


Creating a Decentralized and Equitable U16 Region through Energy Storage

# "Spatial Strategies for the Global Metropolis" Research and Design Studio

MSc Architecture, Urbanism and Building Sciences
TU Delft - Urbanism track

Q3, February - April 2025

Tutors:
Ir. Francesca Rizzetto
Dr. DA Diego Sepulveda Carmona

Students:
Michele Francesco Bonato (6301290)
Kenneth Christopher Dy (6136729)
Gijs Jeuken (5115175)
Wessel Van Elzakker (6339891)



## 0.0 Abstract

The energy transition is advancing, and the share of renewable energy is increasing. The intermittent nature of these energy sources is introducing problems with energy security throughout the day and putting extra pressure on an already heavily congested electricity grid. To alleviate these problems, heavy investments in battery energy storage systems are necessary. But it is important that the energy transition is equitable, and all social classes benefit from it.

This study investigates how we can implement spatial strategies for renewable energy in the U16 region in order to promote an inclusive energy transition. Four communities were identified, and their profile was developed through street interviews, semi-structured interviews and literature review. Through spatial analyses the communities were identified in the U16 region. By connecting different communities in close proximity, clusters were identified which have high potential for collaborative energy strategies. Existing policy and regulation measures to promote sustainability measures were analyzed, and policies were developed to accelerate the deployment of renewable energy, alleviate congestion on the electricity grid and kickstart investments in large-scale battery energy storage deployments.

Two scenarios were developed, one scenario to reach the goal of becoming net carbon neutral in 2050, and one for the timeframe after. The scenario until 2050 includes technological strategies like large scale deployment of sodium-ion batteries, and plug-in solar panels to be installed on balconies and facades. Other strategies include investments by public and private parties in battery storage, and policy recommendations like building mandates and incentives for dynamic energy contracts. The interrelationship between communities is the core of these approaches, creating an interplay between the strengths and weaknesses of these groups. After 2050, strategies are suggested to develop large scale hydrogen production and storage to provide seasonal energy storage. Also, the development of an intercontinental energy grid is suggested, to deploy solar installations in countries around the equator. Using these methods, renewable energy can power society, while benefiting all demographics and communities.

CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS
CONTENTSCONTENTSCONTENTS


**1.INTRODUCTION** 06-19
transition urgency
current scenario
energy transition in the netherlands
the grid congestion
area selection

**2.METHODOLOGY** 20-31
problem statement
research question
methodology
theoretical framework
conceptual framework

**3.ANALYSIS** 32-47
regional analysis
SWOT analysis
current policies and incentives
stakeholder analysis
fundamentals of current storing technologies

**4.COMMUNITIES** 48-77
interviews
profiling the communities
spatial identification of the communities
community demands and needs
interrelation of the communities

**5.VISION** 78-89
vision statement and goals
vision narrative
vision for energy circulation
values and SDGs
vision map

**6.STRATEGIES** 90-125
program
fundamentals of new technologies
policies, politics, subsidies
physical strategies
action cards
strategies and policies interrelation
pilot area
strategy map

**7.PROJECTIONS** 126-133
future scenarios
phasing
timeline 2050 scenario
timeline 2050+ scenario

**8.CONCLUSION** 134-143
evaluation based on the met frameworks
personal reflections
references

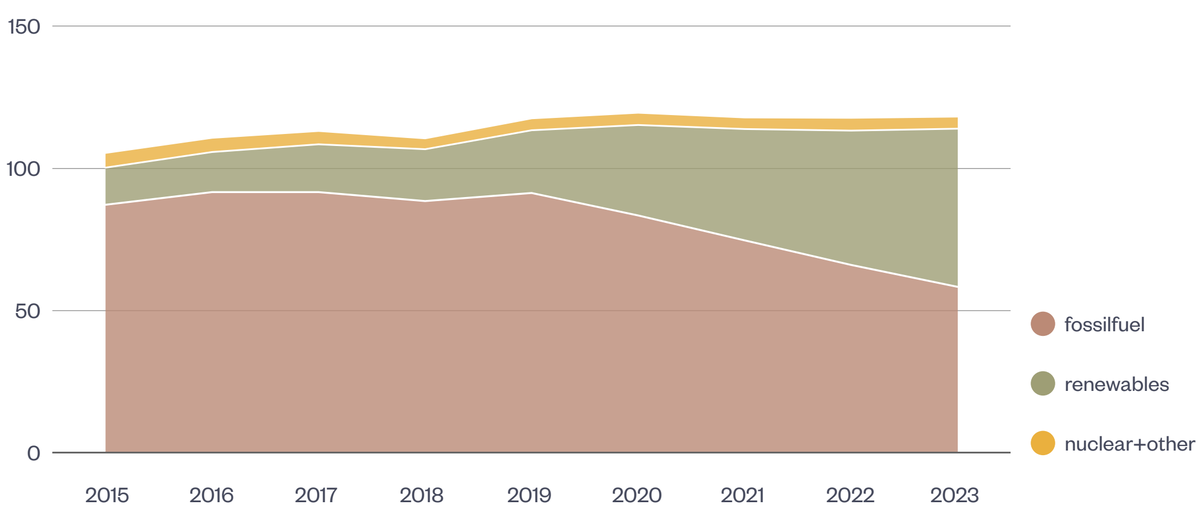
**9.APPENDIX** 144-157
appendix A
appendix B
appendix C
appendix D


INTRODUCTIONINTRODUCTION
INTRODUCTIONINTRODUCTION
INTRODUCTIONINTRODUCTION

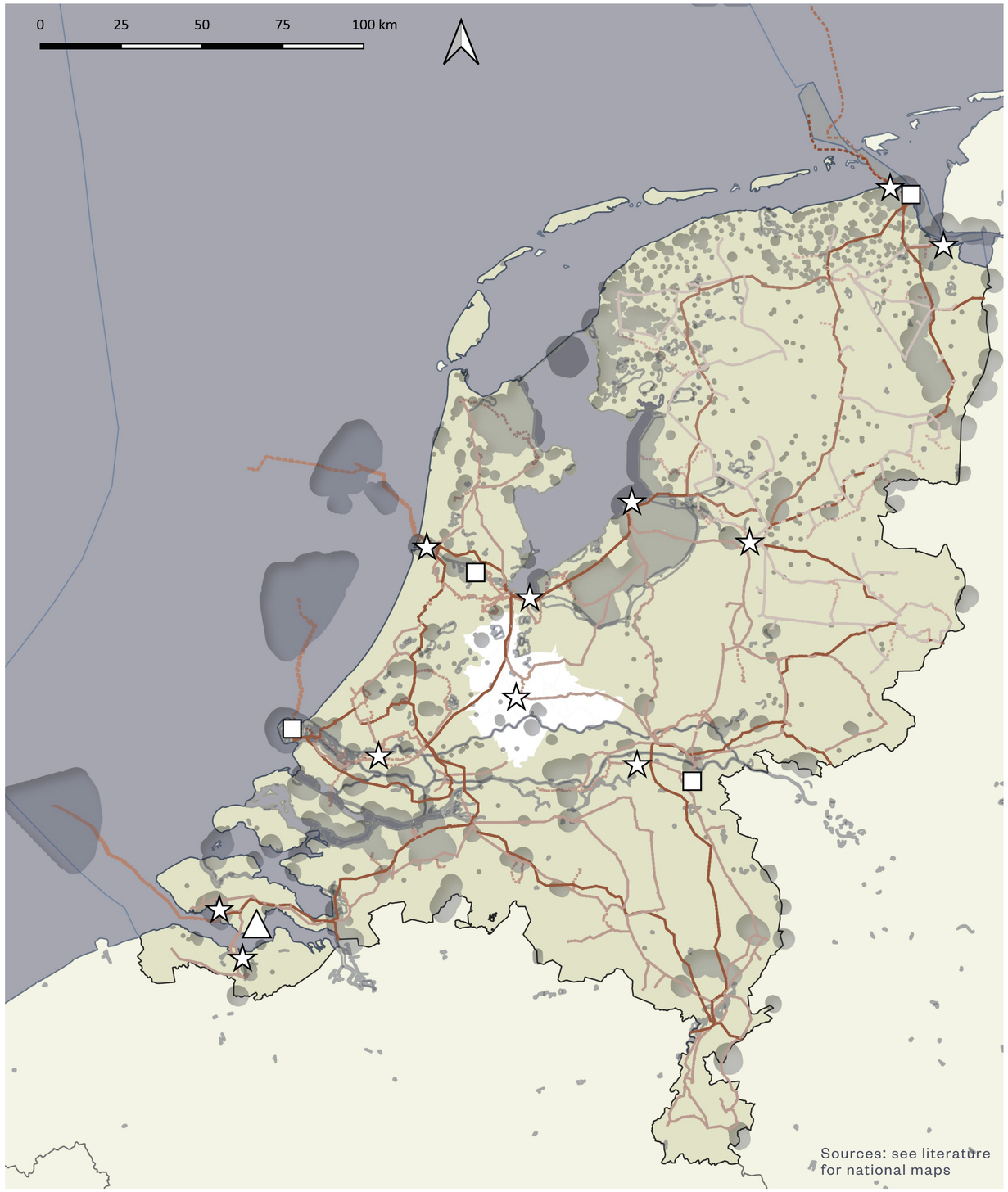
# 1.2 Current scenario

Currently, the Netherlands is in the middle of the energy transition. Existing infrastructure must be upgraded to handle the deployment of renewable energy sources and the increased demand for electricity. Map 1 shows current Dutch electricity infrastructure. High voltage power lines, operated by TenneT, transport electricity over long distances and across borders. Large fossil fuel power plants, highlighted by different symbols, traditionally supplied most of the electricity. The blue areas show wind parks in the North Sea and on land.
Renewable deployment has accelerated significantly over the last years. Wind and solar energy generation increased from 8,658 GWh in 2015 to 49,156 GWh in 2023 (IEA, 2025). By the first half of 2024, renewable sources accounted for over half of Dutch electricity consumption (André Oerlemans, 2025). Especially solar is expected to become a major source of renewable energy. According to the International Energy Agency, solar energy is set to become the largest renewable energy source by 2029, overtaking wind power and hydro globally (IEA, 2024). Map 2 shows a heatmap of current national solar energy has to produce. While there is significant capacity in dense regions with major cities like Amsterdam and Utrecht, there are also large solar parks in the north and south of the country.
Renewable energy production does not necessarily occur in the places where the majority is consumed as highlighted on map 3. Especially in the north there is a large solar capacity while most electricity consumption happens in the west. This is partly due to large electricity consumers like Rotterdam Harbor, Schiphol Airport and Tata Steel being situated in the west.
All the extra electricity production is necessary to power the electrification of all sectors. A sector like passenger transportation is making good progress. The share of electric vehicles has increased from 0.3% of the national car fleet in 2018 to 6.3% in 2025. More than a third of new cars sold are fully electric, which signals a shift in market dynamics and the importance that the consumer places on sustainability. (Duurzame Mobiliteit Databank, 2025).
Other sections of the energy transition are developing more slowly, like the deployment of battery energy storage. As of 2023, the Netherlands had just over 600 MWh of installed battery capacity, enough to power around 50,000 households for a single day. Compared to a country like Germany, which has installed over 11,800 MWh, it shows that major steps still must be made (DNE Research, 2025). This gap highlights the slower adaptation of storage solutions, in part due to policies like the netting arrangement, which has reduced the urgency for storage adoption. With this policy set to end in 2027, the bsttery storage market is expected to accelerate, but whether deployment will keep pace with growing renewable generation remains a question.
Despite these efforts, the transition is not happening fast enough. Carbon emissions per capita have dropped considerably between 2000 and 2022 with 33% (IEA, 2025). While these trends are positive, the Netherlands is not on track to meet its 2030 target of a 55% CO2 reduction compared to 1990 (RVO, 2024). Additional measures are needed in the next years. Investing in improving the electricity grid, accelerating investment in renewable energy projects are needed. Electrification of all industries must be sped up, to shift away quicker from fossil fuels towards renewably produced electricity. The momentum is there, but without decisive action, the country risks falling short of its climate goals.

**Electricity production by source in The Netherlands in kW/h** (CBS, 2025)



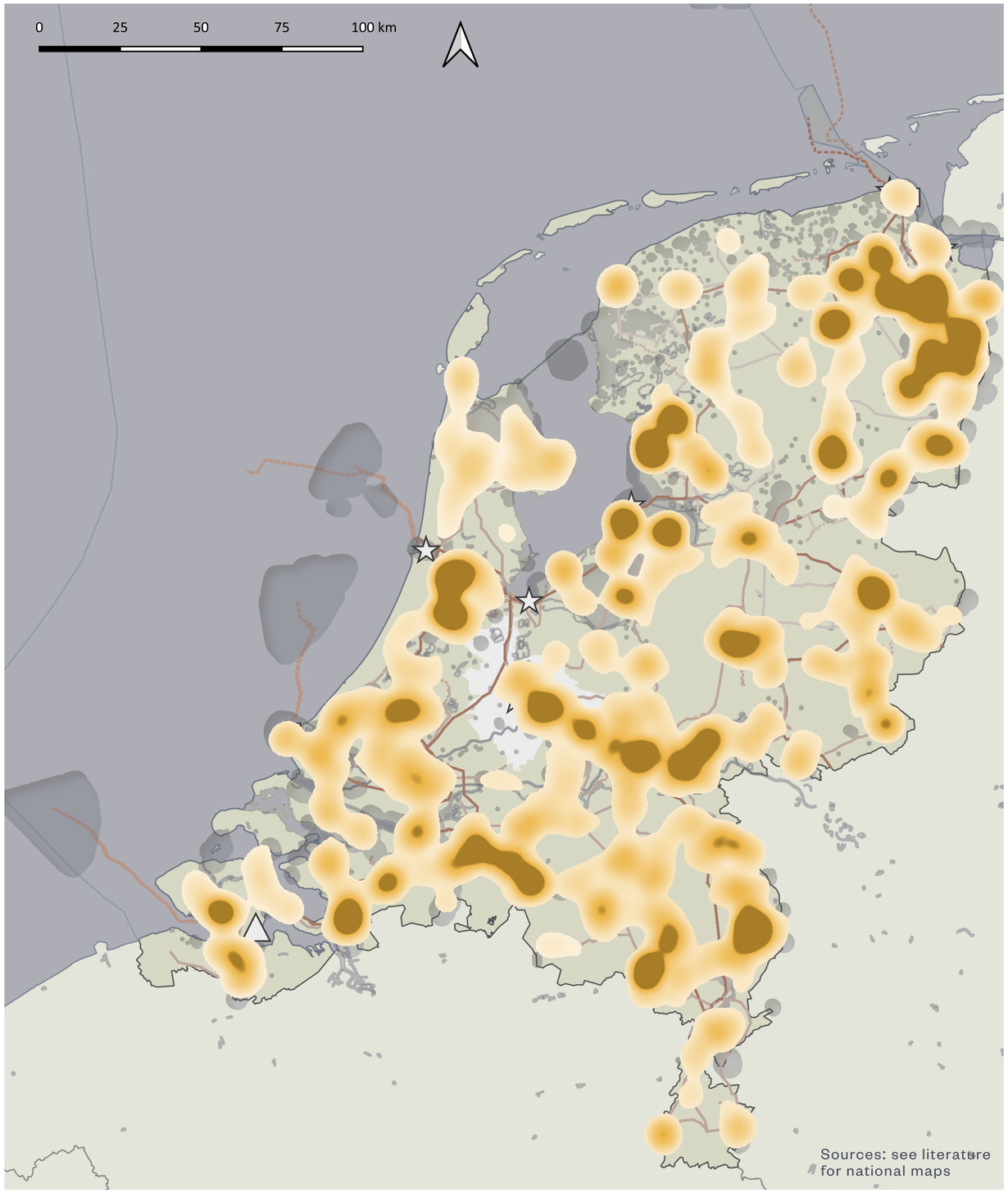


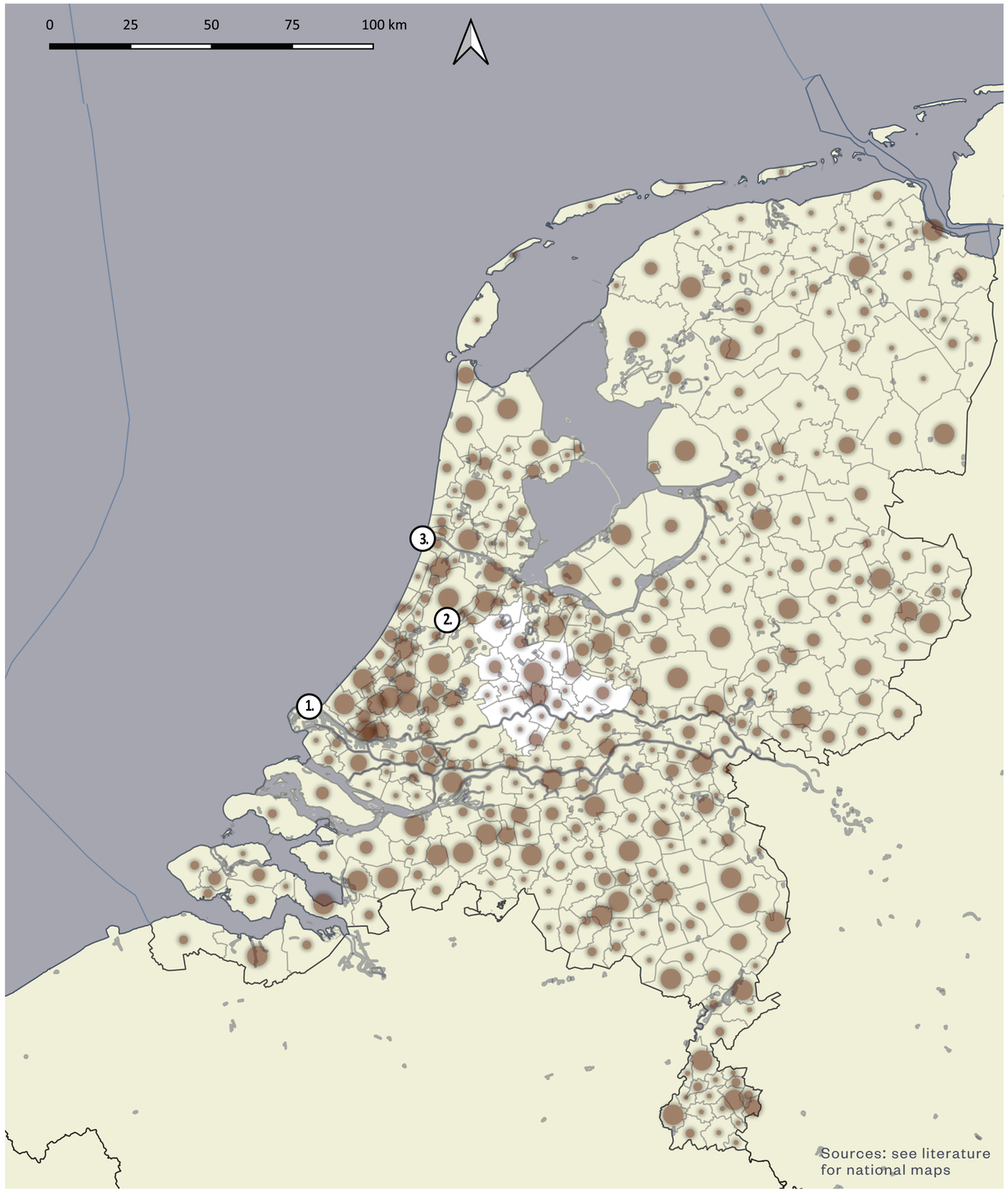

**Map 1**
**National Energy Production**

**High voltage power lines (above ground)**
- 110kV
- 150kV
- 220kV
- 380kV
- Wind park/wind turbines

**High voltage power lines (underground)**
- 110kV
- 150kV
- 220kV
- 320kV
- 380kV
- 400kV
- Natural gas plant
- Coal plant
- Nuclear Plant




**Map 2**
**National Solar Energy Production**




**Map 3**
**National Renewable Energy Production**

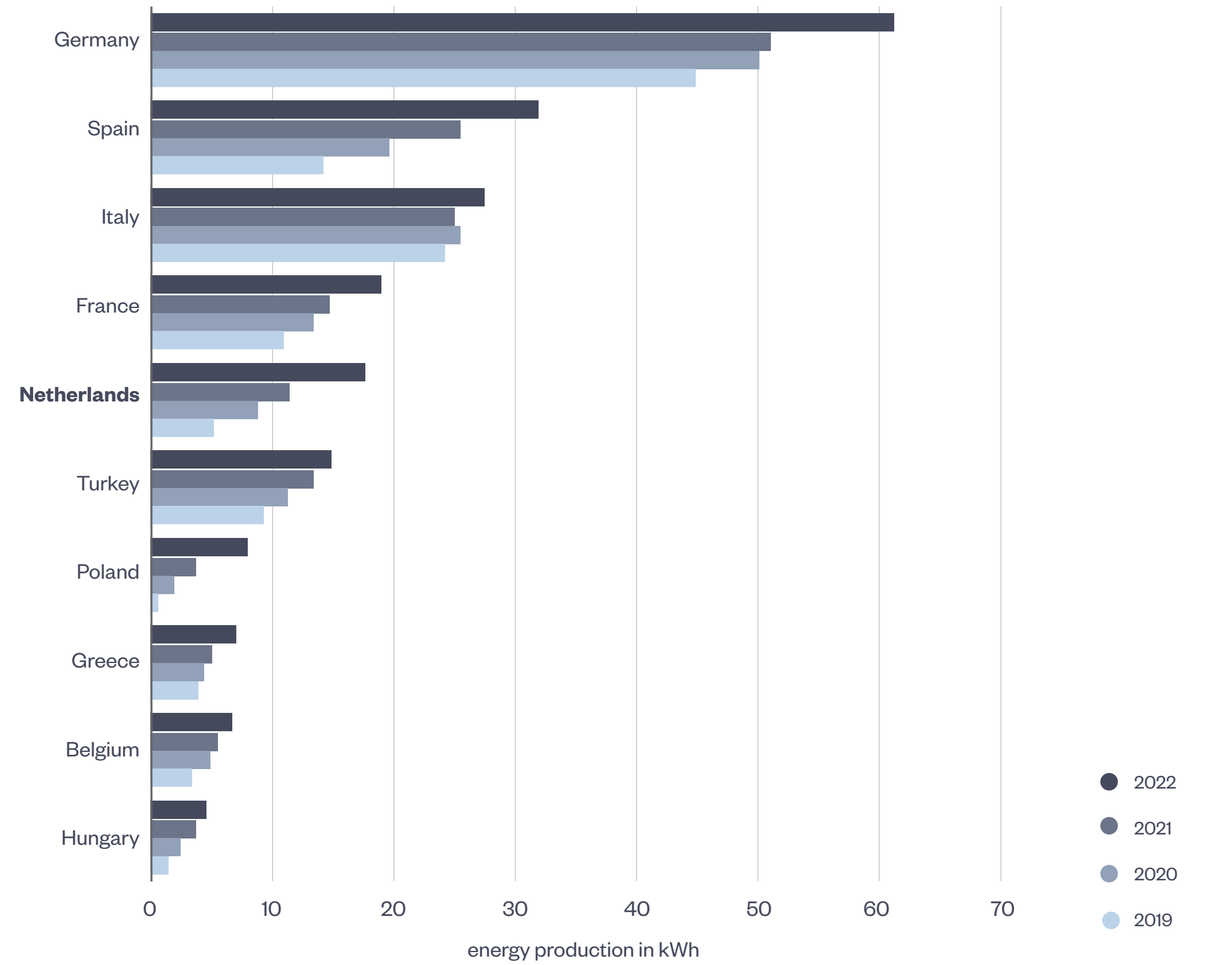
# 1.3 Energy Transition in The Netherlands

Traditionally, electricity in the Netherlands is generated using large power plants that burn natural gas and coal. Heat is released to turn water into steam, which can be used to spin giant turbines, which generates electricity. This electricity is distributed to consumers using the electricity grid, a network of interconnected high voltage power lines, underground cables and transformation stations.

