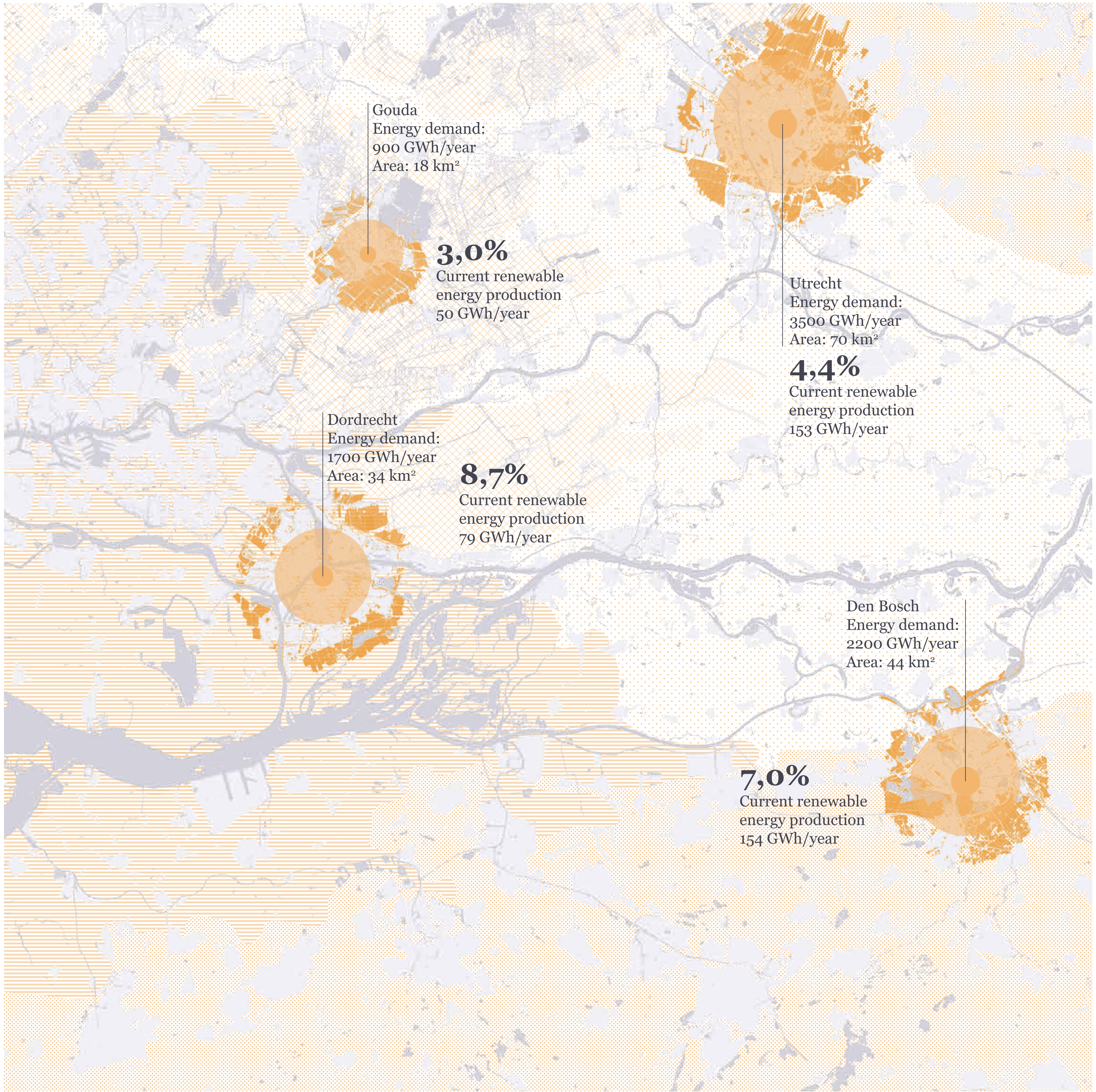
Berekening vuistregel GWh/year productie per km2				
Production method	GWh/ha/year	ratio	sum	
Solar	0,8	30%	0,24	
Wind	0,2	30%	0,06	
Geothermal	2	10%	0,2	
Biomass	0,3	15%	0,045	
Algae	0,3	10%	0,03	
Hydropower	0,5	5%	0,025	GWh/ha/year
		100%	0,6	GWh/year per km2
			60	
Source	https://www.cbs.nl/nl-nl/cijfers/detail/82610NED			