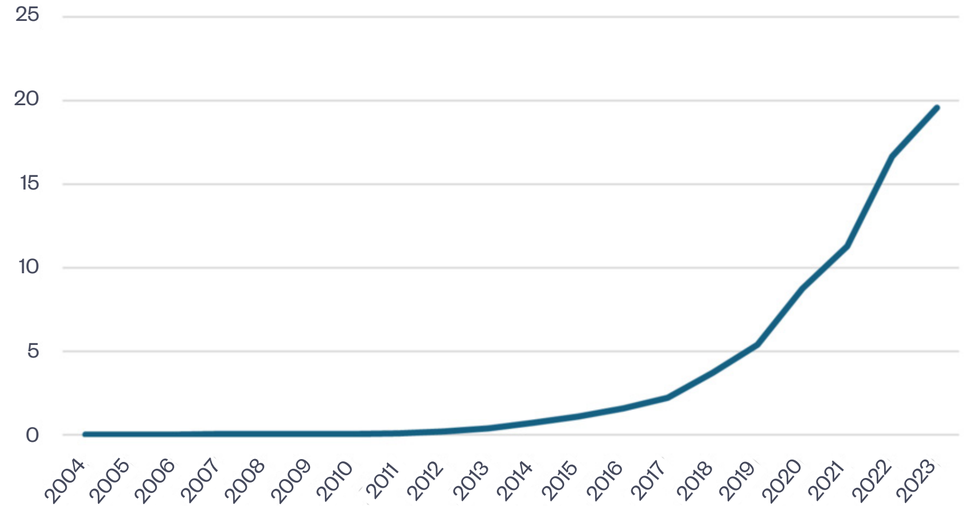
Fuelled by the need to combat climate change, renewable energy sources have become a major contributor to electricity production. Renewables, like solar and wind energy, changed the energy landscape in two major ways. The first is that electricity is not always generated by large producers anymore. Rooftop solar has enabled many consumers to become their own small-scale power producers. Electricity generated during sunny periods is used by the owners, and any excess production can be fed into the electricity grid. Others can use that electricity, and the solar panel owners receives compensation.
The second difference is that we have less control over the amount of electricity being generated at any moment. Whereas traditional power plants can be scaled up- and down by adjusting fuel input, renewable energy sources are often reliant on external factors. Solar production varies throughout the day depending on the location of the sun, weather conditions and season. As the name suggests, wind power relies on the amount of wind at any moment. This variable nature of these energy sources is called intermittency and is increasingly becoming a problem as their share in the energy mix grows. This is because the electricity grid operates on a certain frequency (50Hz in Europe), and to maintain this, production and consumption must be equal at any moment. If deviations become too large, power plants can shut down, or the electricity supply system can fail entirely.

Not only how we generate electricity is changing, also how much we consume. Part of the energy transition is the electrification of things that traditionally used fossil fuels. Transportation is electrifying, and the share of electric cars, motors and trucks is steadily increasing. By installing heat pumps in homes, the heating of water for radiators and showering is shifting from natural gas to electricity. Using induction cooking, stovetops are transitioning to too. The amount of electricity generated per capita increased 9% in the last decade and is expected to increase further into the future (IEA, 2025).

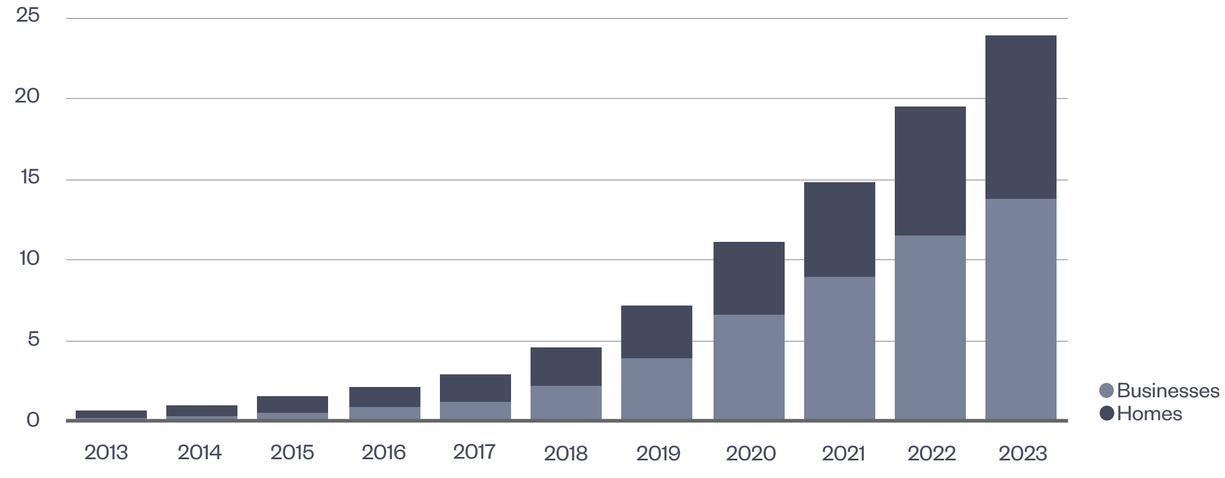
**Top solar-producing countries in Europe** (CBS, 2025)




**Solar Power Production in the Netherlands** (IEA, 2025)




**Total installed solar panel capacity in The Netherlands in GW** (CBS, 2025)



# 1.4 The Grid Congestion

The increase in electricity demand combined with the penetration of renewables have put significant pressure on the electricity grid. In large regions of the Netherlands, the grid is fully congested. Because of this, electricity consumers and producers are often put on a waiting list before they can connect to the electricity grid. This has economic and social impacts. New companies won't be able to get power, and existing companies cannot expand (RVO, 2025). The Netherlands is also in a housing crisis, but because of net congestion fully finished new-built homes must wait to be connected (NOS, 2023). Net congestion also has significant impacts on the energy transition. Large scale renewable energy projects that cannot be connected have to be delayed and companies cannot perform (legally required) sustainability measures (Rabobank, 2025).

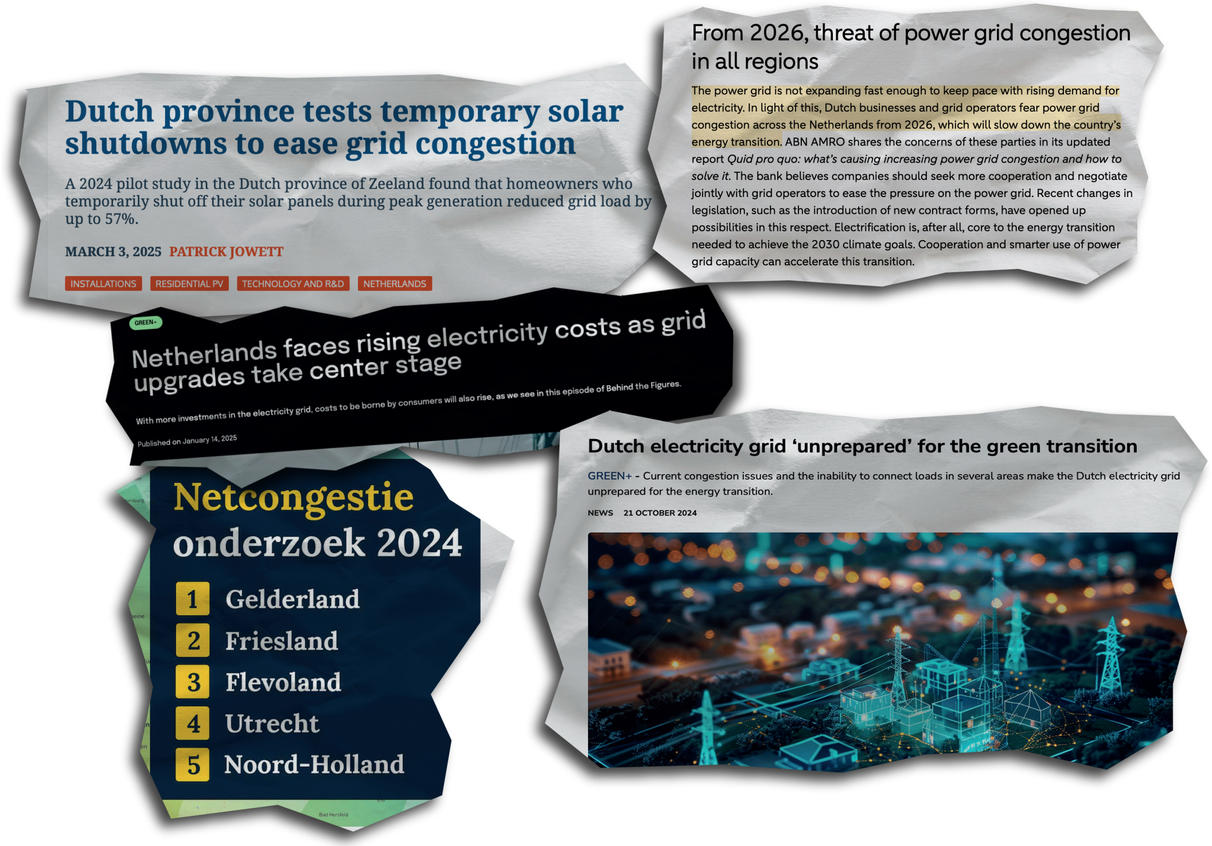
To solve grid congestion and create a path to a fully sustainable energy supply, major infrastructural investments must be made. TenneT, the operator of the Dutch high voltage electricity grid, expects that investments of 200 billion euro are needed in the next 10 years to upgrade the grid source (TenneT Holding B.V., 2025). While investing in upgrading the grid is crucial for the energy transition, it does not resolve the issues that intermittency of renewable energy source cause. Currently during sunny periods, national solar electricity production exceeds total demand. This may lead to curtailment, which involves artificially limiting the amount of renewable electricity being produced by turning off solar panel installations and wind turbines. Later in the day, when the sun has set and solar production has stopped, fossil fuel-powered plants need to step in to generate the electricity.



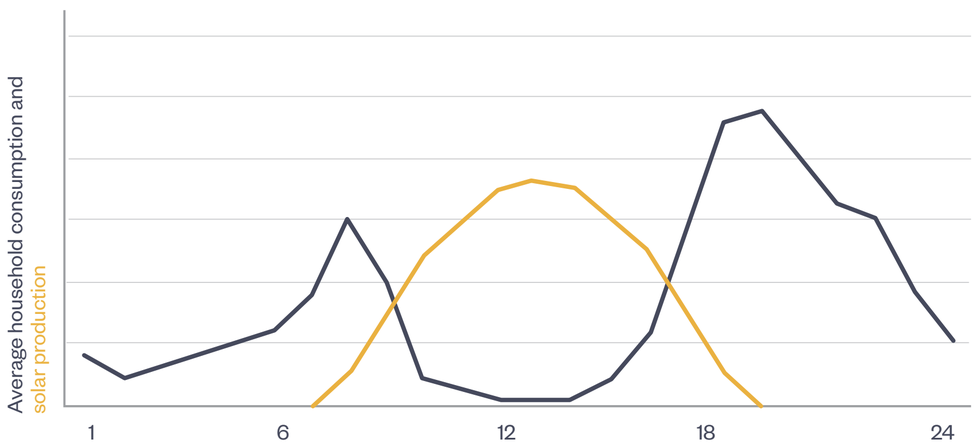
**Grid Capacity in The Netherlands**

- shortage or no capacity on the grid with queue
- area is under investigation with queue
- limited transport capacity available without queue

(Netbeheer Nederland, 2025)




**Average daily household power consumption and solar production of a 5kW system**




(Sunrayspower, 2019)






**National Grid Map**



A grid operator working.
Photo: TenneT

# 1.5 Area selection

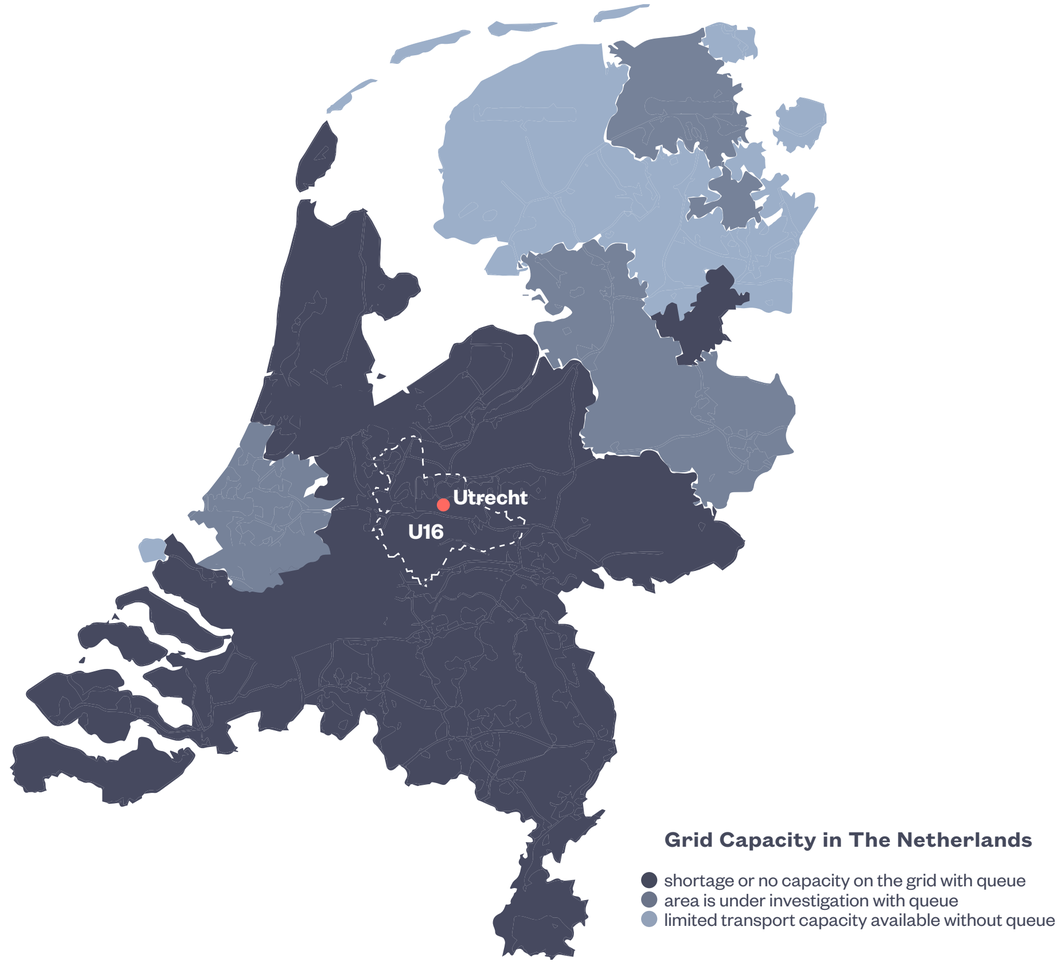
For this project, a RES-region had to be selected. RES stands for Regional Energy Strategy. The RES is a collaborative structure by the provinces, municipalities and water boards, divided into 30 different regions. The first collective goal for the 30 regions is to produce 35 TWh renewable energy on land by 2030 (Regionale Energie Strategy, n.d.). When looking at the context and problems discussed in this project (grid congestion, solar or renewable energy production and the net metering scheme), what area is a good regional 'case' to analyse and find solutions for? In which region does the contextual framework of this project pose a challenge within the energy transition? The U16 has been selected as the focus area for this project. Why?
A more develop dive into the U16 region will follow in the next chapters.

**54%** homes with solar panels in Utrecht (Klerks, 2023)

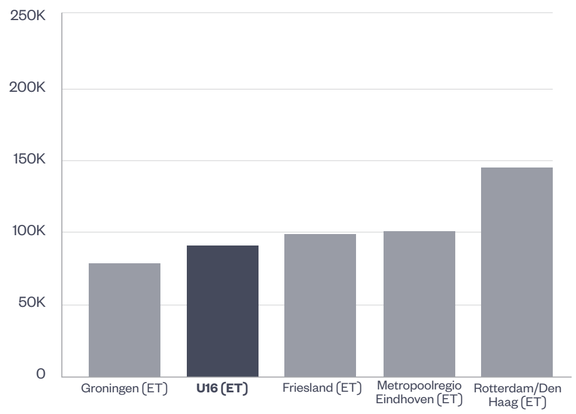
↑ **34%** increase of homes with solar panels in Utrecht in 2022 compared to 2021 (Schwartz, 2023)

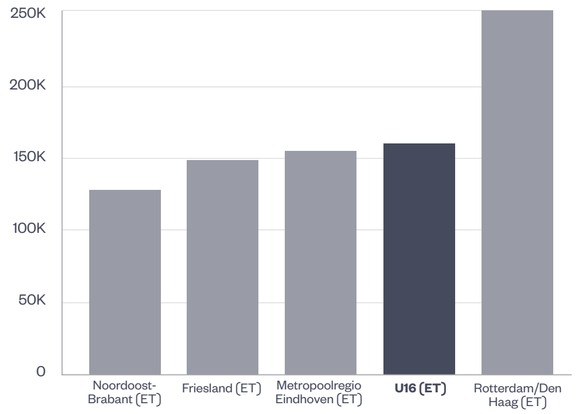
↑ **20%** expect increase of homes with solar panels in Utrecht in 2025 compared to 2024 (Telegraaf, 2025)

↓ **30%** national decrease of installations of solar panels in 2024. Primarily due to the stop of the net metering scheme (Telegraaf, 2025)




**Amount of solar electricity installations per RES-region (2021 vs 2024)** (CBS, 2024)




**Solar installation.** These two graphs shows the top five RES-regions with the biggest amount of solar panel installations within their boundaries (Centraal Bureau voor Statistiek, 2024). The U16 is not only the second region nationally when it comes to this statistic, but has also grown a lot in the past few years. This trend might be conflicting when addressing grid congestion further on. The U16 is is second to the Rotterdam/Den Haag region, but this region has a much higher population and the grid congestion here is less of a problem.

**Grid congestion.** As seen in this map, the national grid is congested in the U16 area (Netbeheer Nederland, 2025). This is not only the case for the U16, but what makes the Utrecht area (which the U16 covers for the largest part) stand out is the calamitous situation in this area – the problem is more alarming given that the grid is so congested, both national grid and regionally, that in the future not only big energy consumers, but also the small energy consumers may experience negative effects caused by this problem (TenneT, 2023).

METHODOLOGY

## 2.1 Problem statement

To combat global climate change, the European Union wants to be carbon neutral by the year 2050. An important aspect of this challenge is the energy transition. Transforming the way life is powered by shifting away from fossil fuels and adopting renewable energy technologies.
The Netherlands is making progress, and renewable energy deployment has been actively incentivized. Due to policy intended to promote sustainable energy investments like the solar energy netting arrangement, installed capacity has increased significantly. Although this rapid expansion is producing negative externalities. Primarily the increased congestion on the electricity grid is becoming a major hurdle in the energy transition.
The high voltage electricity grid is congested nationwide, and the distribution electricity grids in most places too. This hinders further investments into renewable energy generation and companies cannot expand their business if they require more electricity. New businesses and houses are often put on waiting lists for years before they can be connected to the grid (NOS Nieuws, 2024).
It is clear that strategies have to be implemented that resolve these issues and open up opportunities to continue the momentum of the energy transition. One aspect that should be considered in this process is that these strategies work for everyone. An inclusive energy transition is important because distinct communities have different needs. Especially low-income communities, that might not have the opportunity to make investments in renewable energy technologies, risk falling behind. These household spend a significant portion of their income on energy bills and supporting them through the energy transition helps alleviate poverty (Brown et al., 2020). Involving these communities in the decision-making progress ensures their needs are considered, and it leads to more successful energy projects with higher acceptance rates (Axon & Morrissey, 2020; Lennon et al., 2019).
This research aims to investigate and develop spatial and design strategies that resolve issues slowing down the energy transition. Through qualitive research and community engagement, the strategies are developed to ensure equitability and inclusiveness during the process.

# 2.2 Research Questions

### MAIN RESEARCH QUESTION

How can different spatial strategies for renewable energy storage within U16 be implemented in order to promote an inclusive energy transition?

### SUB-RESEARCH QUESTION

How can the communities be empowered through energy storage?

How much space is needed to fit the demands for storage and production?

How could the participation be increased and the surrounding energy storage be implemented?

What are the different regulations and policies in the region?

Which administrative actors are at play?

Which application of battery energy storage is more effective?

Which specific communities need to be taken into account?

How can storage be integrated within different electrical systems?