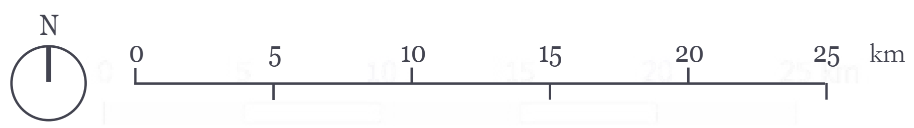
Berekening verhouding landbouw herstructurering					
Landbouwoppervlak	km2	ratio	ratio final	km2	m2/person
totaal	22304				1235
voedsel	16260	73	75%	16728	926
energie	8667	39	40%	8922	370
natuur	1115	5	5%	1115	19
			120%		
Natuur	km2	ratio			
bestaand	6687				
nieuw	1115	17%			
totaal	7802				

Bereking radius energie + voedsel per stad																
Stad	*inwoners*	*energie hernieuwbare productie 2022*				*energie verbruik 2022*					*flexitarisch dieet*		*energie + voedsel productie*			
		TJ	GWh	km2	radius	TJ	GWh	km2	radius	%	km2	radius	%	km2	radius	
Utrecht	376.435	3060	850	17,00	2326,22	20754	5765	115,30	6058,17	14,7	338,79	10384,64	25,4	454	12022,57	
Den Bosch	161.557	1011	281	5,62	1337,11	10550	2931	58,61	4319,33	9,6	145,40	6803,14	28,7	204	8058,49	
Gouda	76.536	188	52	1,04	576,59	3639	1011	20,22	2536,77	5,2	68,88	4682,52	22,7	89	5325,52	
Dordrecht	122.847	1407	391	7,82	1577,38	8801	2445	48,89	3945,09	16,0	110,56	5932,37	30,7	159	7124,38	
Rotterdam	672.330	8092	2248	44,96	3782,84	114484	31801	636,03	14228,63	7,1	605,10	13878,34	51,2	1241	19876,17	
Breda	188.834	1264	351	7,02	1495,08	12729	3536	70,72	4744,47	9,9	169,95	7355,06	29,4	241	8752,54	
Tilburg	230.359	1646	457	9,14	1706,10	15113	4198	83,96	5169,71	10,9	207,32	8123,61	28,8	291	9629,06	
Zoetermeer	129.941	417	116	2,32	858,73	5948	1652	33,04	3243,22	7,0	116,95	6101,26	22,0	150	6909,69	
Source	https://allecijfers.nl/gemeente/breda/															
	https://klimaatmonitor.databank.nl/dashboard/dashboard/hernieuwbare-energie															
	https://klimaatmonitor.databank.nl/dashboard/dashboard/energieverbruik															

HISTORY OF AGRICULTURE

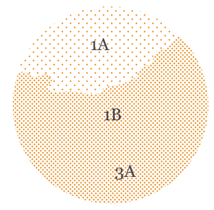






Den Bosch

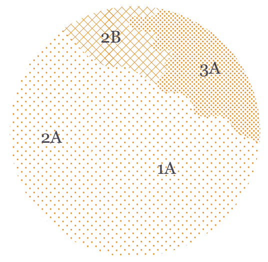
Annual Energy Demand **2200 GWh**



	1A Dry grassland		*1B Dry grassland*		*3A Dry forests*
Soil type	Riverclay	Soil type	Sand	Soil type	Sand
NAP level	+2.00	NAP level	+2.50	NAP level	+4.50
Flowing rivers	Maas	Flowing rivers	None	Flowing rivers	None
Waterbodies	3	Waterbodies	2	Waterbodies	1
Forests	1	Forests	1	Forests	3
Open land	3	Open land	2	Open land	2

Utrecht

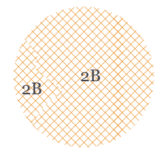
Annual Energy Demand **3500 GWh**



	3A Dry forests		*1A Dry grassland*		*2A Wet marshland*		*2B Wet marshland*
Soil type	Sand	Soil type	Riverclay	Soil type	Riverclay	Soil type	Peat
NAP level	+5.00	NAP level	+2.00	NAP level	+0.00	NAP level	+0.00
Flowing rivers	None	Flowing rivers	None	Flowing rivers	Lek	Flowing rivers	None
Waterbodies	1	Waterbodies	1	Waterbodies	1	Waterbodies	3
Forests	3	Forests	2	Forests	1	Forests	1
Open land	1	Open land	2	Open land	3	Open land	3

Gouda

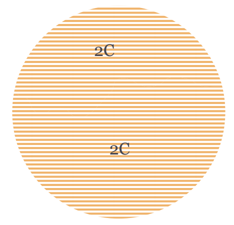
Annual Energy Demand **900 GWh**



	2B Wet marshland		*2B Wet marshland*
Soil type	Peat	Soil type	Peat
NAP level	-2.00	NAP level	-6.00
Flowing rivers	Hollandsche IJssel	Flowing rivers	None
Waterbodies	3	Waterbodies	1
Forests	1	Forests	1
Open land	3	Open land	2

Dordrecht

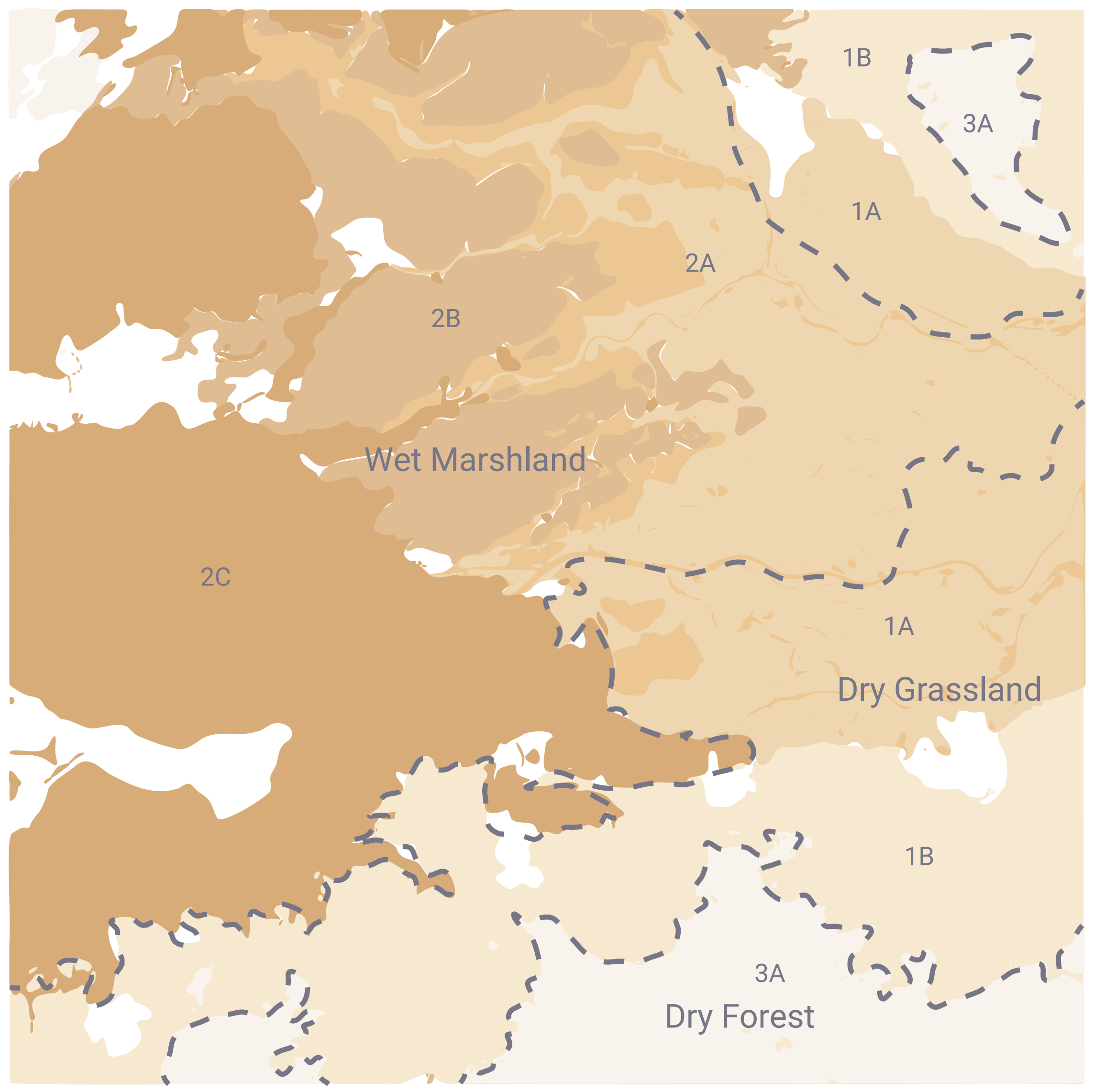
Annual Energy Demand **1700 GWh**



	2C Wet marshland		*2C Wet marshland*
Soil type	Seaclay	Soil type	Seaclay
NAP level	-2.00	NAP level	+0.00
Flowing rivers	None	Flowing rivers	Merwede
Waterbodies	0	Waterbodies	2
Forests	0	Forests	2
Open land	3	Open land	2

		Agriculture	Energy	Nature
1 Dry grassland	A Riverclay	Agriculture Cattle Horticulture	Wind energy Solar energy Geothermal energy	Meadow Thicket Floodplains
	B Sand	Cattle Forestry	Wind energy Solar energy	Meadow Heath Forests
2 Wet marshland	A Riverclay	Wet agriculture Forestry	Algae energy Pumped hydro storage	Marshes Floodplains
	B Peat	Wet agriculture Cattle	Biomass Thermal energy storage	Marshes Thicket Floodplains
	C Seaclay	Agriculture Horticulture	Solar energy Wind energy Blue energy	Marshes Floodplains
3 Dry forests	A Sand	Cattle Forestry	Wind energy Biomass Geothermal energy	Meadow Heath Forests

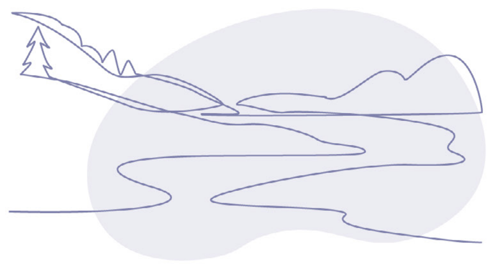
		Agriculture	Energy prodution	Energy storage	Nature