What policies are needed for renters to be part of transition?

How can renters adapt to the transition?

What are the positive and negative impacts of solar panels within the transition?

How does the viability of solar panels for owning parties develop in the future?



Solar panels on a building in Kanaleneiland (Utrecht). Photo taken during a fieldtrip.

# 2.3 Methodology

**RESEARCH**
This research addresses the problem of finding new ways to store solar energy - or implement the existing ones - in the area of the U16 region. This problem is particularly relevant in the context on climate change and energy transition because solar energy has revealed to be a key component in the renewable energy approach.
In addition to this, the energy transition and independence of the communities is more needed now than ever because in 2027 the government plans to stop the netting scheme compensation policy. Therefore, the question of how to implement different renewable energy storage solutions in the region in order to promote an inclusive energy transition arises.

**THEORETICAL FRAMEWORK**
The existing theories that served as a roadmap for developing the arguments used will be further explained later but they consist mainly in residential energy self-sufficiency, energy circularity, residential energy-neutrality, spatial justice, multiscalarity and decentralization. The core essence of all of these theories lays in residential energy solutions. In a world of increasing energy uncertainties that mostly affect the common citizens, this concept could represent a key proposal to face the transition problem.

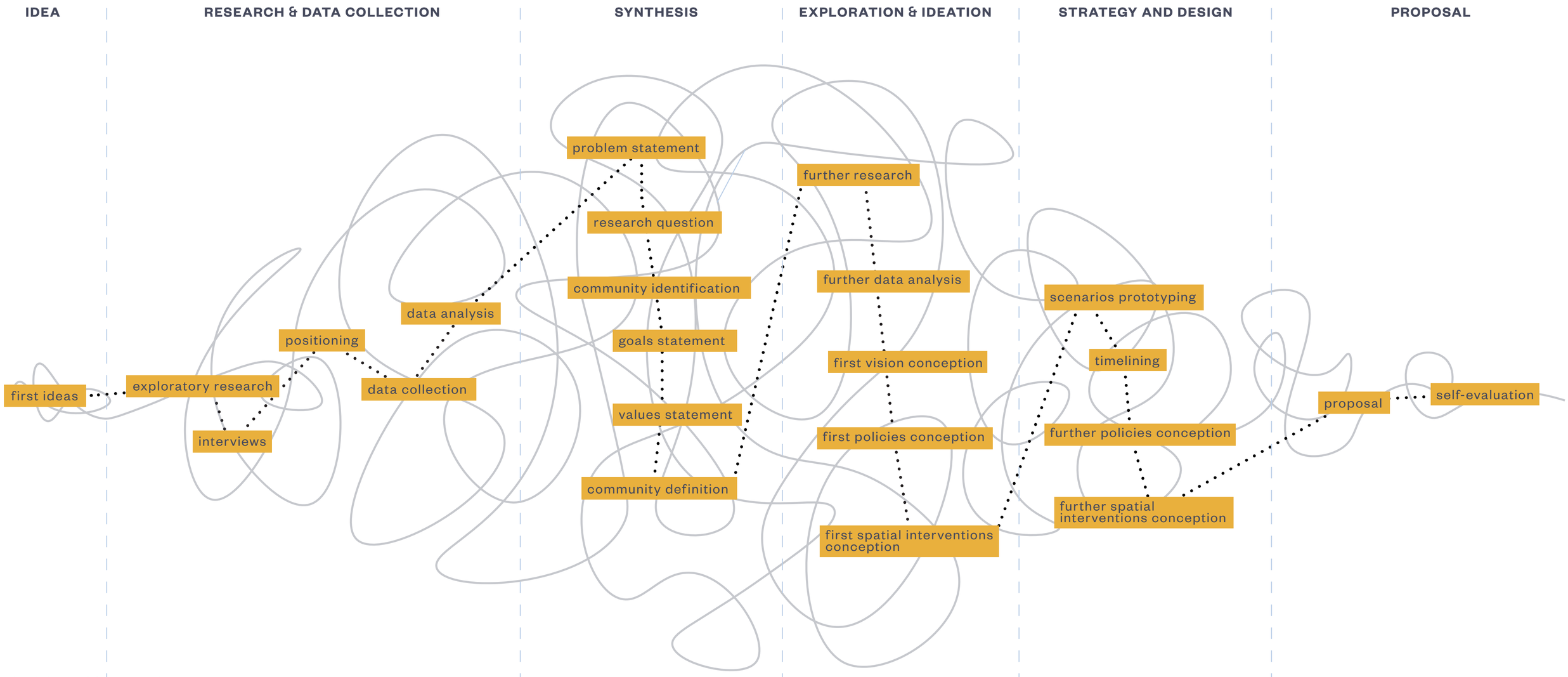
**CONCEPTUAL FRAMEWORK**
The conceptual framework will be further analyzed later. First the independent variables that play a key role in the transition (technology, economy, environment, society and regulations) where identified. These independent variables need then to pass through the dependent ones (the communties) which are more context-based. The responds need then to take in consideration all the energy cycle steps under the lens of the concepts of the approach.

**REASON TO CHOOSE THOSE METHODS**
Those methods were chosen because, in this context, a complex interrelation of different factors was identified. There are some common variables in the energy transition that do not depend on the context per-se but need to go trough a specific context-based scenarios and face the communities. At the same time all of this is linked to an energy cycle made of different components.

**METHODS OF DATA COLLECTION**
The main methods of data collections were quantitative and qualitative data analysis. This translates mainly in literarture review, media analysis, geospecial analysis, on site interviews. overall quantitative and qualitative data analysis

**HOW THE DATA WAS ANALYZED**
The main method of data analysis was to cross and confront sources in order to take in consideration all the different perspectives. Keeping in consideration the biases during the on site interviews was a priority.

**DESCRIPTION AND EVALUATION OF THE TOOLS USED**
The main technical tools were GIS and ATLAS.ti. ATLAS. ti made the process of researching information through papers and articles more efficient and fast. Also, ATLAS. ti allowed to use artificial intelligence in an educational context.
Outside of the technical part, booklets from the Research and Design Methodology for Urbanism course and tutoring were essential to progress.




Methodological framework

# 2.4 Theoretical Framework

Here a foundational review of existing theories that served as a roadmap for developing the arguments used in the work is provided. Each concept contains the seed of different interpretations and divergences of opinion that could arise within it. The interpretations and perspectives adopted are explained here - with the necessary literature.

## RESIDENTIAL ENERGY SELF-SUFFICIENCY THROUGH STORAGE AND PRODUCTION

In Europe, self-sufficient off-grid energy supply is evolving from a niche concept, primarily used in remote areas or specialized applications, into a viable mainstream solution. The shift is driven by rising energy procurement costs and declining capital expenses for renewable energy technologies, making independent energy systems increasingly attractive for residential use.
Beyond financial considerations, non-monetary factors play a growing role in system design. These include prioritizing high shares of renewable energy, gaining greater control over energy costs, and reducing reliance on nuclear or carbon-intensive fossil fuels - especially from regions with governance or ethical concerns. Disruptive events, such as the recent energy crisis and soaring fossil fuel prices, further highlight the vulnerabilities of import-dependent energy systems and reinforce the need for rethinking current structures. (Kleinebrahm, 2023).
While financial savings are a key motivator, the desire for self-sufficiency is a major driver behind household investments in renewable energy technologies. Photovoltaic systems and other sustainable energy solutions enable individuals to actively contribute to the energy transition. As the economic feasibility of local energy generation improves, more consumers will generate the majority of their electricity independently, using the grid primarily as a backup. Those who produce and store their own solar energy not only maximize their energy autonomy but also reduce electricity costs and CO2 emissions compared to conventional power sources. However, to fully optimize self-sufficiency, each system must be tailored to the specific needs of the user (Feron, 2024).
In the context of the U16 area this concept is significant because of the challenges related to energy transition which could help enhancing the resilience of the households.

## CIRCULAR ENERGY IN A CIRCULAR ECONOMY

Circular energy is an approach to energy production and consumption that aligns with the principles of a circular economy, aiming to minimize waste, reduce reliance on finite resources, and maximize efficiency. Unlike the traditional linear system, circular energy focuses on designing sustainable energy systems that promote reuse, recycling, and resource regeneration.
At its core, circular energy prioritizes resource efficiency, ensuring that energy is produced, used, and recovered in ways that minimize losses. This often involves integrating renewable energy sources like solar, wind, and bioenergy to replace fossil fuels and reduce environmental impact. Another essential element is energy recovery, where waste heat from industrial processes or excess energy from renewables is captured and repurposed instead of being lost. Additionally, circular energy emphasizes product longevity, designing infrastructure such as wind turbines, solar panels, and batteries to be durable, repairable, and recyclable. This reduces the demand for raw materials and prevents unnecessary waste (Green Purposes Company, February 2023).
By embracing circular energy, the energy sector can move toward a more sustainable future, where resources are continuously repurposed rather than discarded. This shift not only enhances energy security and efficiency but also supports the broader transition to a low-carbon economy.
A particular focused was given, above all, to energy circularity.
There can be no circular economy without clean energy and there can be no energy transition without a circular economy (Kotter, Rocken, Moloney, 2023). For this reason this theory fits in the U16 context and could highly enhance the efficiency of a transition proposal.

## RESIDENTIAL ENERGY-NEUTRALITY

Residential energy neutrality refers to the state in which a household's total energy consumption is balanced by an equivalent amount of energy produced from renewable sources, resulting in a net-zero energy footprint. This balance is achieved by implementing energy-efficient measures to reduce consumption and generating sufficient renewable energy on-site or nearby to meet the remaining demand. Achieving residential energy neutrality involves integrating technologies such as solar panels, wind turbines, and geothermal systems, alongside enhancing insulation and utilizing energy-efficient appliances to minimize energy loss. The concept is closely related to net-zero energy buildings, which are designed to produce as much energy as they consume over a given period, typically annually. By attaining energy neutrality, households can significantly reduce their reliance on external energy sources, lower utility costs, and contribute to broader environmental goals by decreasing greenhouse gas emissions associated with energy use (HOOG, n.d.).

## SPATIAL JUSTICE

It is sometimes forgotten that the spaces designed by architects or urban planners will then be lived and inhabited by people. In this sense, urban space is deeply embedded in people's lives not only as a passive place where interactions - and therefore also injustices - occur, but also as an actor that has the possibility to actively change society.
Regarding spatial justice, Edward W. Soja asserts that space is not merely a passive backdrop for social interactions but actively shapes and is shaped by societal structures and relations. This perspective highlights that injustices are often embedded in the spatial organization of cities and regions, where marginalized communities may face systemic barriers due to uneven development, inadequate infrastructure, and limited access to essential services. Addressing spatial justice involves both the fair distribution of material resources and the inclusion of diverse voices in decision-making processes that shape the built environment. By recognizing and rectifying spatial inequalities, urban planning and policy can contribute to creating environments where all individuals, regardless of their socio-economic status, have equitable access to the benefits and opportunities that urban spaces can offer (Soja, 2010).
Spatial justice translates into three fundamental dimensions: distributive (how we spatially distribute burdens and benefits), procedural (justice in procedures and governance) and recognition (do we recognize and validate collective and individual identities?) (Roberto Rocco, 2023).
Distributive justice could be particularly significant for the region as different injustices on the distribution of technologies for the storage of renewable energy were analyzed.

## MULTISCALARITY

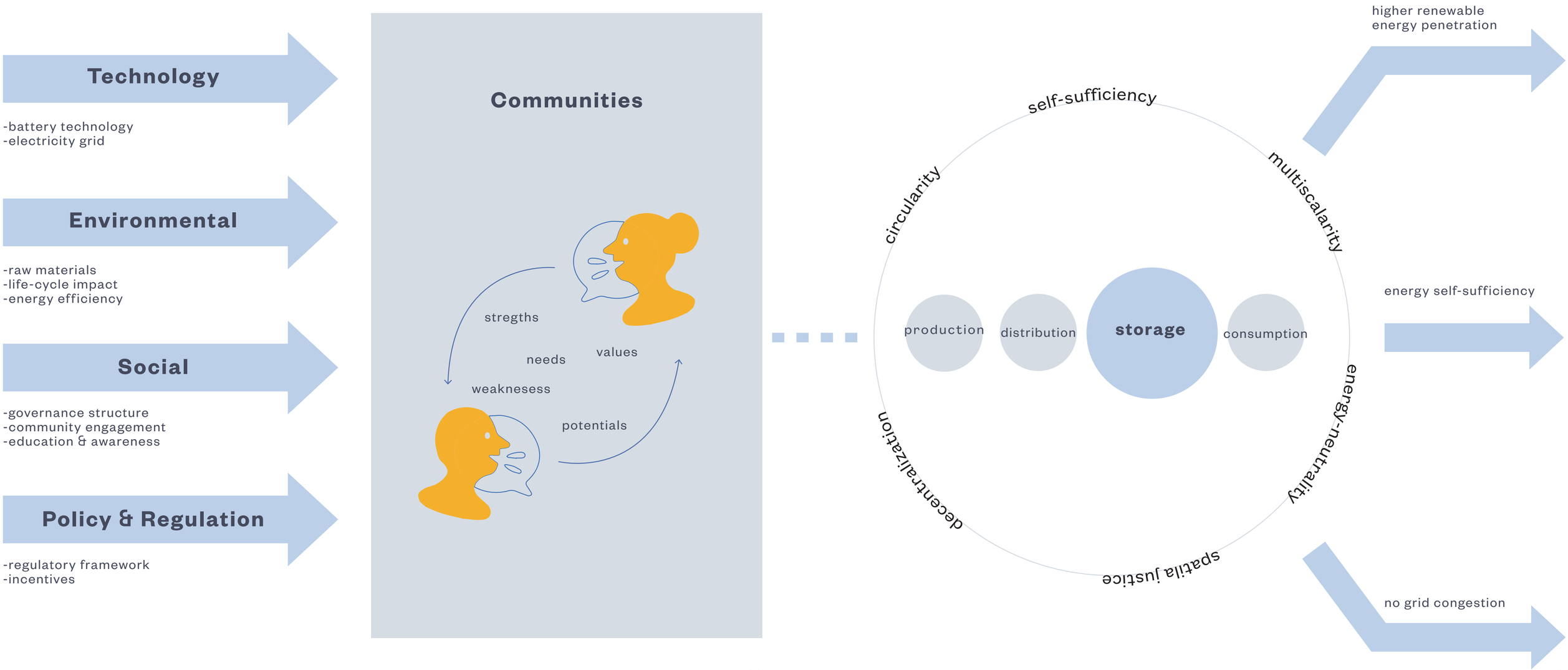
Multiscalarity refers to the analytical approach of examining urban phenomena across multiple spatial and temporal scales. This is useful to recognize that cities are complex systems where interactions at various levels - from individual buildings and neighborhoods to entire urban regions and beyond - are interconnected and influence one another (Maureira, Paz, 2023).
This perspective acknowledges that urban processes and structures cannot be fully understood when analyzed in isolation at a single scale. It emphasizes the importance of considering how local actions and policies resonate at broader scales and how macro-level trends and decisions impact local contexts. For instance, neighborhood governance structures are shaped not only by local community dynamics but also by national policies and global economic forces, illustrating the necessity of a multiscalar analysis to comprehend the layered and interdependent nature of urban governance. Similarly, the design and function of urban systems, such as transportation networks or housing developments, require an understanding of both micro-scale elements, like individual architectural features, and macro-scale factors, such as regional planning strategies and global environmental considerations, to create adaptive and resilient urban environments (Somerville, 2010).
By adopting a multiscalar approach, urbanists can better address the complexities of urban life, ensuring that interventions are responsive to the diverse and overlapping scales that characterize contemporary cities. (Mostafavi, 2016). This is particularly true for an area rich in contrasts and specificities like the U16 where a multiscalar approach is very much needed.

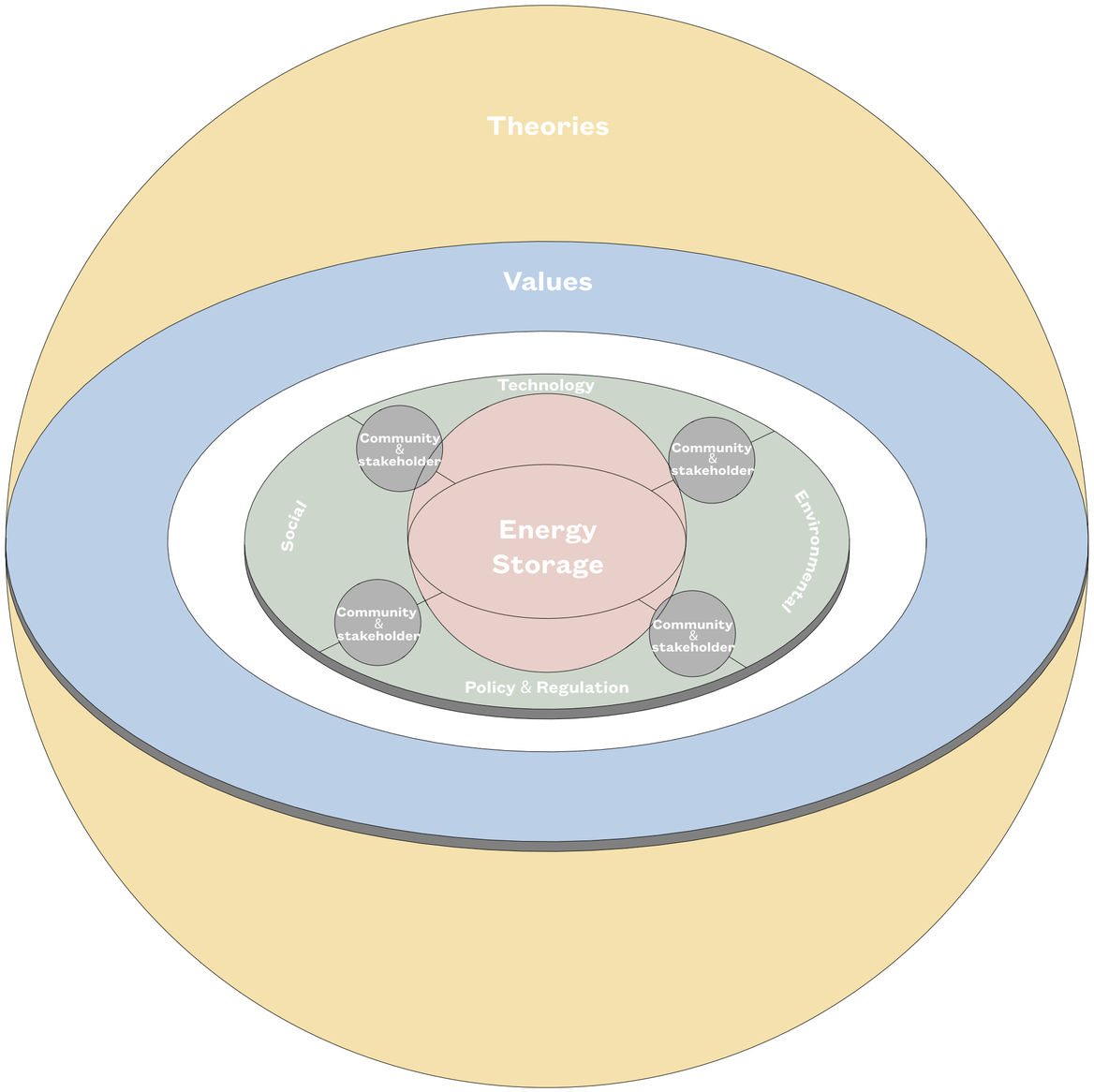
## ENERGY DECENTRALIZATION

While, traditionally, it was preferred to locate the power stations and transmitting loads in with a more central approach, new more decentralised positions were proposed. At the core of this concept there is the idea of putting the power sources closer to the end users that are spread all across one region. This approach enhances energy efficiency by reducing transmission losses and promotes sustainability by integrating cleaner energy technologies into the urban fabric. Decentralized energy systems often incorporate microgrids - localized grids that can operate independently or in conjunction with the main grid - integrating distributed renewable generation, energy storage, and smart controls to enhance reliability, flexibility, and resilience. By empowering local communities to generate and manage their own energy, these systems foster greater community engagement and ownership in the energy transition, allowing citizens to actively participate in the production, distribution, and consumption of renewable energy (European Future Energy Forum, n.d.).
Additionally, decentralized energy systems can enhance the resilience and energy security of urban areas by reducing reliance on centralized grid infrastructure and diversifying energy sources, making them less vulnerable to large-scale disruptions. The integration of smart city technologies, such as smart meters and energy management systems, further supports the efficient operation of decentralized energy systems by enabling real-time monitoring and optimization of energy consumption (Marrone, 2023). It is then clear how an approach that focuses on enhancing multiscalarity could improve significantly the energy transition in the U16 region.

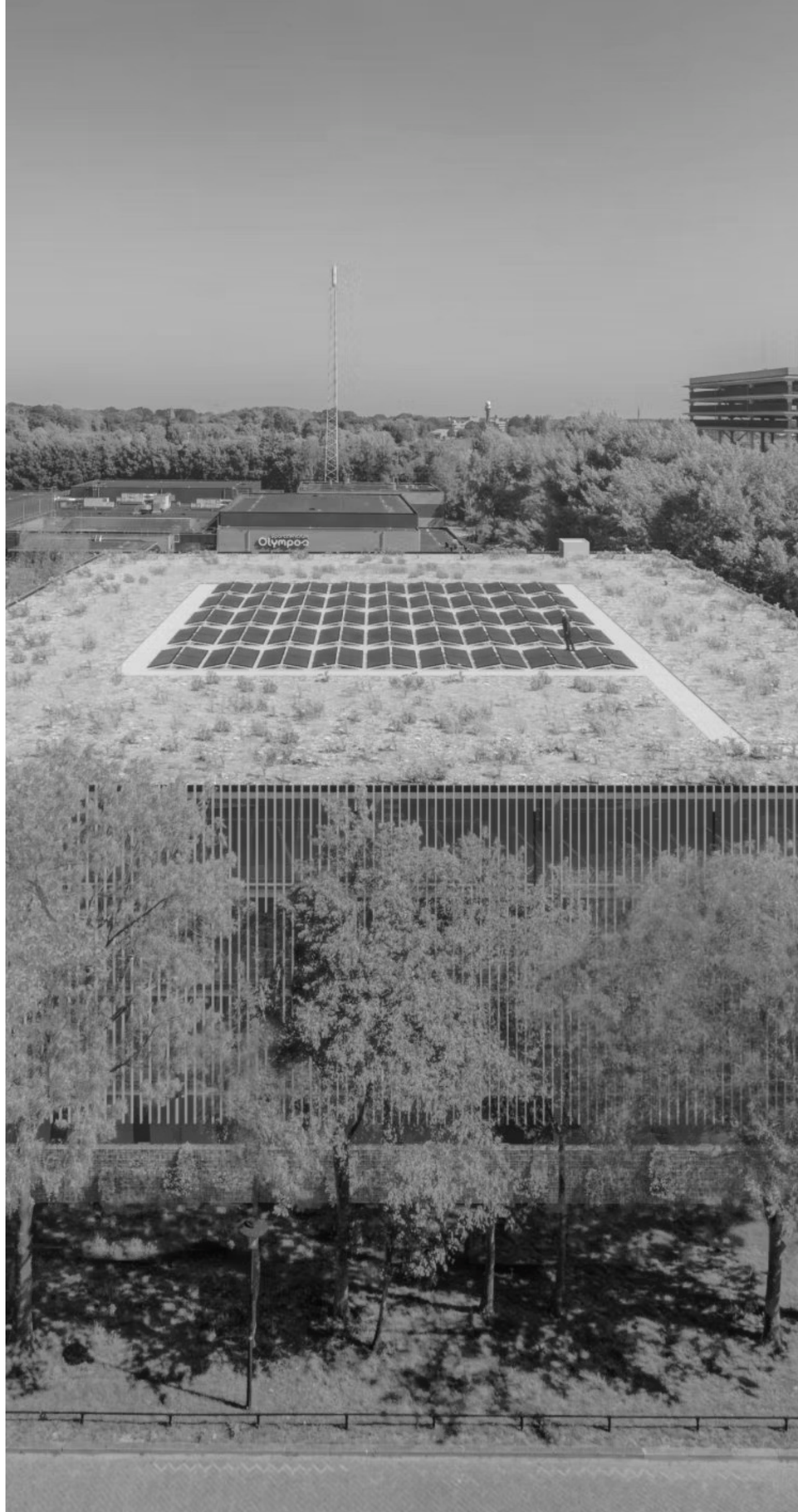
## 2.5 Conceptual Framework

The conceptual framework highlights the aspects being analyzed that affect the result of the research. Variables discussed in existing academic literature can be divided into four categories: technology, environmental, social and policy and regulation. The ability to support the grid using batteries has become possible due to recent technological developments in battery technology. Technical improvements in the safety, longevity and energy density of lithium batteries have laid the foundation for these possibilities (Chen et al., 2020), but recent innovations in using other materials might accelerate wide-scale deployment.
There is a lot of supportive infrastructure required to optimally utilize battery energy storage systems. The integration of these systems requires careful consideration of system architecture to ensure reliable and safe operations (Khalid et al., 2021; Rouholamini et al., 2022). Energy management systems that are connected to all battery installations must be developed to handle supply, demand and congestion alleviates in real-time (X. Li & Wang, 2019). For this, standard protocols must be developed that enable all parts of the system to be connected, and to ensure compliance with technical specifications and operational requirements (Khalid et al., 2021; Mohd Razif et al., 2024).
The shift to renewable energy creates the need for battery energy storage due to environmental benefits. It is important to consider the significant environmental impact of manufacturing and installing large quantities of batteries. Mining for rare earth materials like lithium and cobalt especially harms local environments (Dehghani-Sanij et al., 2019). There are greenhouse gas emissions in different stages of the battery's life cycle which have to be minimized and the end-of-life phase of batteries still poses significant challenges. Proper recycling and disposal are crucial to minimizing hazardous waste and environmental pollutants (Han et al., 2023; Pellow et al., 2020).
There are many applications for batteries based on size and ownership. Ownership structure will vary between projects with different benefits for the community as a result. User-owned systems will directly benefit the user with energy saving and potential revenue streams (R. Zhang et al., 2024). Community-owned systems can be economically advantageous and support community engagement and energy sharing (Y. Li et al., 2022). Large-scale systems will be owned and operated by energy service providers, which allows consumers to benefit without upfront investment costs (Rodrigues et al., 2020). To increase acceptance of energy projects and ensure a high success rate, community engagement and education of potential is crucial (Axon & Morrissey, 2020).
To encourage energy storage deployment and create a foundation for investments, it is important that the government creates a strong regulatory framework. Using policy and regulation, the energy transition can be steered into a desirable direction and accelerate its progress. Financial incentives can help offset initial investment costs to accelerate deployment (Filho et al., 2023). Ensuring that policies are flexible to technological and socio-economic changes can help maintain grid stability while supporting the growth of renewable energy (Oluwadayomi Akinsooto et al., 2024).
These aspects are considered in this research on how to design spatial strategies for renewable energy storage and promote an inclusive energy transition. The strengths and weaknesses of the four communities will be considered and used to complement each other. Through this it is ensured that all needs will be fulfilled. The deployment of battery energy storage systems will impact the entire energy system. It is important that values such as circularity, self-sufficiency and spatial justice are considered to ensure equitable implementation. Through this, higher renewable energy penetration will be possible. Increasing renewable energy investment potential and alleviating grid congestion unlock opportunities to accelerate the energy transition and become carbon neutral.



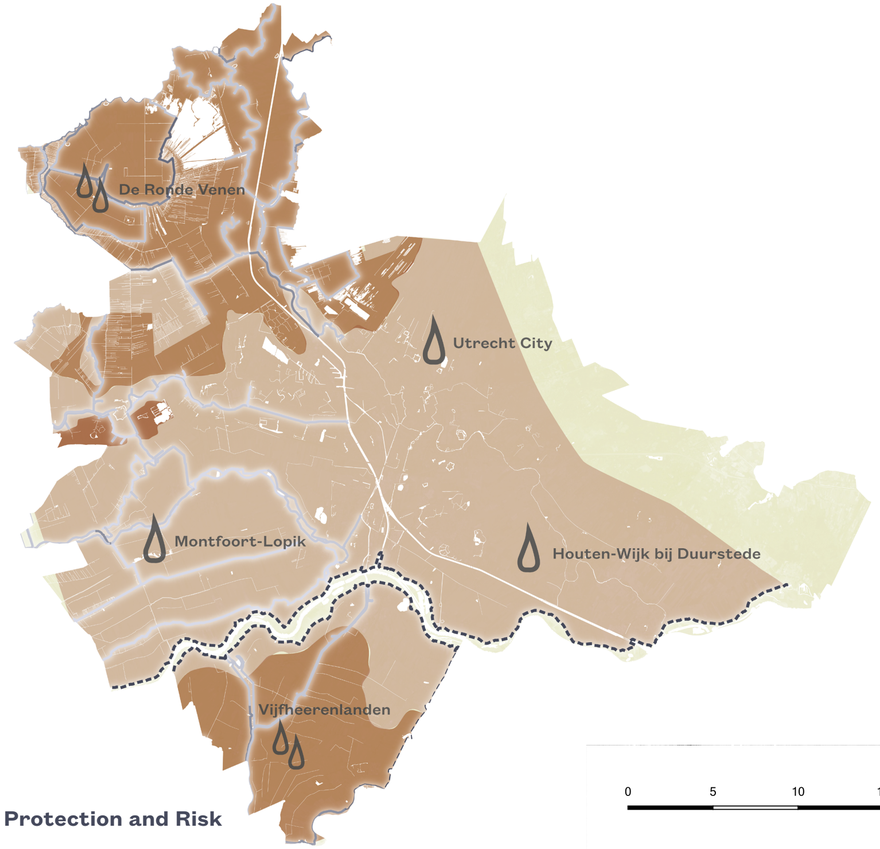



Synthesized conceptual framework.



Solar park on the top of Utrecht Science Park. Photo: Cobouw.

ANALYSISANALYSISANALYSIS
ANALYSISANALYSISANALYSIS
ANALYSISANALYSISANALYSIS

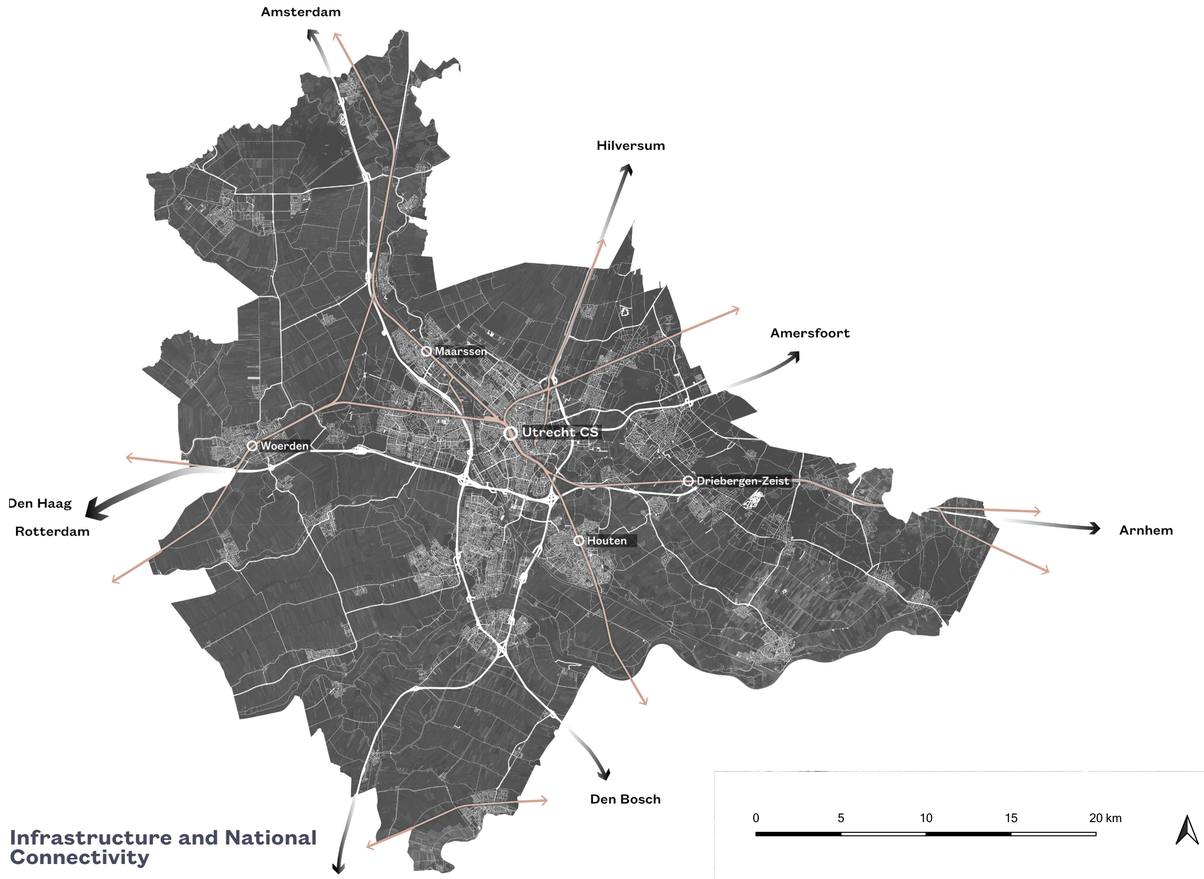



## Flood Protection and Risk

- Primary Water Barrier
- Regional Water Barrier Class I
- Regional Water Barrier Class II
- Regional Water Barrier Class III
- Regional Water Barrier Class IV
- Regional Water Barrier Class V
- Flood Risk Type 2
- Flood Risk Type 3

As seen in the map, big parts of the U16 area are classified under 2 different flood risk categories. Type 2 corresponds with type B flood risk - 'flooding of protected areas along main or primary water barriers by their failure'. Type 3 corresponds with type C flood risk - 'flooding of protected areas along regional barriers by their failure' (Rijkswaterstaat, 2024). The water barriers protect the lands from flooding. These have been classified into categories corresponding with a safety norm and potential economic damage as a result of a potential breach and flood. Category 'I' corresponds with a safety norm of 1/10 or a chance of 10% every year of failing by the water barrier. 'II' corresponds with 1/30, 'III' with 1/100, IV corresponds with 1/300 and V corresponds with 1/1000 (Stichting Toegepast Onderzoek Waterbeheer, 2022).






## Infrastructure and National Connectivity

Utrecht Centraal is a very important national railway junction because of its central location and is also the busiest railway station in the country, connecting the Randstad to the rest of the country (Nederlandse Spoorwegen, 2023; CU2030, n.d.). Also, a lot of highways connect the region to other parts of the country. The map is based on geodata from the national road database (Rijkswaterstaat, 2025).



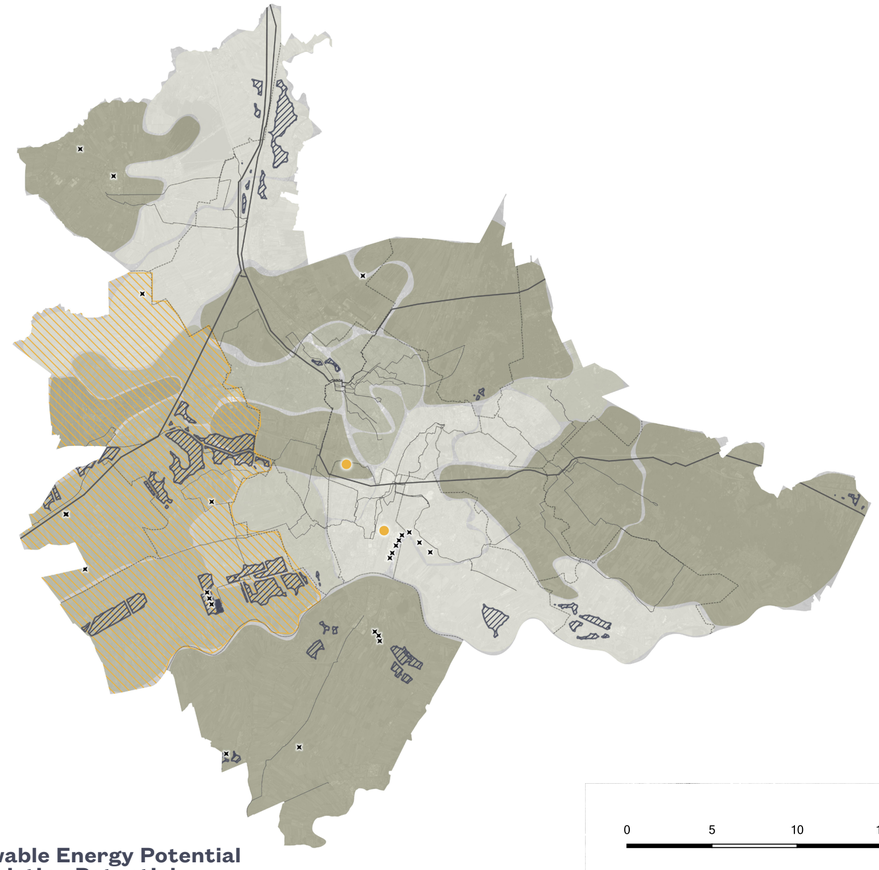
0 5 10 15 20 km

## Fossile Energy Production and Distribution

- Boiler
- Natural Gas Plant
- TenneT High Voltage
- TenneT High Voltage
- TennetT Underground High Voltage
- Regional High Voltage Lines
- Regional Medium Voltage Lines
- IBIS industry/office Estates
- Transport Capacity Available Without Queue
- Limited Transport Capacity Available Without Queue
- Area is Under Investigation With Queue Shortage or
- No Capacity on the Grid With Queue

This map contains the Regional Grid (Stedin, 2024), the National grid (TenneT, 2025), the existing non-renewable energy production in the area overlaid with a simplified version of spatial presence of grid congestion (Netbeheer Nederland, 2025). Also, the IBIS industry/office estate areas are shown. This map shows the interrelation of production and distribution and their potential relation to Industries. There is a lot of regional grid congestion in the area, but some areas still allow for new connections to the grid and its distribution. It can be clearly seen that regional High-voltage lines connect to the different industry/office estate areas. It is also clear that the natural gas plants demand a lot of electricity transport. A decade ago, according to Eneco (2014), the 'Lage Weide 6' plant has an electricity capacity of 248MW and around 180MW thermal capacity. The 'Merwedekanaal 11 & 12' plants on the other side of the water have a total electricity capacity of 328MW and a total thermal capacity of 290MW. Since this is a while ago these numbers might have changed.





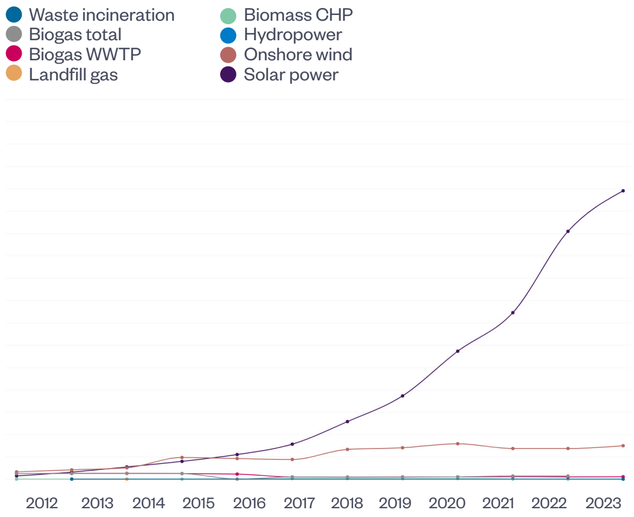
0 5 10 15 20 km

## Renewable Energy Potential and Existing Potential

- Wind Turbines
- Solar Parks
- Most Potential Wind Areas
- Highest Solar Potential within U16
- Transport Capacity Available Without Queue
- Limited Transport Capacity Available Without Queue
- Area is Under Investigation With Queue Shortage or
- No Capacity on the Grid With Queue

This map contains the renewable energy potential in the area and the existing renewable energy production sources. These sources only concern wind and solar energy production. There are a few windturbines and a few solar parks in the area (Nationale Energieatlas, 2024; Warmteatlas, 2025). When it comes to the potential there are a few clarifications to be made. The most promising wind production areas (Provincie Utrecht, 2023) are broadly considered areas based on spatial and contextual bottlenecks from the 'plan-milieueffectrapport' (report of environmental effects) done by advisory group Bosch & van Rijn (2023). The most potential area for solar production however is based on area that has the highest daily solar potential, within municipal boundaries (GIS Workshop, 2025). The renewable energy production in 2023 produced by solar panels was 2.581 TJ (or 0,717 TWh) and 299 TJ (or 0,083 TWh) by wind on land (Rijksoverheid, 2023). Other sources are significantly low (Rijksoverheid, 2023). These numbers have increased over the last decade.

## Known Renewable Energy per Category





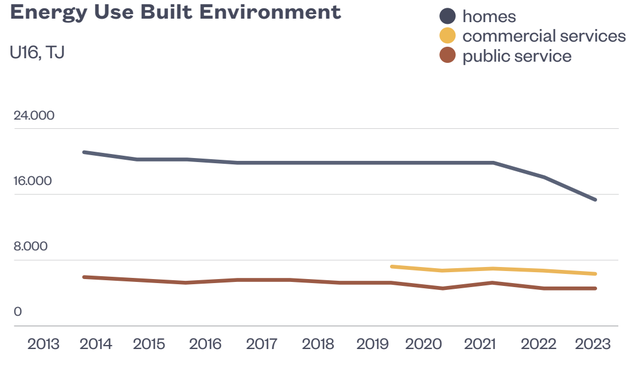



**Total Average Residential Energy Consumption**

- 0-1000
- 1000-2000
- 2000-3000
- 3000+

This map shows the residential energy consumption per household per neighborhood in the U16 area (Centraal Bureau voor Statistiek, 2022). What's interesting, is that the neighbourhoods corresponding with the more urban areas have a lower energy consumption than the ones that correspond with peri-urban or rural areas. This might be explained by the use of residual heat; In the Utrecht region, 'warmtenet' or heating network providing residual heat coming from industry processes distributes heat to Utrecht city, Nieuwegein and Houten (Eneco, n.d.). Energy consumption in the area consists for the biggest part of transportation (24.784 TJ in 2023) and second biggest part of homes (15.266 TJ in 2023). This number has been dropping in the last few years. Industries accounted for 4.582 TJ in 2023, commercial services/companies accounted for 6.319 TJ in 2023 (Rijksoverheid, 2023). The two latter sectors don't show a significant drop in their energy consumption, which means that the percentage of energy consumption in the area by industries and the commercial services sector are increasing (see graph).

**Energy Use Built Environment**













**Strengths Map**

- Provincial road
- Highway
- WarmteAtlas:WarmteNetten
- Relatively low average residential energy use per household per neighbourhood

One of the major strengths within the area is its infrastructural and transportational connectivity and mobility. The good quality of rail network and transport network and its connectivity might make large scale transition to lower-carbon transportation, like trains, easier. Also, regarding the context of this project, a well-connected road network possibly improves overall access to potential EV-charging. Wolbertus et al. (2021) imply the importance of accessibility and convenience (and the trade-off between the two; direct access or central charging-hubs) when it comes to EV-charging. Therefore, the U16 Area can be an infrastructural matrix for the adoption of large-scale EV-charging and the transition towards electrified transport and infrastructure. Another strength is the previously mentioned residual heat from energy-intensive processes that provides for heat demand in households, therefore reducing their energy demand. This can be observed in the top map (Warmteatlas, 2025). Since this project focusses on electricity, the lower energy demand is just taken as a given fact, rather than a design component.