1 Dry grassland	A Riverclay	Agriculture Cattle Horticulture	Geothermal energy Solar energy Wind energy	Battery-storage Compressed Air Energy Storage Hydrogen storage Thermal energy storage	Meadow Thicket Floodplains
	B Sand	Cattle Forestry	Geothermal energy Solar energy Wind energy	Battery-storage Compressed Air Energy Storage Hydrogen storage	Meadow Heath Forests
2 Wet marshland	A Riverclay	Wet agriculture Forestry	Algae energy Biomass Geothermal energy Solar energy Wind energy	Pumped hydro storage (dikes) Thermal energy storage	Marshes Floodplains
	B Peat	Wet agriculture Cattle	Algae energy Solar energy Biomass	Pumped hydro storage (dikes)	Marshes Thicket Floodplains
	C Seaclay	Agriculture Horticulture	Algae energy Biomass Blue energy Geothermal energy Solar energy Wind energy	Pumped hydro storage (dikes) Thermal energy storage	Marshes Floodplains
3 Dry forests	A Sand	Cattle Forestry	Biomass Geothermal energy Wind energy	Battery-storage Compressed Air Energy Storaget Hydrogen storage	Meadow Heath Forests



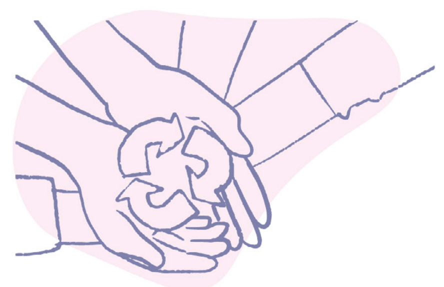
Bioregion

A bioregion is a geographic area defined by natural boundaries like watersheds, climate zones, soil types, and ecosystems rather than political or administrative borders. It's an approach that integrates cities and human settlements into the larger ecological systems they depend on. Bioregional urbanism seeks to harmonize cities with their surrounding landscapes, ensuring long-term sustainability.