0 5 10 15 20 km

**Weaknesses Map**

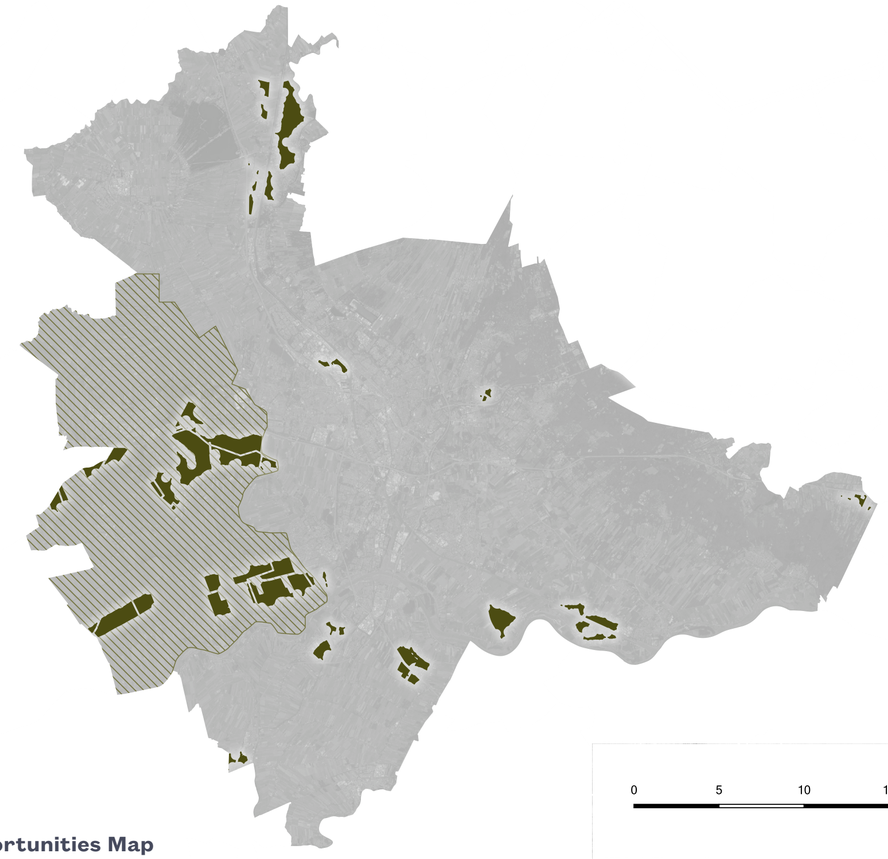
- TenneT High Voltage lines
- Stedin High Voltage Lines
- Building occupance
- Agricultural occupance

**Grid Congestion**

- There is Capacity
- Very little capacity
- Congested with future queues
- Congested with queues

One of the weaknesses or problems the area might face when it comes to development within the energy transition, is the lack of free space. A lot of urban and production landscapes make it hard to for example implement wind turbines and solar parks. Arguably the most prominent problem is grid congestion. Grid congestion is a stark weakness in the area. As mentioned earlier, grid congestion can really limit or block the path of development and opportunities of the energy transition. This is one of the key challenges addressed in this project, for the near future in particular.



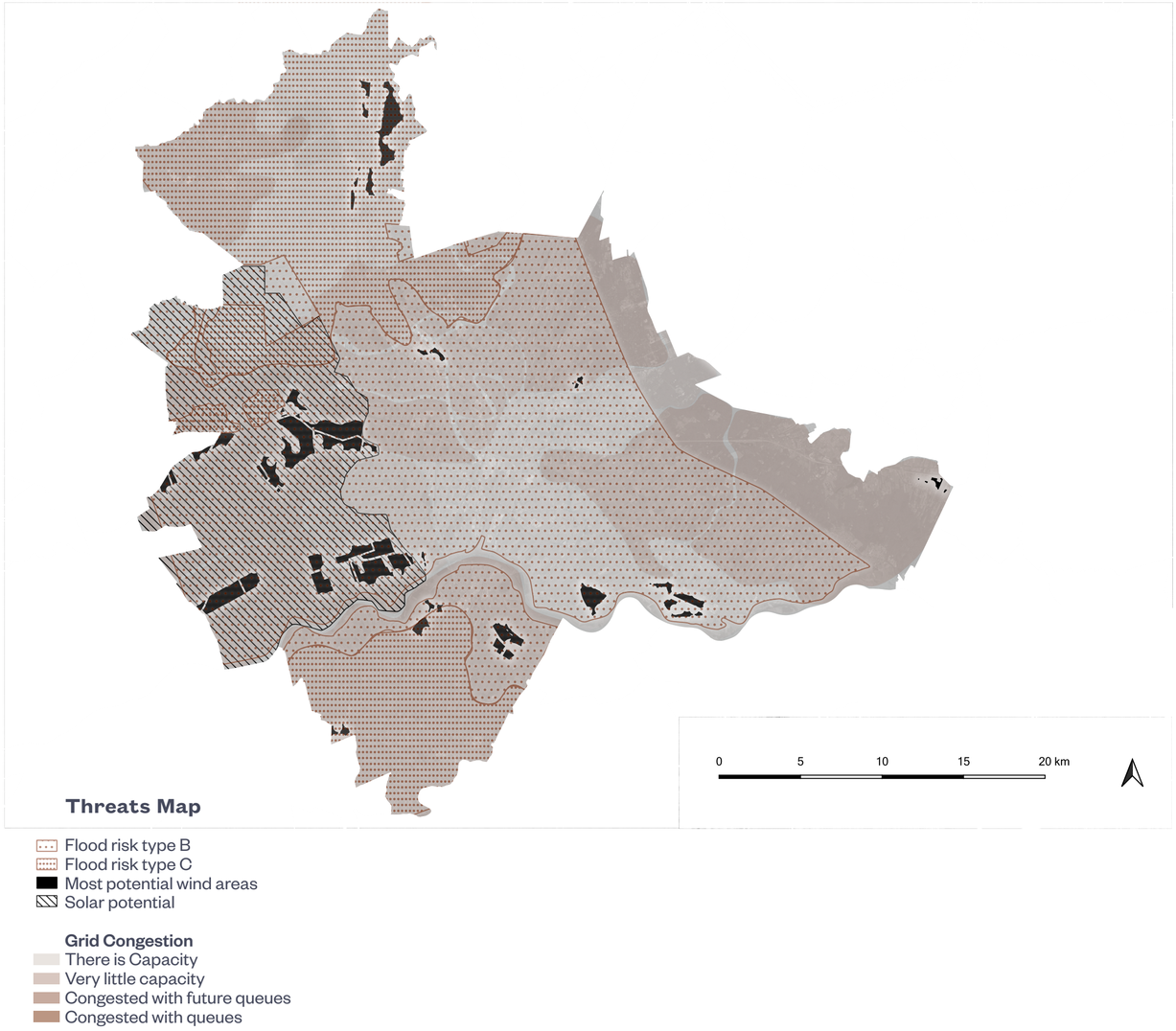


0 5 10 15 20 km

**Opportunities Map**

- Most potential wind energy areas
- Highest solar potential (solar hours)

Despite the fact that the land in the area is completely occupied, there is a lot of open farm land on the west side of the city, where also a lot of high-potential wind areas are located and the ‘highest’ solar potential when it comes to sun hours. So even though there are difficulties regarding land use, the future adoption of wind turbines and solar parks in this area is this promising to an extent




There can be two threats identified from the area analysis. One of them is flood risk. The areas with the highest potential are also located in the areas where flood risk is present. Many of the water barriers here have relatively low protection levels, often with a once in a 10 to 30 years potential incident risk. Since the risk is still quite low and this threat is not the biggest concern within the context of this project, but rather seen as a parallel development to the landscape, there won't be much emphasis on this aspect. Although the problem does have to be addressed to an extent. The biggest threat is grid congestion. Not only is it a current weakness, it also poses a serious threat regarding future developments within the context of this project and the negative implications that grid congestion can have. Therefore it has to be addressed in multiple ways in this project.



# 3.3 Current Policies and Incentives

## INSTALLATION ON RESIDENTIAL AND COMMERCIAL PROPERTIES

**1.Permits.** Generally, installing solar panels on most residential and commercial buildings does not require a permit. However, exceptions exist for protected heritage sites and monuments (Gemeente Utrecht, n.d.).

**2.Protected Heritage Sites.** If your property is a designated monument or located within a protected cityscape, specific regulations apply to preserve cultural and historical aesthetics (Gemeente Utrecht, n.d.).

## FINANCIAL INCENTIVES AND SUPPORT

**3.VAT Exemption.** As of 2023, the Dutch government has implemented a 0% VAT rate for the purchase and installation of solar panels on residential properties. In addition, if you install solar panels on or near premises without a residential function (business premises), you charge 21% VAT (Netherlands Tax Administration, n.d.).

**4.Sustainability Loan.** Homeowners in Utrecht can apply for a sustainability loan to finance the installation of solar panels. (Gemeente Utrecht, n.d.). This initiative supports residents in making their homes more energy-efficient.

## NET METERING SCHEME

**5.Current Scheme.** Presently, the net metering scheme (salderingsregeling) allows solar panel owners to offset the electricity they feed back into the grid against their consumption, effectively reducing energy bills (Netherlands Enterprise Agency).

**6.Upcoming Changes.** Starting from January 2027, this scheme will be modified. The scheme is expected to reduce annual earnings by around 250 euros for households with an eight-panel system generating 3,000 kWh (Netherlands Enterprise Agency, n.d.).

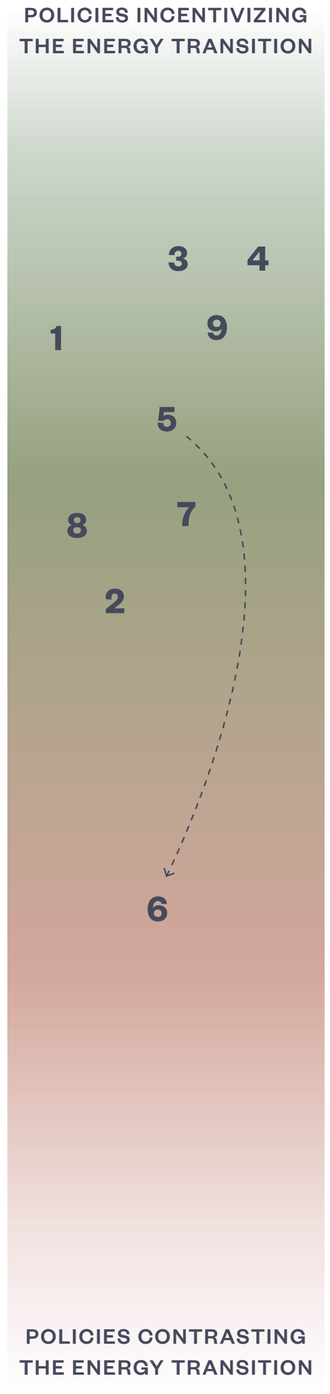
## MUNICIPAL INITIATIVES

**7.Zon op Dak and Netoplossing 2022-2026 Program.** The Municipality of Utrecht aims to triple the solar energy generated from rooftops by 2030 compared to 2020 levels. This program focuses on maximizing the use of available roof space for solar installations and addressing challenges related to the capacity of the electricity grid (Gemeente Utrecht, n.d.).

**8.Support for Businesses.** Efforts are underway to assist businesses in adopting solar energy solutions, including exploring innovative approaches to mitigate grid congestion and promoting the development of energy hubs (Gemeente Utrecht, n.d.).

## EUROPEAN FUNDS

**9. European Regional Development Fund, Just Transition Fund and Cohesion Fund.** The EU provides a series of funds like the Regional Development one which aims to strengthen economic, social and territorial cohesion, the Cohesion one, which supports investments in the field of environment and trans-European networks, or the Just Transition one, which aims supports the economic diversification and reconversion of the territories negatively impacted by the energy transition (European Commission, n.d.).



# 3.4 Stakeholder Analysis

### INHABITANTS

The inhabitants are the biggest stakeholders since the energy transition is a global goal that - first of all - influences the average citizen. First of all, energy has costs, produces job opportunities. In addition, the energy transition regards technology changes, communities and has environmental benefits (Kennedy n.d. ; Funk and Tyson 2023; The Times 2025; Time 2024).
During the interviews - that will be explained later - a big difference has been drawn between those who already started the transition - with solar panels for example - and those who didn't.

### BUSINESSES

**Large energy producers.** In the U16 area there are different energy producers that play a significant role in satisfying the energy demand of households and industries. Some of them are Eneco, which acquired the heat and electricity generation assets in Utrecht from Nuon in 2014 (Eneco, 2014) or LC Energy, which develops renewable energy projects, including solar farms and energy storage systems and contributed 289 MW of renewable energy (LC energy, n.d.).

**Big energy consumers industries.** In the province of Utrecht, the industrial sector accounts for approximately 8% of the total energy consumption. Between 2017 and 2019, industrial energy use in the province increased by nearly 40%, contributing to a rise in overall energy consumption during that period (Staat Van Utrecht, n.d.). They include large institutions of education and healthcare, high-tech and pharmaceutical industries, food and beverages manufacturing, data centers and IT infrastructures and logistics and warehousing.

**Fossil fuel producers.** Still today, fossil fuels are prominently used and many companies base their business around them. The energy transition is surely a challenge they need to face to keep their relevance and profitability. Many of them are investing in green technologies or in low-carbon ones (Kienzler, Lichy, Tai and van der Marel, n.d.).

### PUBLIC SERVICE

**Governmental organs.** In the Netherlands, the national government possesses the biggest grid operators, TenneT. For this reason the Dutch government is also involved in this topic. Other branches of the government, such as the municipalities of the U16 manage the grid at a more local level (TenneT, n.d.).

**Grid operators.** TenneT is the national TSO responsible for the high-voltage electricity transmission network, specifically managing the 380 kV and 220 kV grids across the country. (TenneT, n.d.). Along TenneT, several other companies are responsible for the distribution of electricity to end-users within their respective regions. For Utrecht it is Stedin Netbeheer (Stedin, n.d.).

**Renewable solutions manufacturers.** The Netherlands hosts a variety of manufacturers specializing in renewable energy solutions across different sectors. In a future of energy transition, these actors will have a more significant role.

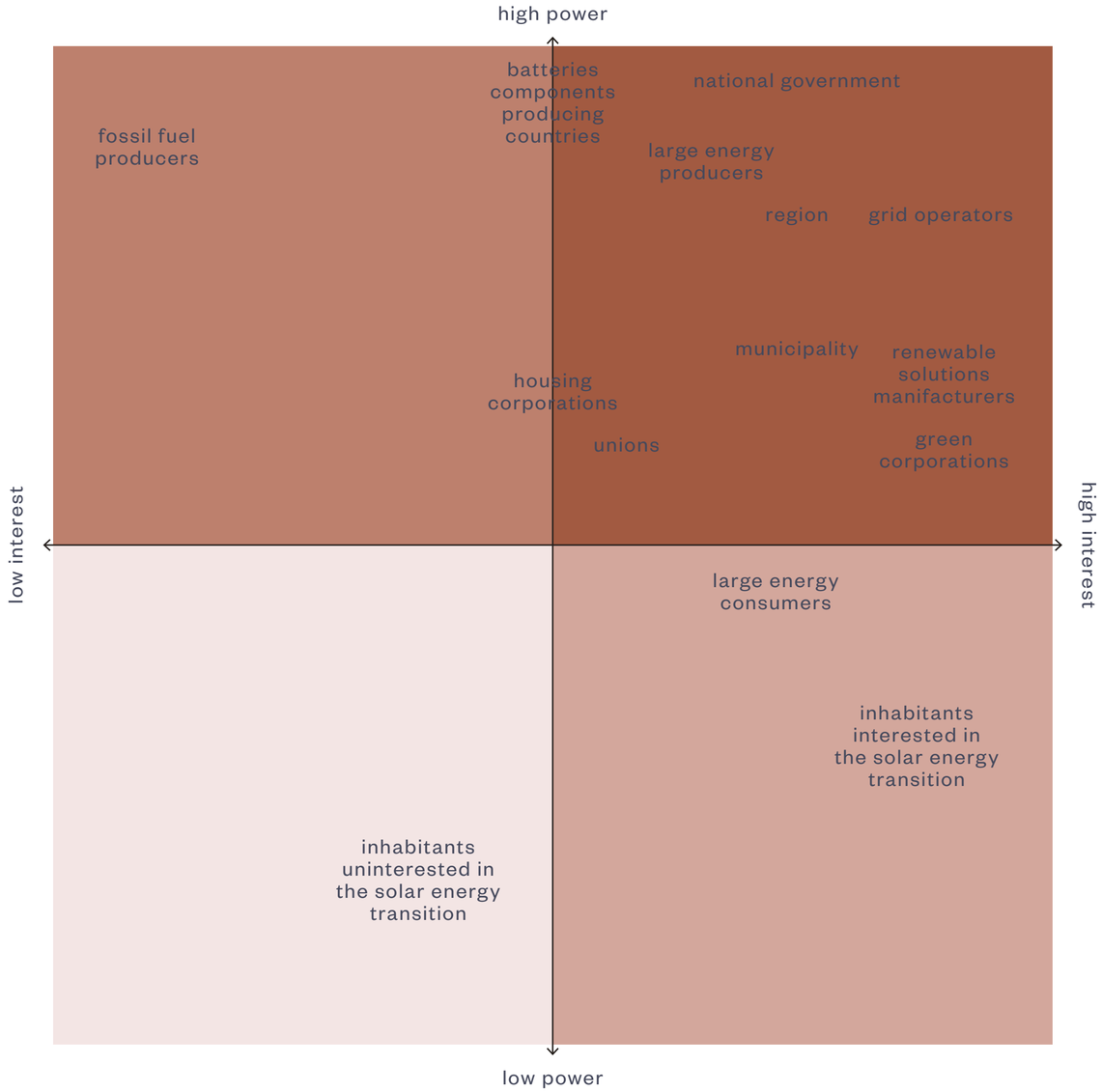
### FINANCIAL CAPITALS

**Housing corporations.** In Utrecht different housing corporations manage residential properties. Some of them are Woonin, Portaal, Bo-Ex, Cazas Wonen and SSH. Collectively, they manage nearly 120,000 homes, with over 95% in the social rental sector, accounting for about 30% of all housing in the region (RWU, n.d.). Many of them are interested in the theme of solar panels and other green energy residential production options because they limit grid congestion, enhance energy trade, save costs and reduce CO2 emissions (Woonin, n.d.).

**Green corporations.** In the Netherlands there re different corporations of different sizes that have the common goal of making the country greener. Some examples related to the topic of solar energy and the grid congestion are Vandebron, which supplies green electricity and regular gas, or Greenchoice, which provides 100% green electricity.

**Countries producing batteries components.**
For the production of batteries - but also solar panels - some specific materials are required and they're not always easy to find. For both these technologies, China is the main producer. For example, components essential for solar panels, such as solar cells, silicon wafers, encapsulant, backsheets, glass covers and aluminum frames, are all mainly produced in China (U.S. Department of Energy 2022, International Energy Agency 2022). In a scenario where storing technologies are implemented, this country would play a key role.

**Unions and tenants' associations.** Unions are organizations that represent the collective interests of workers, while tenants' associations represent renters in negotiations with housing corporations, politicians, and landlords. In the next chapters their role in the context of a project in the area will be better explained, but working for both workers and renters, these associations would represent many actors of the transition.




The fossil fuel producers are the main actors against the project. They base their activity on the production and use of non-renewable energy, while the project aims at an energy revolution from the point of view of solar. They are also powerful, especially the larger corporations, and they could do lobbying against us.

In this specific case, the problem of grid congestion is central to the public debate and affects many groups with different interests and characteristics. From the government that requires it, to the producers of renewable solutions and grid operators, a new sustainable system of electricity storage would bring many stakeholders to an agreement.

If we move to the actual inhabitants of Utrecht we notice that unfortunately, as stakeholders, their power is quite low. As already shown, however, the inhabitants of the city who own solar panels are already interested in this energy and therefore their interest is high.

The only city dwellers who are not interested in solar energy storage solutions are those who are unaware of the benefits it could bring. They are typically less educated and less likely to identify with the place where they live. They are the stakeholders in the most critical position because we need to find something that will get them moving in the transition process.

# 3.5 Fundamentals of Current Storing Technologies

To better understand the topic, current technologies to store energy were analyzed.

### BATTERIES

A crucial step in the energy transition is finding methods for storing electricity for later moments. But contrary to fossil fuels, large scale storage of electricity is hard and expensive. Globally, the most common method is pumped hydropower. Excess electricity is used to pump water from a lower to a higher reservoir, storing it in the form of potential energy. During periods of high demand, this water is run through hydro turbines which generate electricity. The constraints of energy storage through pumped hydropower limit application to regions with suitable topographic conditions. In a flat country like the Netherlands, other methods are required.
With technical developments over the last decades, using batteries to store electricity has become increasingly viable. The batteries are charged during periods of high electricity production and discharged later when power is needed. Batteries have the benefit of being efficient, scalable and have many applications.
Battery energy storage systems can play multiple roles in the energy system. If storage is deployed together with renewable production 'behind-the-meter', on this same electrical system, it can increase self-consumption of renewable energy. During a period of excess solar production, the battery is charged for the power to be used at a later moment. This increases power consumption while drastically reducing the dependence on the public electrical grid (Zare Ghaleh Seyyedi et al., 2025).
Batteries can also alleviate pressure on the electricity grid by actively engaging with it, even if no solar panels are installed in the same system. These processes are called energy arbitrage and peak shaving. The battery charges using electricity from the grid during periods of high production, and the electricity can be consumed or fed back into the grid later (Zare Ghaleh Seyyedi et al., 2025). For these applications to be attractive, a dynamic energy contract is required. Throughout the day, the price of electricity changes based on supply and demand. When renewable energy production is high, the price of electricity is much lower, sometimes even negative. Later, when demand exceeds renewable energy supply, prices are much higher. Normally, residential energy contracts have a predetermined price per kWh, but dynamics contracts are becoming more common. By storing electricity during high solar production against low cost, and feeding the power back later, the battery generates revenue for the owner, while reducing grid congestion and increasing sustainable energy usage.
Battery energy storage systems are very versatile, widely applicable and available in a wide range of capacities. There are three main categories in which a battery belongs, based on capacity and ownership structure.
The first category, often with the smallest capacity, are home batteries. These batteries are privately owned by residential homeowners, often to complement their residential solar system. They are primarily used to increase self-consumption of solar energy, but they can be used to provide balancing and frequency services on the electricity grid (Milieu Centraal, 2025).
The second category are community batteries, or neighbourhood batteries. These systems are owned and operated by a group of people often living in close proximity. The battery acts as an energy management system for the community, creating a smart energy community (Barbour et al., 2018). Members that do not own solar panels can benefit from the renewable energy generated by community members with excess production. Another benefit is in communities with smaller homes, often there is no space for individual home batteries. Community batteries are also found to lower the amount of storage necessary, decrease energy exported to the wider electricity grid and have a higher return of investment compared to private home batteries (Barbour et al., 2018).
Finally, there are large grid-scale battery energy storage systems. Often owned and operated by large scale energy producers to work in synergy with their solar farms and wind parks. These systems provide the same functionality as home- and community batteries on a larger, more centralised scale (Fan et al., 2020).

### ELECTRIC VEHICLES

While these solutions will play a major role in the energy transition, another strategy is to utilise the batteries in electric vehicles (EVs) to provide energy services. Currently, the growing number of electric cars puts extra pressure on the grid, as they significantly increase local electricity consumption and often charge at similar times (Abousleiman & Scholer, 2015). One way to partially alleviate this congestion is through smart charging. Normally when an EV is plugged in, it starts charging immediately at the quickest speed possible. Smart charging delays or slows the charging until favourable times to the electricity grid, or when share of renewable energy is highest (Corsetti et al., 2024). Ideally, this would be incentivized by introducing real-time pricing for electricity.
But just like stationary batteries, it is possible to use EVs as active storage for energy. Feeding energy back into the grid is called vehicle-to-grid charging (V2G). Because the main purpose of a car is mobility, only a section of the battery's capacity would be used for V2G. Using advanced charging and discharging prediction algorithms can maximize V2G services, while not impeding the mobility usage of the car (Shaheen et al., 2024).

### SOLAR PANELS

With sufficient energy storage, investment in renewable energy sources become financially viable again. Currently, solar panels are installed in in solar farms, or on roofs of businesses and homes. One application that is rising in popularity is small-scale plug-in solar. These solar panels installation plug directly into a power outlet of the home and don't need to a certified installer. Its application can be attractive to people living in apartment buildings, because they often do not have the roof space for solar panels. While this installation will not make owners fully self-sufficient, the reduction in energy consumption can be around 40% (Kim et al., 2020). The barrier of entry is also much lower than with regular rooftop solar panels because of the lower cost of small installation.



A balcony solar system in Germany.
Photo: Dreamstime




## 4.1 Interviews

A few interviews have been conducted to help with community identification, finding indications for solutions or future implications and to give a face to these communities. The first interviews were conducted during the site-visit, trying to find what people in different neighbourhoods thought about solar-panels and battery storage and also if they already were in the possession of solar panels. This lead to some interesting outcomes, for example people expressing their worries and thoughts about the net metering scheme stop in 2027, people having interest in solar panels but aren't able to adopt them because they rent and people expressing financial and safety concerns about home batteries. Also the answers were different in different neighborhoods. The site-visit consisted of a visit to 3 different neighborhoods: Kanaleneiland - one that has a siginificant low-income group (Centraal Bureau voor Statistiek, 2022), Oudwijk/Wilhelminapark - one that has a siginificant high-income group, and one that has been found to be the most average neighborhood according to a media article in 2019 (De Utrechtse Internet Courant, 2019). Other interviews will be referred to in-text and can be found in the appendix.

### KANALENEILAND

Many residents live in apartment buildings. Some of these apartment buildings have solar panels but the residents don't notice that they are present. They don't experience a lower energy bill because of them and the home cooperations doesn't send communications regarding the solar panels. The resident think it is important that they are there because of sustainability reasons. Other residents mentioned that there are plans to install solar panels on their apartment building in the near future. Generally, these residents are positive towards this, especially if it would show in their monthly energy price. Finally, there are many residents that do not have solar panels on their apartment building or house, that also claim that they 'do not care'.

### MALIEBAAN

These residents interviewed close to Maliebaan appeared more interested in the topic, more knowledge and more experienced. One interviewee did not have solar panel yet, but would definitely be interested in the future. When she was explained the change in regulation, she seemed positive towards a home battery as a solution. She mentioned the financial side was important. She was willing to make an investment in sustainable energy, but she wondered about the extra cost of a home battery and how long the payback time would be. She mentioned that especially with newly installed solar panels, it seemed like a good solution to combine it with a home battery as a package deal.

### ZUILEN

In Zuilen, while many residents live in houses instead of flats, I did not encounter people in that living situation. Similarly to Kanaleneiland, there were residents living in apartment buildings without solar panels who also did they show any interest in them. One interviewee had on multiple occasions told the housing cooperation to install solar panels on the roof of the building but without success. She said that if she would be in a living situation where she could manage her own roof, she would definitely be willing to invest in solar panels. She had heard of the netting arrangement ending and seemed positive towards a home battery as a solution. One concern brought up was safety, she heard of electric cars sometimes catching fire and she would not want that to happen to her house because of the home battery.

**" I heard the electric grid net scheme is too expensive [...] People need to invest in batteries, maybe on a municipal level"**

Adult woman from Kanaleneiland.

**"I live on a rent. I don't even know if I we have solar panels"**

Young woman from Kanaleneiland.

**"My solar panels will arrive tomorrow. I got 16 [...] I own a house and it will be a long-term investment[...]The batteries market is still too small and expensive"**

Adult man from Maliebaan.

**" I have been owning 11 solar panels for 5 years [...] I do not like the 2027 stop, I get money back from the grid"**

Adult woman from Maliebaan.

**"I would get home batteries if they were safe"**

Adult woman from Zuilen.

**"I would get solar panels if I owned a house"**

Young woman from Zuilen.

# 4.2 Profiling the Communities

### WHO IS AFFECTED?

Some trends and sensitivities have been identified within the energy transition and the problems arising from the energy transition regarding who are affected by this, and therefore indicate potential communities. This has been done by conducting an analysis using 20+ articles using the altas.ti software (Atlas.ti 25, 2025). The articles have sourced by using NEXIS uni, with prompts like ”energietransitie”, ”gedupeerden”, ”netcongestie” and ”negatieve effecten”; Dutch for energy transition, victims, grid congestion and negative effects. The following text came out using the Atlas.ti tool (2025) to summarize:

”The articles discuss the impact of the energy transition in the Netherlands, focusing on the consequences of grid congestion and the abolition of the net metering scheme for solar panels. Lawyer Oscar van Oorschot is considering legal action against the government because of this abolition, which will lead to financial damage for solar panel owners. More than 20,000 people have now registered for a possible collective claim. Furthermore, companies and individuals are experiencing problems with connecting to the electricity grid due to a lack of capacity. This leads to lawsuits, postponement of construction projects and frustration within the industry. The energy transition, while necessary for sustainability, is encountering practical obstacles such as insufficient grid capacity and high network costs, which endangers economic growth and sustainability goals. TNO’s policy advice calls for targeted support for households in energy poverty and emphasizes the urgency of effective measures to address these problems. The ongoing grid congestion is hindering the progress of the energy transition, and there are concerns that without significant investments the current problems will worsen.”(Besteman, 2025a, 2025b; Borst, 2021; De Jong, 2025; Dit is een complexe uitdaging, 2025; Ermstrang, 2025; Geijp, 2023; Greijn, 2025; Kok, 2024; Lammertse, 2025; Redactie, 2025; Thijssen, 2025; Van den Berg, 2024; Van der Wielen et al., 2024; Van Dijk, 2021;Vinkenborg, 2025; Vogelsang, 2025a, 2025b; Zorgen bij ondernemers, 2024; Help; File op het elektriciteitsnet, 2025; Industrie raakt achterop, 2024)”.

Affected or to be affected groups arising from these articles are solar panel owners that are affected by the abolishment of the net metering scheme, companies and individuals that are affected by the lack of grid capacity and households in energy poverty.
In the next section the questions ”What problem affects what community?” and ”Who is and who will be affected?” will be examined with literature to try to identify the communities

### AFFECTED BY THE ENERGY TRANSITION REGARDING SUSTAINABLE RESOURCES (LOW-INCOME BIRDS)

In the energy challenge that all of us are facing there are certain groups that are affected the most in a negative way. For example, financially vulnerable people aren’t able to catch up with the energy transition, which is essential, as it has a significant downward pressure on energy prices in the short and medium term. This leads to so-called “energy poverty” meaning little to no access to electricity and other forms of (modern) energy (Straver, Tirado Herrero, 2020). The price of energy is not only increasing because grid operators need to expand the capacity of the grid for the future, but also because households need to switch to and invest in new forms of energy. Research shows that sustainable energy is indeed mostly used by high-income households (Borenstein, Davis, 2016). Additionally, energy costs are rising specifically for those left behind, as fossil fuels are being increasingly taxed (Straver, Tirado Herrero, 2020). Also it seems that there is a big difference between people who own their own home versus people who rent - and also between different types of renters - because renters oftentimes have less power in deciding whether or not they can invest in sustainable energy regarding the property they live in compared to home-owners. When it comes to renters, landlords or housing corporations have the biggest say in this, but their commitment to sustainable energy varies (Straver, Tirado Herrero, 2020).
In a Dutch case-study performed in The Hague by Kraaijvanger et al. (2023) it is found that the adoption of sustainable energy techniques, in this case PV-panels particularly, is linked to more high income groups. They therefore also benefit from energy policies that are associated with this, which widens the gap of inequality in regards to disadvantaged groups. Another interesting find in this study is that the existing potential of solar energy is used in the more high income areas, whereas the findings indicate that there is a lot of untapped potential in the more ‘disadvantaged’ areas (socioeconomically disadvantaged/lower income), but with low access to this potential. The study suggests that policies specific to this problem are necessary means to get to a more equitable adoption of solar energy.

### AFFECTED BY GRID CONGESTION (BIG BIRDS)

As mentioned earlier, the energy transition faces various challenges nationally, for example increasing electrification and grid congestion.
A governmental report (Ministerie van Economische Zaken en Klimaat, 2024) found that grid congestion can have a significant negative effect on economic growth, and it can slow down certain projects and processes. And these will eventually lead to social costs. It also affects high-intensity energy consuming sectors (big energy consumers) more than low-intensity energy consuming sectors and households. This is because high energy intensive sectors generate less added value per energy unit and are less flexible when it comes to location and restrictions (Ministerie van Economische Zaken en Klimaat, 2024). Also TenneT, who provides the national high-voltage grid, underscores particularly the impact of the grid congestion on expanding companies who need heavier electricity connections and calls out for reinforcing the grid and future creative solutions (TenneT, n.d.). Whereas big energy consumers are affected by the congestion, the small energy consumers are not yet affected (Regulatory Assistance Project, 2024).
New high-intensity/Big energy consumers can not be attached to the grid anymore in the whole Utrecht province - wherein the U16 is located - anymore due to grid congestion. Even small energy consumers might fall victim to the effects of the congestion on the longer term (Provincie Utrecht, n.d.). In fact, the need for electricity consumption is nationally the biggest in Utrecht with over a thousand companies on the waiting list. The liability of electricity supply in the area is under pressure on cold winter days (Stedin Groep, 2024).

### AFFECTED BY GRID CONGESTION (EARLY BIRDS)

When it comes to the grid congestion problem there is also groups affected on the supply side of the grid’s capacity. Regarding solar panels, the netting scheme will stop on january the 1st 2027, affecting all small energy consumers, like households and small companies (Rijksoverheid, n.d.; Rijksdienst voor Ondernemend Nederland, n.d.). When the netting scheme will be stopped, this will not only take away the positive effect on the growth of solar energy in the country, but will also negatively affect the payback period of an investment in solar panels. It also results in lesser benefits for both home-owning solar panel owners and renting solar panel owners. For both the cut in benefits per year is estimated/calculated to be approximately by half (CE Delft, TNO, 2024).

### SUPPORT COMMUNITYW (HIGH-INCOME BIRDS)

As mentioned earlier, high-income groups have better access to and make better use of sustainable energy (Borenstein, Davis, 2016; Kraaijvanger et al., 2024). There is a clear gap revealed between socioeconomical advantaged and disadvantaged groups in the first section of this chapter. Cannot there be an opportunity to link and relate the advantaged and disadvantaged to each other in the energy transition context. How can higher-income groups for example help or sustain lower income groups in transitioning to an independent strong community?

# 4.3 Spatial Identification of the Communities

To find the Low-Income Birds in the spatial context, the CBS definition is used from the demographic dataset 'Kerncijfers Wijken en Buurten 2022' (Centraal Bureau voor Statistiek, 2022). The definition used in the spatial analysis of this community is the percentage of households that are part of the 40% households with the lowest disposable income in the Netherlands. Another definition by Centraal Bureau voor Statistiek (2022), which is not spatialy analyzed, is described as a household that has a resulting standardized and deflated income below €9,249. For the rental aspect of this community the Centraal Bureau voor Statistiek (2022) definition of what a rental property is is used: A residential property in which its owner does not live. In this dataset, residential properties that do not have an inhabitant registered are sometimes also assumed as rental properties.

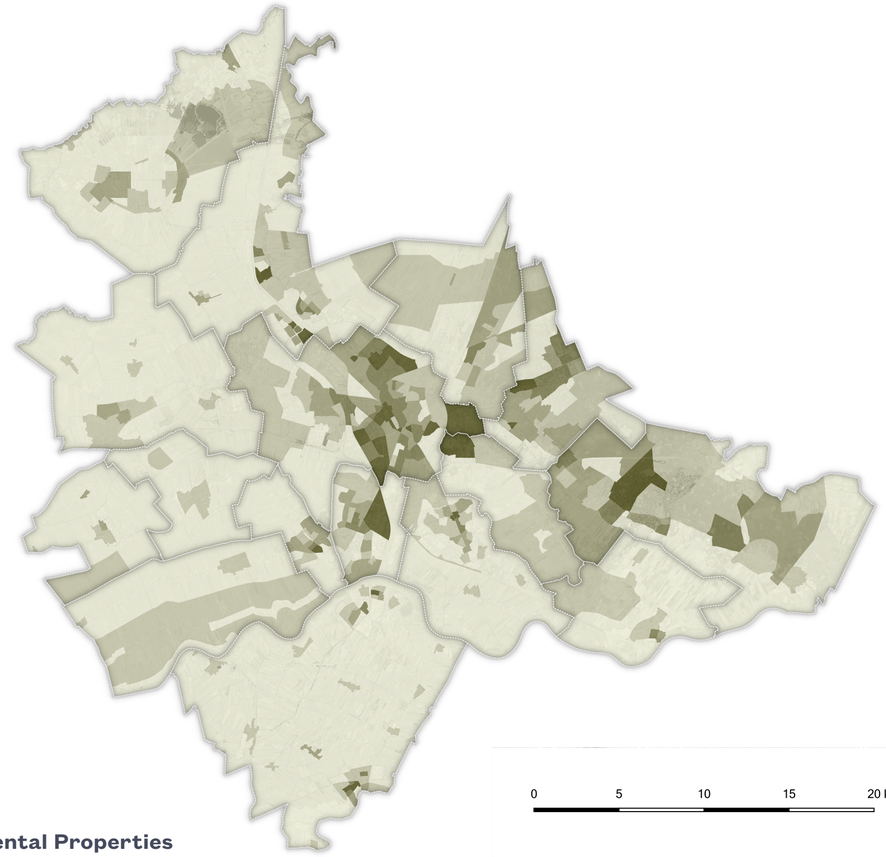
To find and frame the Big Birds in the spatial context, a few datasets have been combined. What is the definition of a big energy consumer? In the Netherlands, a big energy consumer is defined as an entity with an electricity connection to the grid of 3x80A and/or a natural gas connection of 40 m3/h or G25 (Stedin, n.d.). Regarding the previously mentioned literature elaborating on the lack of flexibility of industry and business sectors within the big energy or high energy intensity consumers (Ministerie van Economische Zaken en Klimaat, 2024), a dataset concerning the location of big energy consuming clusters (Provincie Utrecht, 2016) has been combined with datasets mapping out industry and office estate areas (IBIS, 2022) and properties (Kadaster, 2025). The dataset mapping out big energy consumers from Provincie Utrecht (2016) is the most recent dataset that maps out this specific information on a provincial scale, therefore the assumption is made that the information regarding energy consumption - heat demand and electricity power - has not changed for the worst. Heat demand is assumed to be indicative of total energy use.

The Early Birds community have one common denominator; they are in the possession of solar panels and are/will be affected by the upcoming netting scheme in 2027 (CE Delft, TNO, 2024). Demographically, there is not much data found on this community. It is assumed that they are a diverse community in that regard. But for this research it is not a necessary aspect regarding their relation to the energy transition.

To find the High-Income Birds in the spatial context, the CBS definition is used from the demographic dataset 'Kerncijfers Wijken en Buurten 2022' (Centraal Bureau voor Statistiek, 2022). This is defined as the percentage of households that are part of the 20% households with the highest disposable income nationwide. For the home-ownership part, the definition of owner-occupied home from Centraal Bureau voor Statistiek (2022) is used: Homes that are property of their (future) occupants, or second homes.




This map shows the percentage of low-income households per neighbourhood (Centraal Bureau voor Statistiek, 2022). This is based on the latest 'Kerncijfers Wijken en Buurten' dataset with complete dempographic data, which is from 2022. The neighbourhoods with the highest percentage of low-income households seem to be primarily situated in areas that correspond with urban areas. For the synthesis of localising the Low-Income Birds community, a threshold is used. Through investigating which percentages give a spatial indication of where low-income households predominantly reside or where they are concentrated (they are of course also spread throughout the region), a threshold of 50% is used, so if 50% or more of all households in a neighbourhood consist of low-income households.

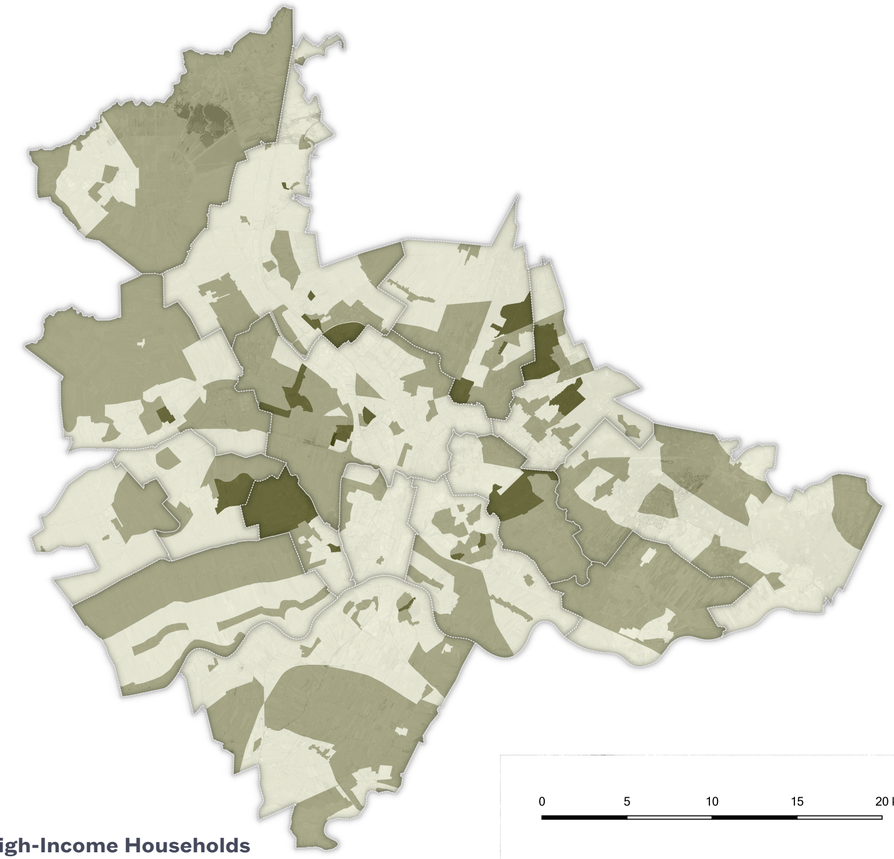



## Percentage Rental Properties

0-20
20-40
40-60
60-80
80-100

This map shows the percentage of rental properties per neighbourhood (Centraal Bureau voor Statistiek, 2022). This is based on the latest 'Kerncijfers Wijken en Buurten' dataset with complete dempographic data, which is from 2022. The neighbourhoods with the highest percentage of rental properties seem to be primarily situated in areas that correspond with urban areas. Also for this map, a threshold is used for the synthesis of localizing the community. Based on investigating the data on how through all the neighbourhoods the percentage of rental properties generally relates to the total housing stock, a threshold of 60% is used.

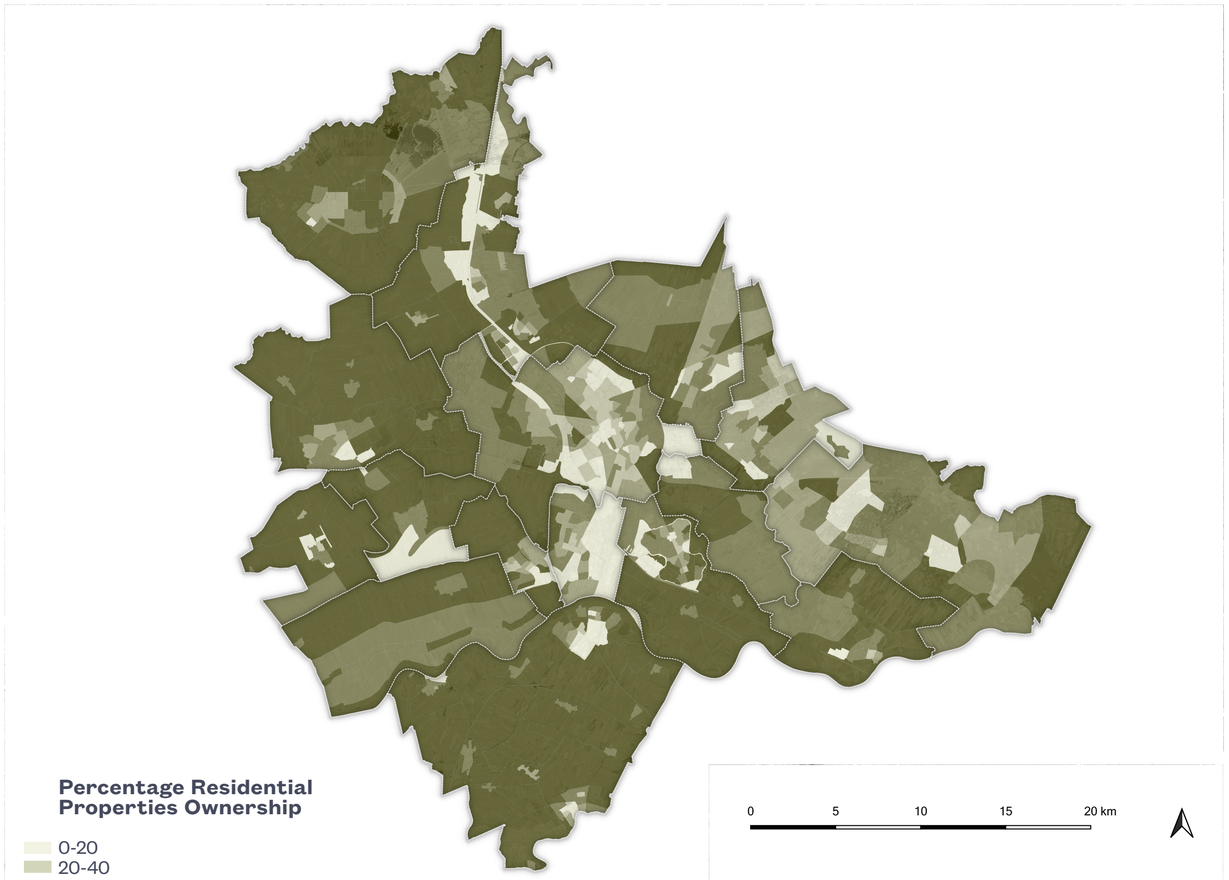





## Percentage High-Income Households

0-25
25-50
>50

This map shows the percentage of high-income households per neighbourhood (Centraal Bureau voor Statistiek, 2022). This is based on the latest 'Kerncijfers Wijken en Buurten' dataset with complete dempographic data, which is from 2022. The neighbourhoods with the highest percentage of high-income households seem to be primarily situated in areas that correspond with the outskirts or peri-urban areas. For the synthesis of localizing the High-Income Birds community, a threshold is used. Through investigating which percentages give a spatial indication of where high-income households predominantly reside or where they are concentrated (they are of course also spread throughout the region), a threshold of 50% is used, so if 50% or more of all households in a neighbourhood consist of high-income households.