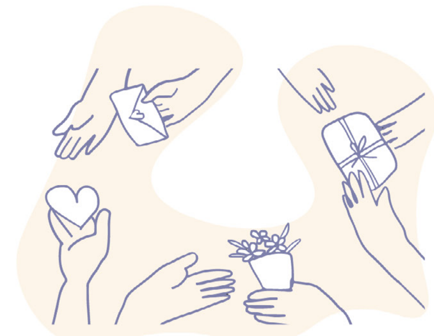
Key Principles:



Watershed-Based Planning



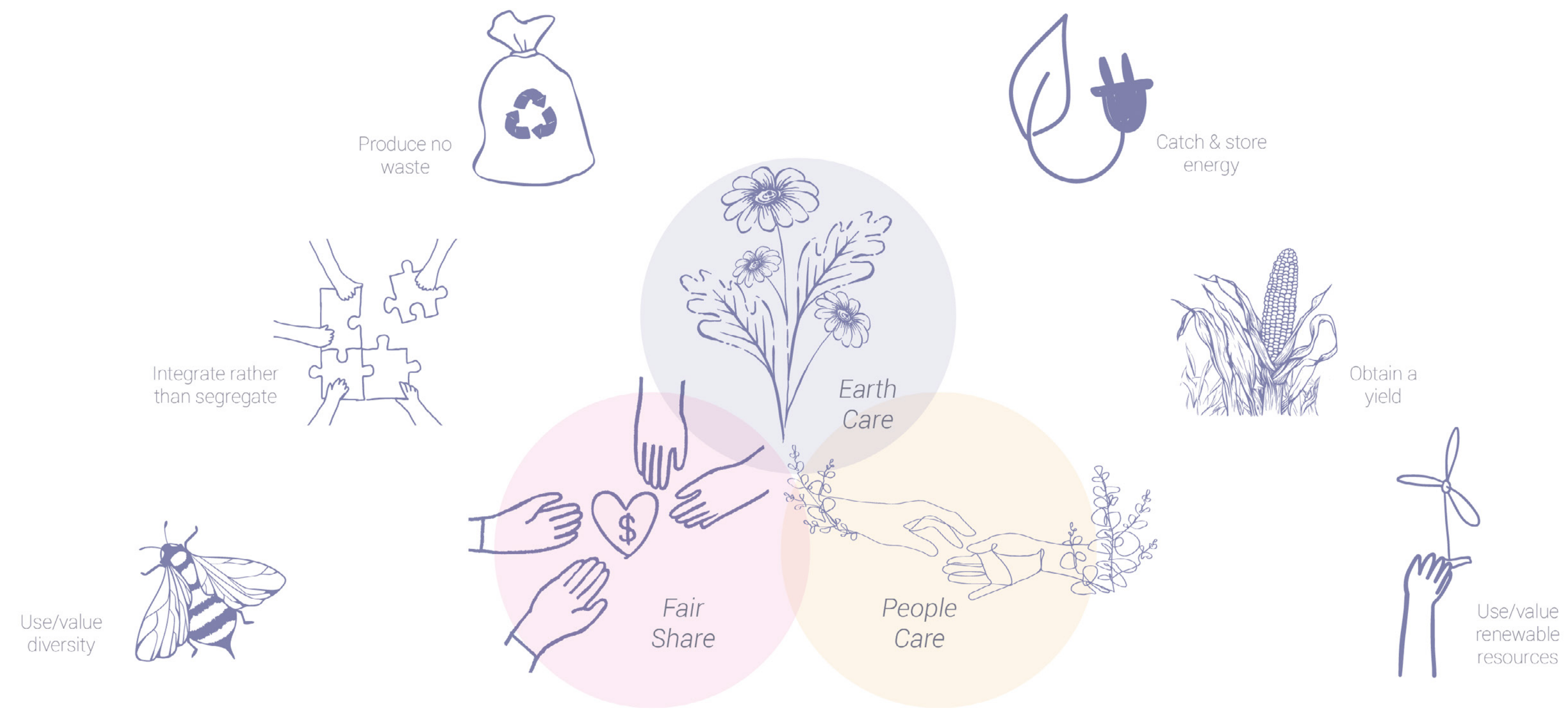
02. Localized Resource Use

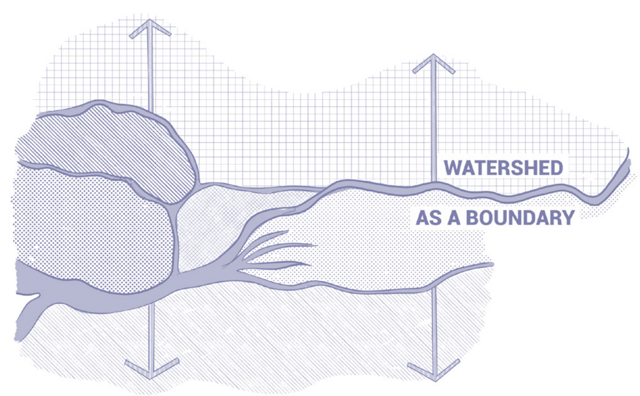


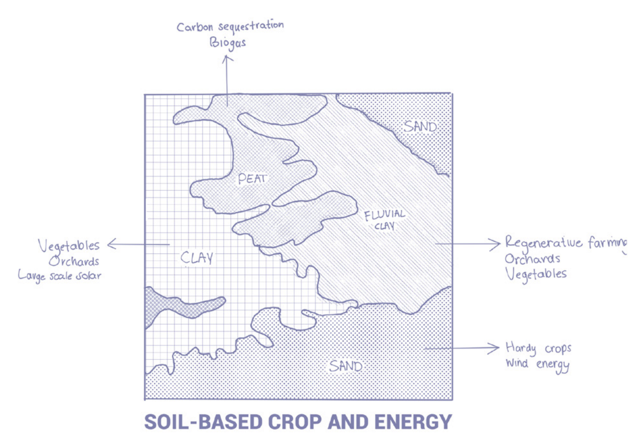
03. Community Participation

Permaculture

Permaculture is an agricultural system of design approach that imitates natural ecosystems to create self-sufficient, regenerative systems. It takes inspiration from nature to create food systems that work in harmony. It has 12 guiding principles. Here are some:





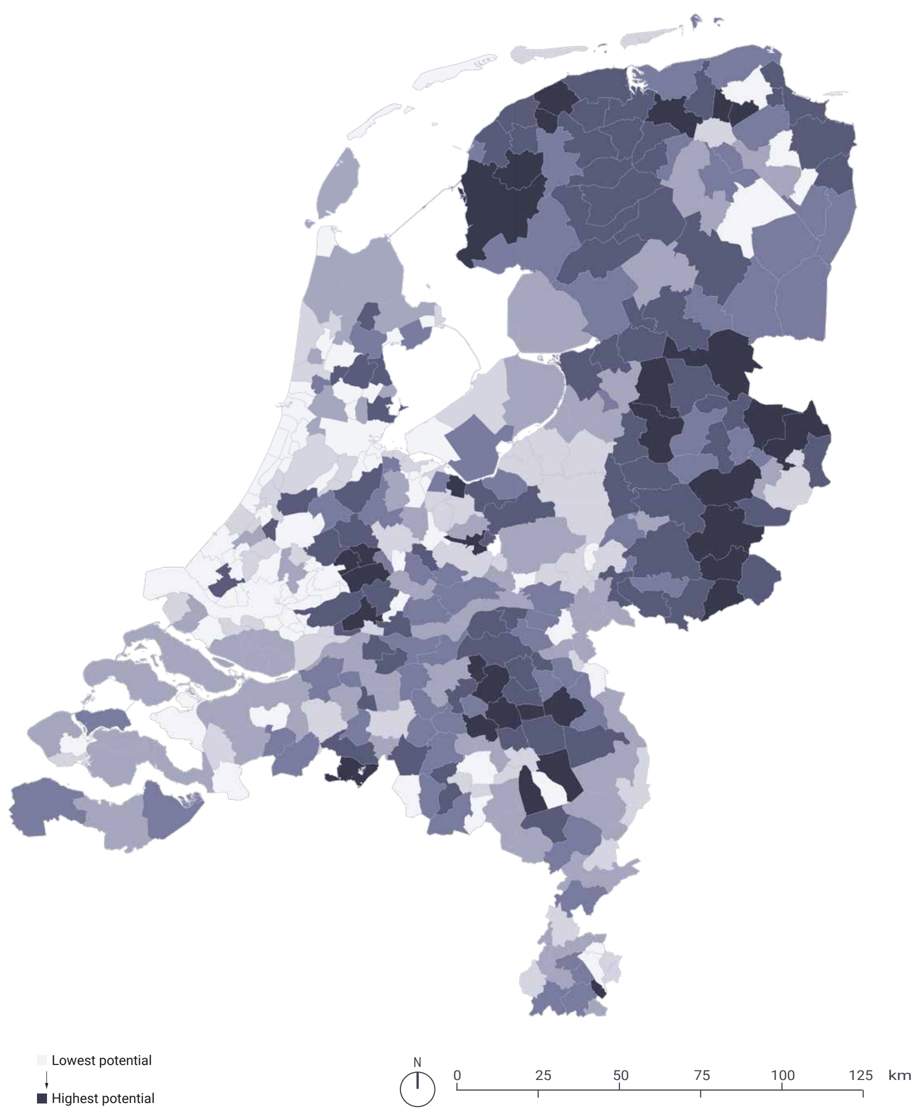


LANDSCAPE HEIGHT - NATIONAL

WINDSPEED AT 100m - NATIONAL

GEOTHERMAL POTENTIAL - NATIONAL

BIOGAS POTENTIAL - NATIONAL



CURRENT ENERGY

CURRENT ENERGY: DORDRECHT

Farmers
“Wij hadden willen verkopen. We zitten op zo’n leeftijd dat je best zou willen stoppen. Maar toen namen we een adviseur in de arm en die zei: ‘Niet gelijk toehappen, want de premies die ze bieden gaan nog wel meer stijgen.’ Tja, daar hebben we helaas naar geluisterd. En nu is het te laat.”

“Dus jij wilt weten hoe het voelt nu alles weg is? Laat ik het zo zeggen: doodziek ben ik ervan.”

“Nu is de kogel dus door de kerk. Als het goed is, is alles over twee weken weg, dan is het klaar. En da’s wel heftig. Dan moet ik gaan afbreken. Ik zei: ‘Dat doe ik wel op mijn eigen maniertje’. Want ik weet hoe dat gaat: je hebt een paar maanden de tijd en dan komt er ineens een ecoloog kijken of er vleermuizen zitten, of vliegen, of weet ik veel… Allemaal van dat kutjesvolk waar ik schijt aan heb. Begrijp me niet verkeerd: ik ben gek met de natuur hé, daar zorgen we met z’n alle goed voor. Maar intussen worden we bekeken als de grootste vervuilers, de grootste criminelen.. Nou, in mijn beleving gaat dat helemaal nergens over. VOrige week las ik in de grant: de sportvelden hier in de buurt krijgen twee jaar lang geen kunstmest, omdat er een keer een vrachtwagen met een kraan het bos in moet rijden. Maar er rijden elke dag 180.000 vrachtwagens door het bos. Dan ben je toch met z’n alle knettergek geworden of niet soms?”