This map shows the percentage of residential properties ownership per neighbourhood (Centraal Bureau voor Statistiek, 2022). This is based on the latest 'Kerncijfers Wijken en Buurten' dataset with complete dempographic data, which is from 2022. The neighbourhoods with the highest percentage of residential property ownership seem to be primarily situated in areas that correspond with rural areas, but are also seen in urban areas. Also for this map, a threshold is used for the synthesis of localising the community. Based on investigating the data on how through all the neighbourhoods the percentage of residential property ownership generally relates to the total housing stock, a threshold of 80% is used. This is higher than the threshold used for the rental properties since the percentage of residential homeownership is generally higher than the percentage of rental properties, both nationally and regionally.



Lively street in Maliebaan Photo taken during a fieldtrip.

## Low-Income Renters Examples

1. Overvecht



2. Vollenhove



## High-Income Renters Examples

3. Oog in Al



4. Lyceumkwartier



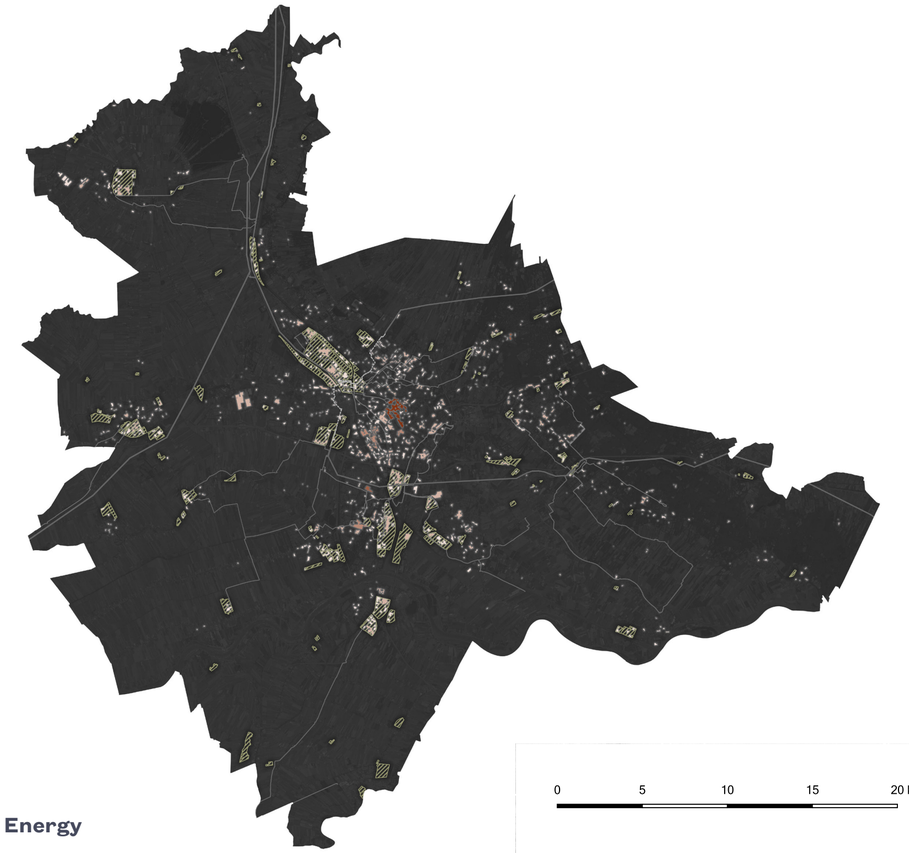



In this map the synthesis of rental properties, low-Income households, property ownership and high-income households is visualized and by that shows the location of where the Low-Income Birds and High-Income Birds are primarily located located.

0 5 10 km

**Low-Income Birds & High-Income Birds Map**

- high % rental property (60-100)
- high % home ownership
- high % low income households (50+)
- high % high income households (50+)





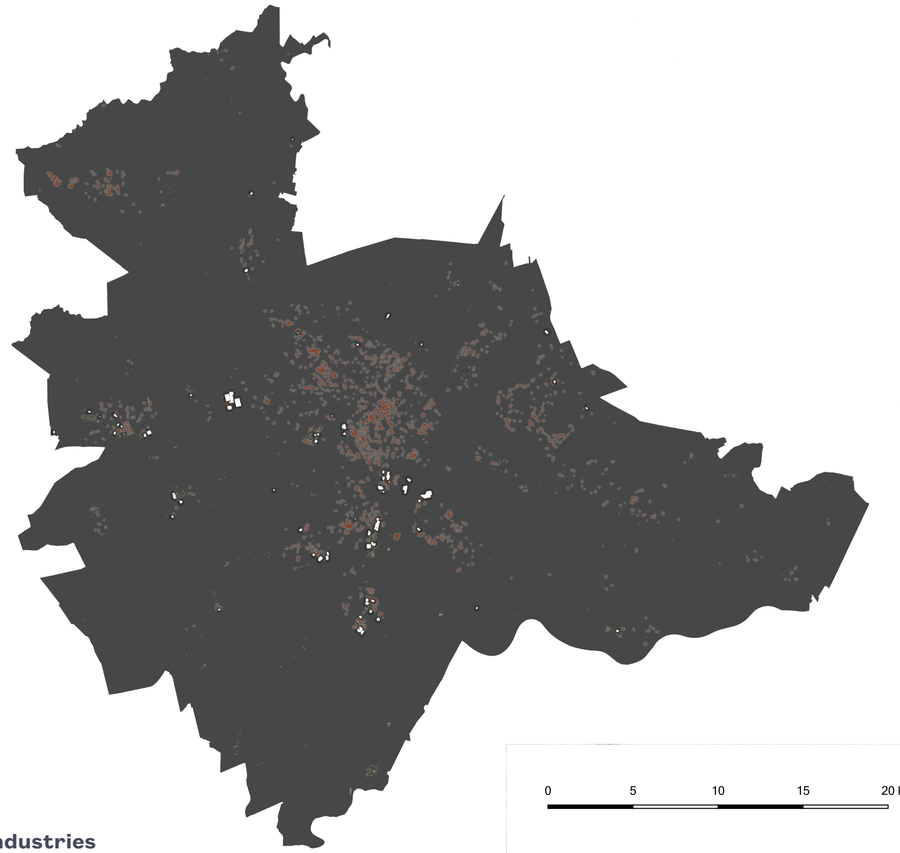

## IBIS and Big Energy

**Electricity Grid and Distribution**
- TenneT High Voltage Line (Above Ground)
- TenneT High Voltage Line (Underground)
- Stedin Regional High Voltage Line
- IBIS Industry/Office Estate

**Heat Demand Big Energy Consumers (kW)**
- 0.0-0.0
- 500-300
- 3000-6000
- 6000-10000
- 10000-15000

This map shows the synthesis of big energy consuming clusters (Provincie Utrecht, 2016) and the IBIS industry/office estate areas (IBIS, 2022) to find out where big energy consuming industries/companies are located. This synthesis is needed, as the big energy consuming clusters data seems to also correspond with residential properties to some extent. As the Big Birds concern only companies, excluding the residential aspect is needed.



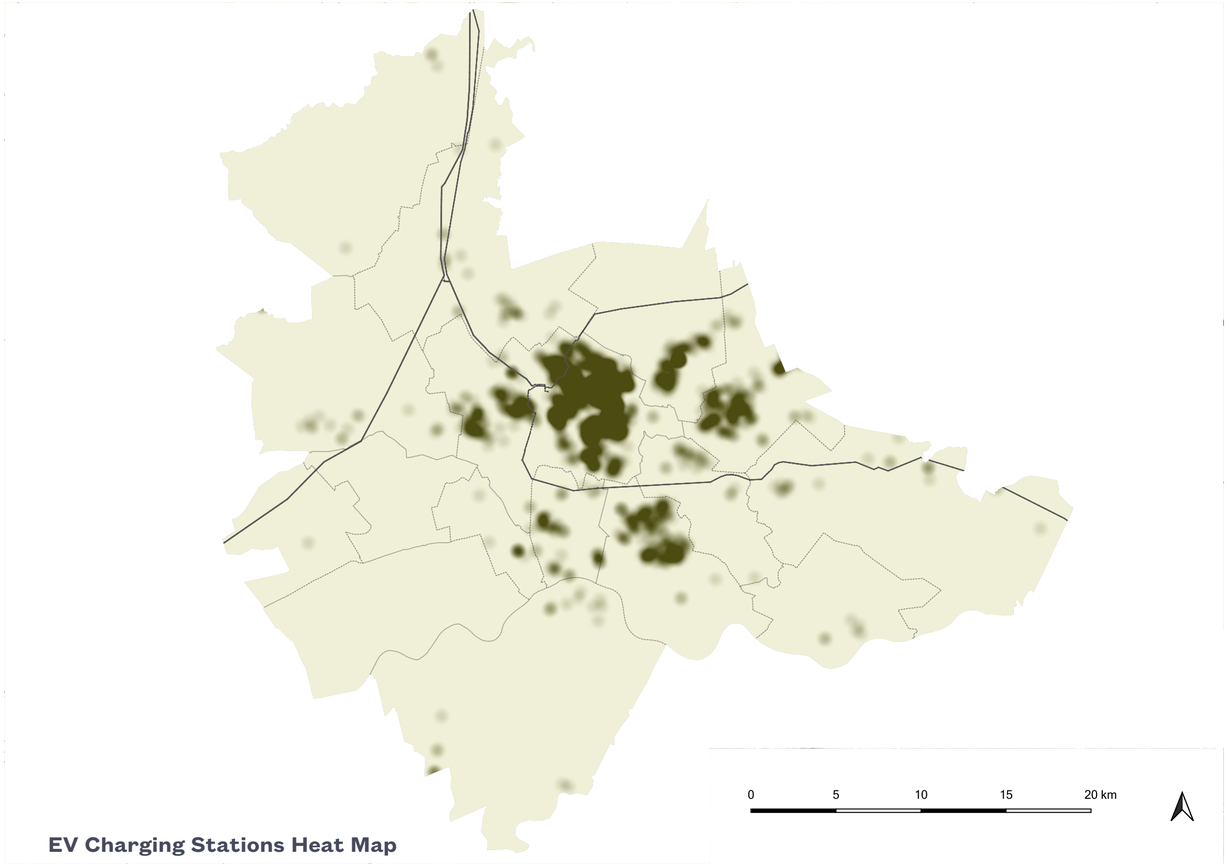





## Big Energy Industries

- Big Energy Consuming Clusters
- BAG Registered Industry Functions
- Industrial Big Energy Consumers (overlay)

This map shows the synthesis of big energy consuming clusters (Provincie Utrecht, 2016) and the BAG registered industry functions (BAG, 2025) to find out where big energy consuming industries/companies are located. This synthesis is needed, as the IBIS industry/office estate areas do not cover all the industries in the area. The big energy consuming clusters data seems to also correspond with residential properties to some extent, as is the same case as in the previous map. As the Big Birds concern only companies, excluding the residential aspect is needed. Offices have been excluded in this synthesis, as many of these are registered in residential properties/areas and oftentimes seem to be small energy consumers within big energy consuming clusters. Therefore, they damage the accuracy of the localization of this community and blur its spatial relationship to the area. The localization of this community will therefore not cover all big energy consumers in the area, but does



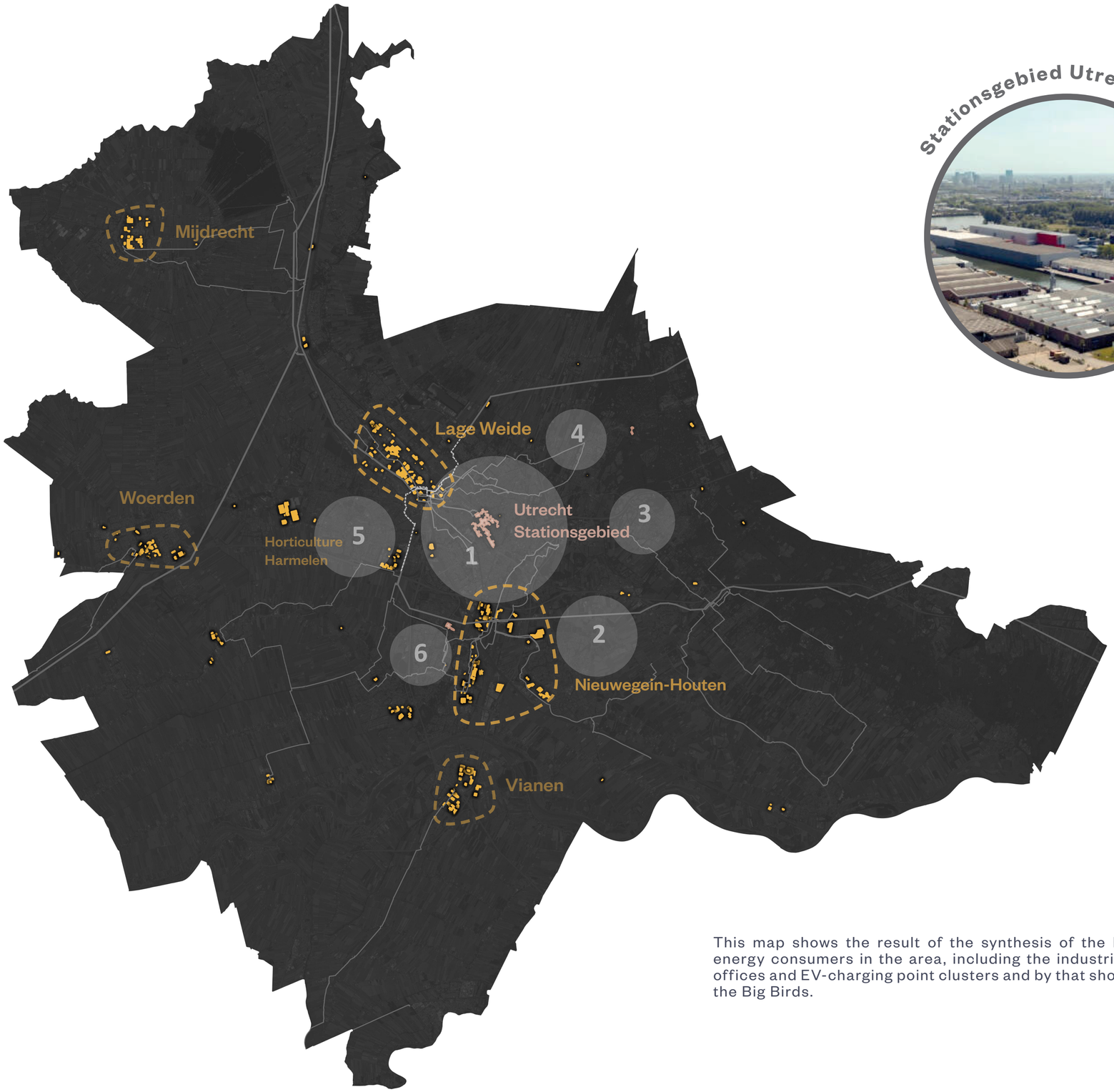

**EV Charging Stations Heat Map**

This map shows where the highest concentrations of EV-charging points are located, based on data from Esri Netherlands (2023). Because of the ongoing electrification of energy use as mentioned earlier, electric vehicles are predicted to be also a big bird in the (near) future, because of their vast electricity consumption. This map indicates where the consumption of this electricity for cars is concentrated the most.






Power Plant PEGU in the Lage Weide area. Photo: UIT.









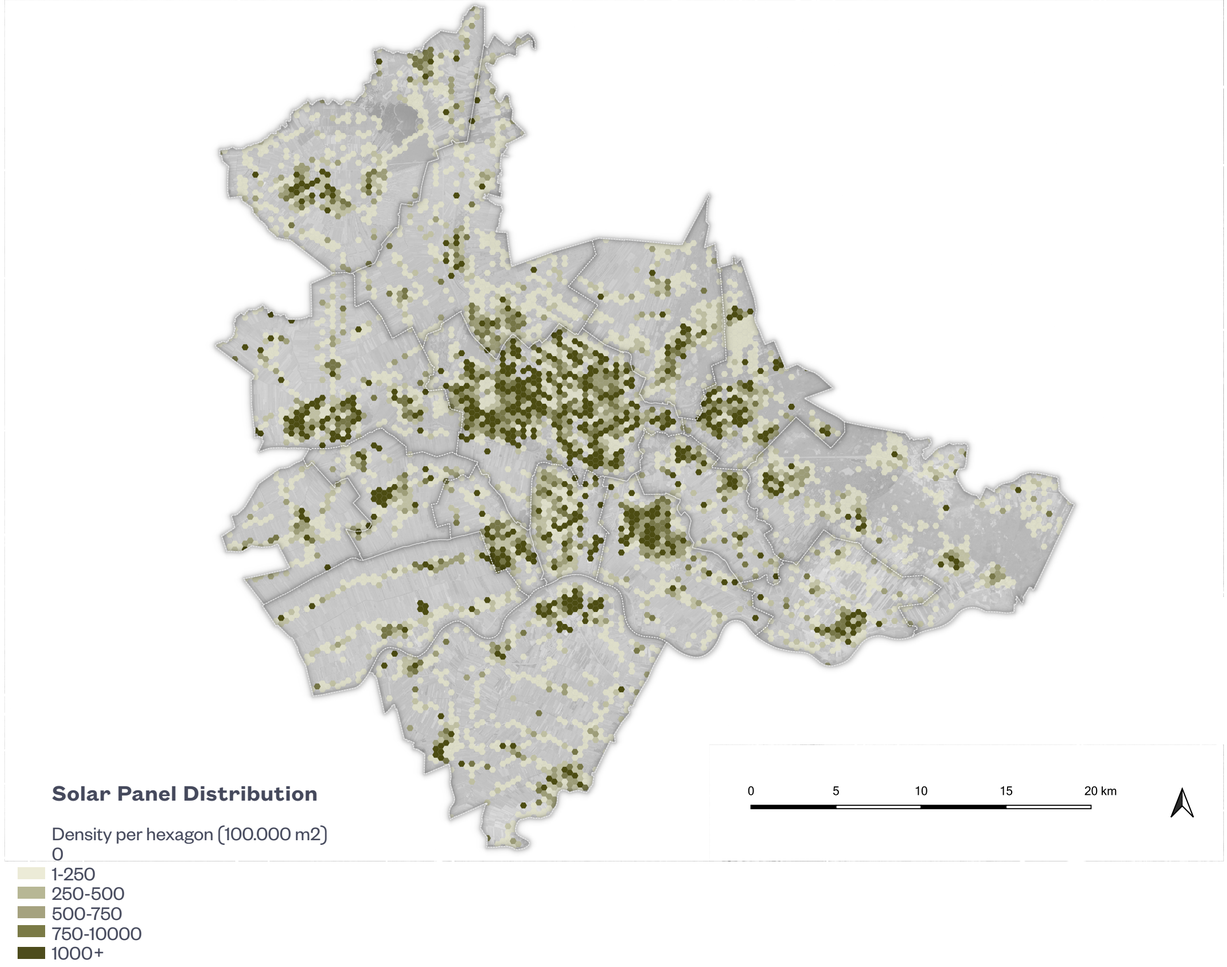




This map shows the result of the synthesis of the big energy consumers in the area, including the industries, offices and EV-charging point clusters and by that shows the Big Birds.

**Big Birds Map**

- Other big energy consumption clusters (5000-15000 kW)
- Big energy consuming industry/office
- Clusters




To localize the Early Birds on the map the density of solar panels per area with the size of 100.000m2. From this map, areas with most solar can be identified, which seem to be located primarily in more urban areas. This can be explained by the higher density of population and households in these areas. It does however also indicate the number of Early Birds in these areas.



Streets of Zuilen. Photo taken during a fieltrip.






2. Vianen



3. Woerden



1. Leidsche Rijn

This map visualizes the indications of high number Early Bird clusters, and is therefore an effort in localizing this community spatially.