“… Ze zijn zo hard op zoek naar onzin redenen om ons niet te financieren, dat ze zelfs vragen waarom wij, jonge mensen, niet gaan emigreren. Maar ik wil niet naar het buitenland en ik ga niet naar het buitenland! Ik blijf gewoon hier.”

“Als ik boer blijf, draag ik bij aan het milieu en niet zo’n klein beetje ook. De controles in Nederland zijn extreem streng; daardoor werken we efficiënt. Stel dat wij hier allemaal zouden ophouden. Dan breekt de pleuris uit. Dan zijn we afhankelijk van landen waar mag worden geknoeid met antibiotica en gifstoffen en weet ik veel wat allemaal nog meer. Nee hoor. Door boer te blijven in Nederland en me te houden aan die strenge milieuregels, draag ik bij aan het milieu.”

Local residents
“Ik woon hier al vanaf 1993 en ervaar de intensieve veetieelt in dit gebied niet als overlast. Wel heb ik het de laatste 15 jaar heel erg zien veranderen: van een buitengebied in een soort Oostblok-zone met veel leegstand. Ja dat die intensieve, pluimveehouder weg moet, begrijp ik wel, want mensen hadden last van de stank. Maar nu zie je dat ineens alles verdwijnt. Ze worden niet gedwongen, maar je ziet dat met name oudere boeren ervoor kiezen om uitgekocht te worden. Ze kiezen voor een stabiele toekomst, dat snap ik wel. Maar het gaat hier leeg worden. Ik verwacht dat ze woningen gaan bouwen. Wat voor gevolgen dat heeft voor mijn persoonlijke beleving - dat kan ik niet goed inschatten.”

Scientists
“Uiteindelijk gaat het natuurlijk om vervuiling. De intensieve veehouderij veroorzaakt ontzettend veel vervuiling. En als die nou binnen zo’n bedrijf zou blijven, was er niks aan de hand. Maar het gaat over de grenzen van het bedrijf heen en bedrijgt andere belangrijke dingen, waar we collectief verantwoordelijk voor zijn. De bodem bijvoorbeeld, en … van die vegetatie. Ik vind het dus eigenlijks heel logisch dat je degene die vervuilen, in welke mate dan ook, daarop aanspreekt … Het gaat me er niet om dat die mensen geen boterham mogen verdienen. Het gaat erom dat ze dat doen zonder de boel te vervuilen.”

Recreational visitors
“Kijk, ik weet zo langzamerhand niet meer wat waar is. Er wordt zoveel beweerd, door politici, de wetenschappers, de boeren. Ik weet alleen maar dat de natuur verandert en dat het weer steeds extremer wordt. Soms denk ik: we hebben het aan onszelf te danken, het is het gevolg van de keuzes die we maken. Maar dat is mijn mening.”

Agricultural service providers
“Die nieuwe stallen leveren nog wat op, maar die oude - daar beur je geen geld voor.”

Speakers
‘In de kerk zeggen ze twee dingen, ten eerste zeggen ze: “De overheid is het beest uit de afgrond.’ Maar op het moment dat het ze past, zeggen ze: ‘De overheid draagt het zwaard niet tevergeefts.’ Daarmee bedoelen ze dan dat de overheid alle criminelen moet oppakken en de vluchtelingen moet weren, enzovoorts. Tussen die twee werelden leven zij. Gaat het over belasting betalen of je aan de milieuregels houden, dan is de overheid de duivel die zich overal mee bemoeit. Maar gaat het over vluchtelingen of criminelen dan moet er ineens hard ingegrepen worden. Dat is natuurlijk zo idioot als maar kan.”

“Beste mensen, het is een smoes! Stikstof is een smoes om de boeren weg te jagen en hun land vol te proppen met woningen voor asielzoekers. Dat is hun echte agenda: de D66-agenda van boerenhaat en afbraak. Maar vandaag maken wij er een historische dag van… Vandaag spreken wij met elkaar af dat we Nederland terug gaan veroveren!”

“Ah ja, dat narratief: ‘De overheid is uit op ons land!’ Dat komt uit de fabeltjesfruik en snijdt op geen enkele manier hout. Zelfs als we blijven bouwen zoals we nu gewend zijn, met eigenlijk veel te veel ruimte per wooneenheid, dan is maar een paar procent van die grond nu in bezit van boeren.”

“...Neejoh, het gaat eigenlijk maar om één ding: de koeienboer. Die heeft twee derde van Nederland in handen, die grond willen ze hebben. Echt waar, dat is honderd procent waar het om gaat: onze grond! Dat hele kutklimaat - ik zeg het gewoon: ik schijt erop!”

Nature conservationists
“... Laten we mekaar opzoeken en schouder aan schouder dit gebied aanpakken. Niet in de zin van: we gaan het helemaal omploegen en we maken er wat anders van. Nee, laten we kijken waar we elkaar kunnen versterken en helpen. Waar we win-winsituaties kunnen creeëren, zowel voor de landbouw als voor de natuur.”

“Je zag het gebeuren in die tijd dat de Afsluitdijk kwam, de boel wered ingepolderd en het huidige Ijsselmeer ontstond; dat al die vissers dan maar eenden gingen fokken. Ja, da’s nogal een verschil: of je met je schip de zee op gaat, met alle vrijheid en alle risico’s van dien, óf in een stal ergens op het vasteland zit, boordevol kwakende eenden. Er zijn meer van die golven geweest, waarbij bepaalde beroepsgroepen volledig hebben moeten omschakelen.”