0 5 10 km

**Early-Birds**


Low-income birds
High-income birds
Big birds
Early birds
0
5
10 km

# 4.4 Community Demands and Needs

## Low-income Birds

### WHAT DO THEY THINK, WANT AND DEMAND?

One major demand by the low-income community that can be concluded from the previous analysis is affordable energy, since the financial capabilities concerning this community are a threat to its accessibility. This aligns with an interview conducted for this research with a representative from housing corporation 'Woonin' (conducted 31-03-2025). According to her, residents are mainly concerned about the financial aspect when it comes to sustainable energy. In a case study in the Netherlands investigating social housing residents' attitude towards a zero-energy building renovation found that residents demanded to have a bigger participatory role in the process. They weren't against transitioning towards a greener future but mainly had concerns about the inclusivity of the process (Bal, et al., 2021). A study conducted in Japan resonates with the call for inclusivity and participation other than showing results that clearly state that low-income and energy poor people have little to very little interest in renewable energy, but therefore the energy transition needs to focus on inclusivity and participation. This is to make sure vulnerable low-income groups can partake in the transition. This study has been conducted using a survey asking about people's energy preferences (Chapman, Okushima, 2019).

### FUTURE PROJECTION

Coming from more participation, power and inclusivity for low-income birds within the energy transition and their demands for affordable energy, a pediction for the future has been made regarding the low-income birds. In the future they might want to become less dependent or completely independent and resilient. This leads to a certain directionality when it comes to the implications within this project. According to Vallecha and To (2024) for example, Energy Communities are important for vulnerable and underserved communities to create and improve community resilience.

## Big Birds

### WHAT DO THEY THINK, WANT AND DEMAND?

There is limited literature available identifying specific needs and demands from big energy consumers, but concluding from the problems that this community is facing a few needs and demands can be extracted. They need sufficient energy supply to function, but also trustworthy and continuous supply of electricity for their processes. Also, more and more companies are transitioning or want to transition to producing their own energy because of the grid congestion (Rijksdienst voor Ondernemend Nederland, 2023). This creates decentral flexibility which gives the opportunity to not always use the grid and can benefit big energy consumers also financially (Van der Steen et al., 2024).

### FUTURE PROJECTION

Since big energy consumers arguably have big properties, they can produce big amounts of renewable solar energy. Since there is a need and incentive to produce locally within this community regarding the grid related problem, it is predicted that the community can become a key role player in collaborative local green-energy efforts.

## Early Birds

### WHAT DO THEY THINK, WANT AND DEMAND?

When it comes to the community of people that already own solar panels, there is a clear demand that can be extracted from media. According to the (Algemeen Dagblad, n.d.), more than 24.000 households have rapidly signed up for a mass claim against the government that two lawyers have been preparing; the investment in solar panels becomes much less worth and the excess energy produced "becomes worhtless" (Voermans, T. 2025). This is also reflected in the media analysis at the start of this chapter. The Early Birds therefore demand financial justice for their investments.

### FUTURE PROJECTION

Since this community has already progressed the most within the energy transition, their future projection isn't the most significant for the project. To be able provide financial justice for their provision of locally produced (excess) energy, it is predicted they can play an integrated role within energy collaborations to sell their excess energy to other communities.

## High-income Birds

### WHAT CAN THEY PROVIDE?

The High-Income birds are, as discussed previously, not necessarily negatively affected by the problems stated as the root of this project. Therefore, their demands are out of the scope of the project, besides of course provided that they won't be negatively affected by the proposals in this project. The focus for this community is on how they can provide for other communities. They have the financial capabilities to become pioneers in a sense. Energy Cooperatives are found to consist of high-income groups primarily (Yildiz et al., 2015; Radtke, Olhorst, 2021). An example of this is the DE Ramplaan Energy Cooperative in Haarlem. In the Ramplaankwartier, almost half of all households belong to the 20% richest nationally (Centraal Bureau voor Statistiek, 2022). We conducted an interview with the chairman/representative of the cooperation (interview conducted on 18-03-2025). They installed 1347 solar panels on the roof of a tennis court and horticulture company. Participants hold a 'share' in the solar panels. If low-income people want to participate in the project, they can get a subsidy from the municipality. The cooperative has tried to inform people about this. In the studies by Yildiz et al. and Radtke & Olhorst (2015; 2021), it is found that Energy Cooperatives led by high-income groups often fail to include the low-income or energy poor groups. This calls for thought about the community's role on how to integrate it with the other communities, especially the Low-Income Birds.

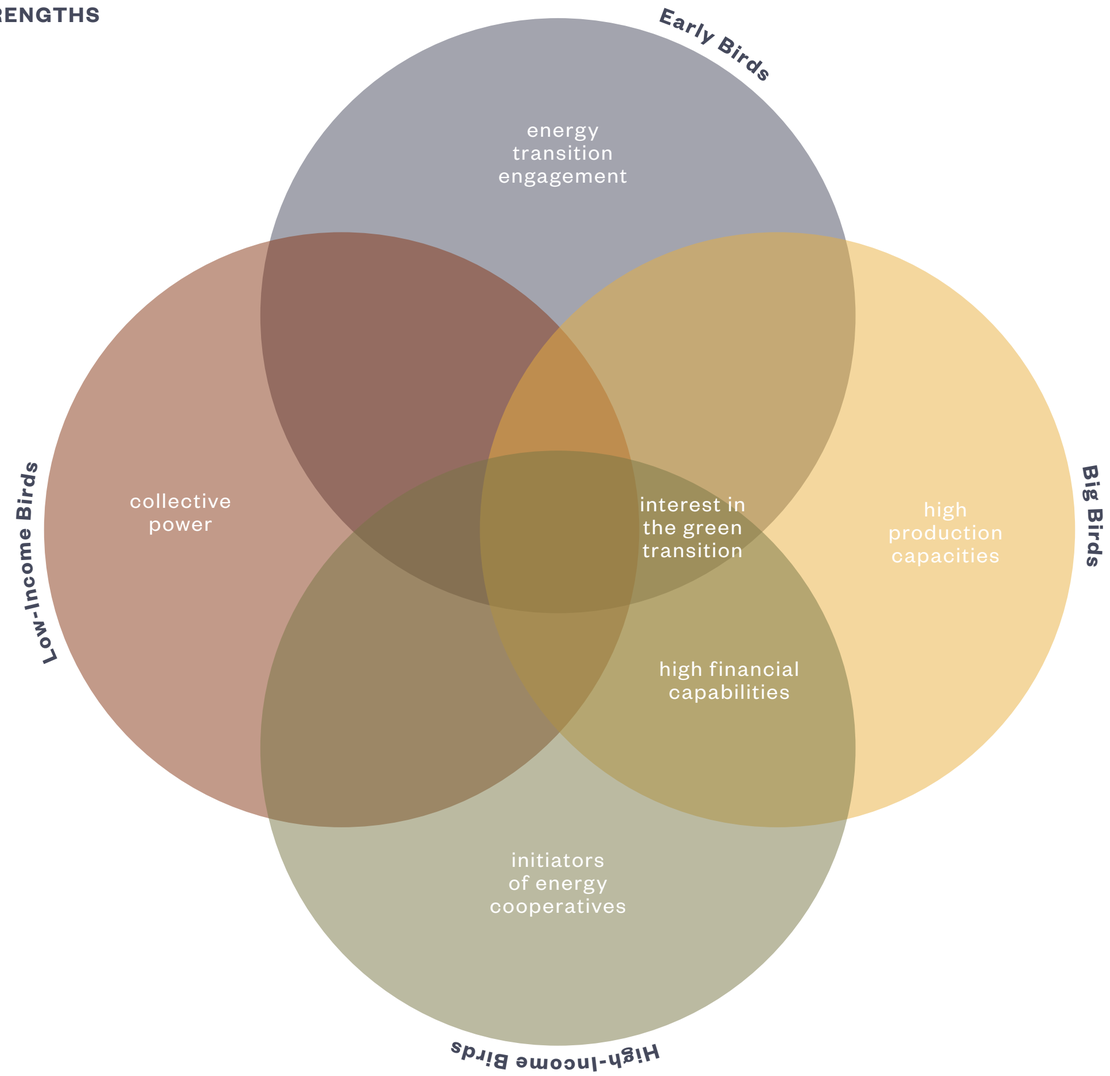


Communal housing in Kanaleneiland. Photo: NOS

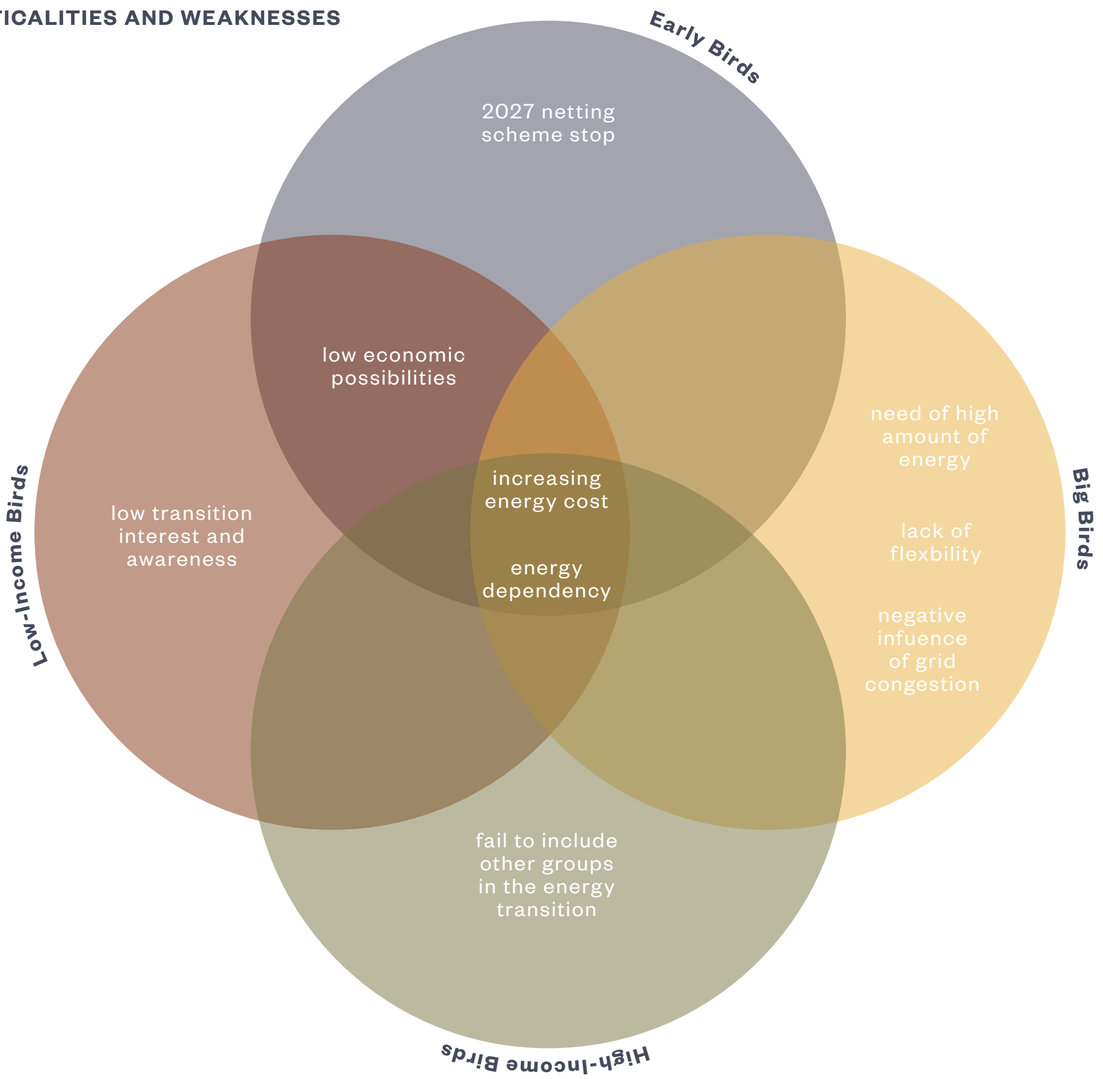
# 4.5 Interrelation of the Communities

What do the communities have in common in terms of strengths, weaknesses and need, based on the analysis and research made?

**STRENGTHS**

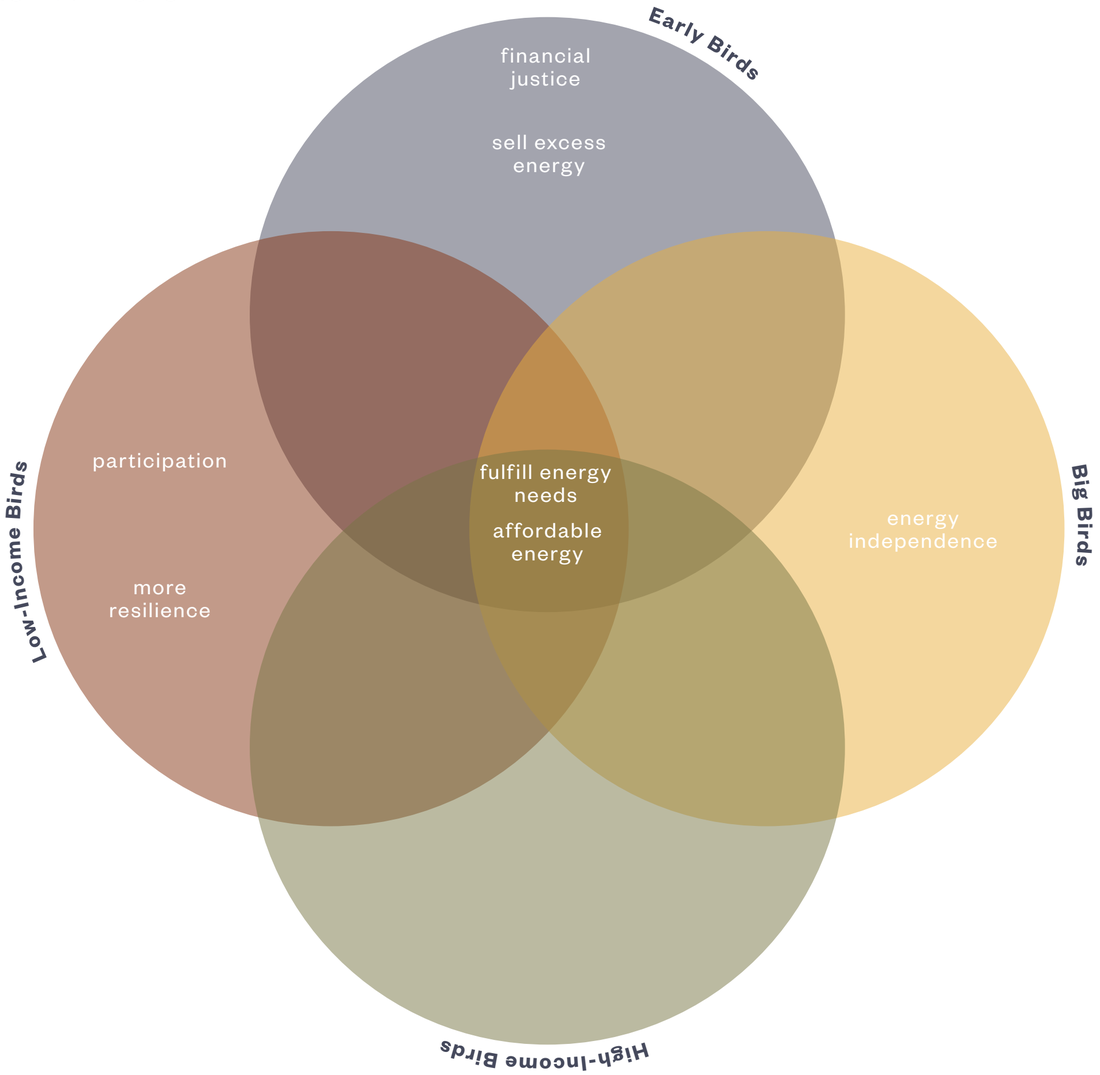



**CRITICALITIES AND WEAKNESSES**

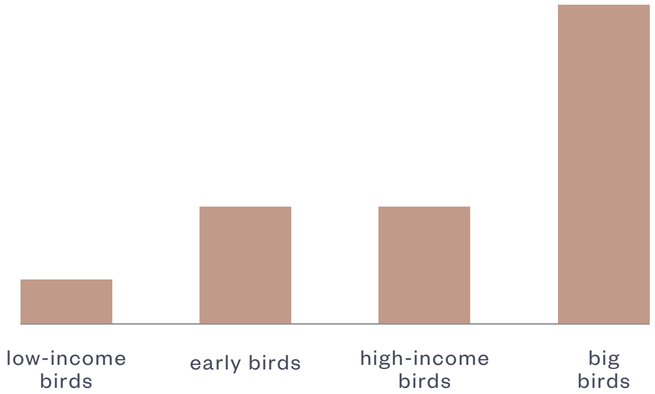


*these representations are merely graphical and do not have a specific scale of measurement.

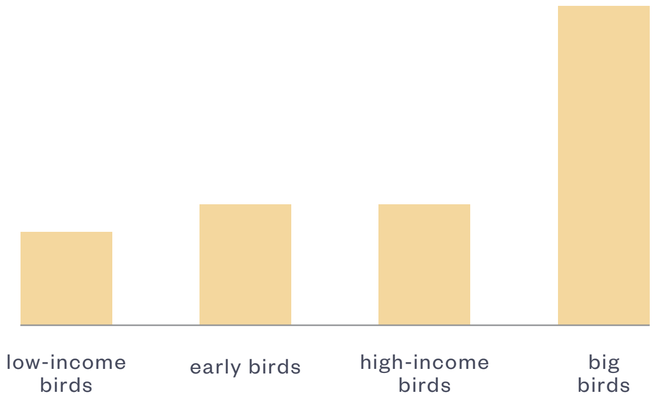
## NEEDS AND VALUES



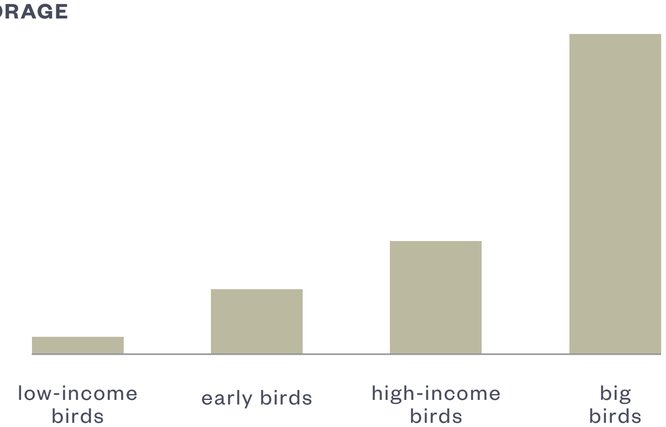

## CURRENT ENERGY PRODUCTION CAPABILITIES*




## CURRENT ENERGY CONSUMPTION CAPABILITIES*

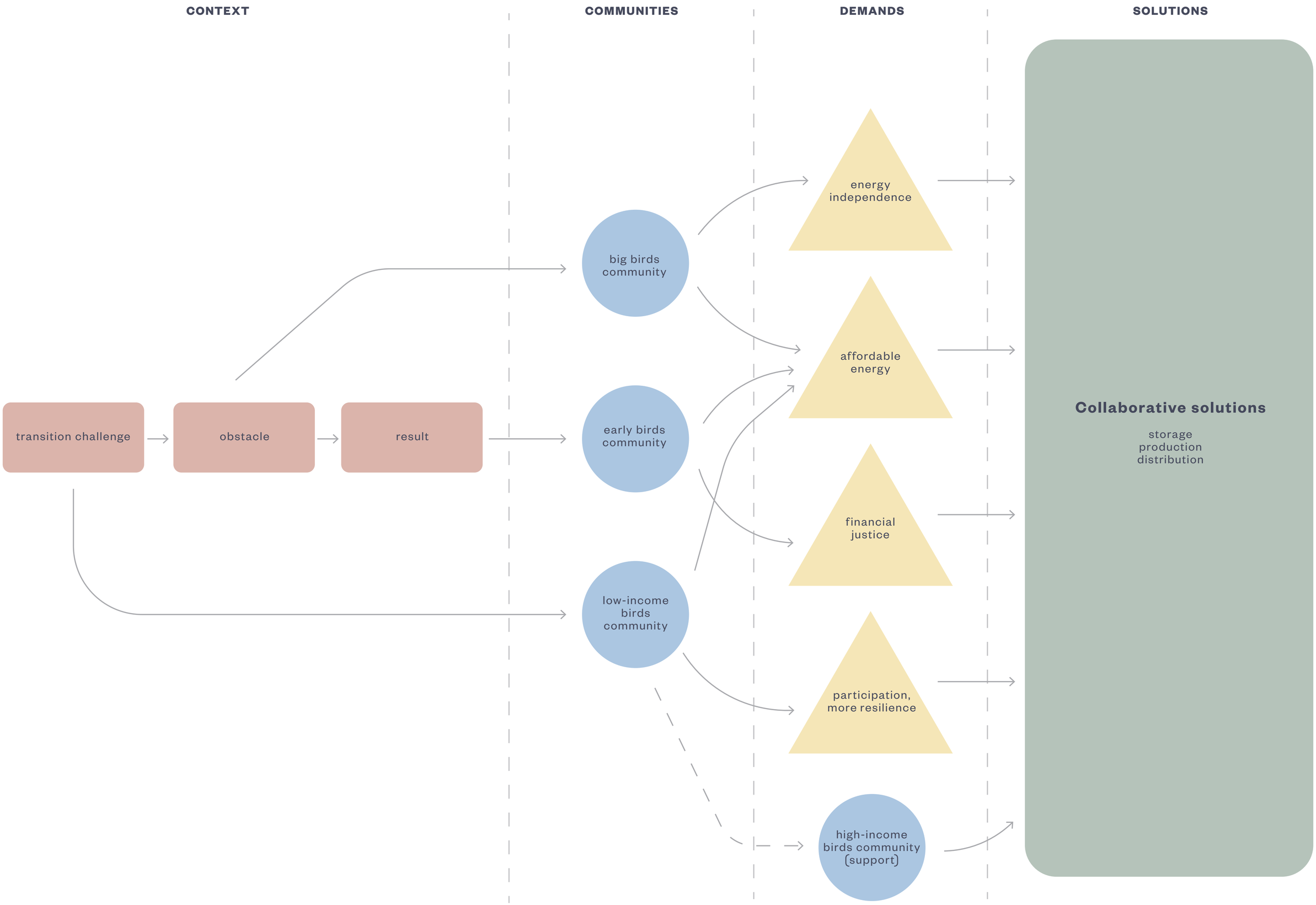



## CURRENT ENERGY STORAGE CAPABILITIES*

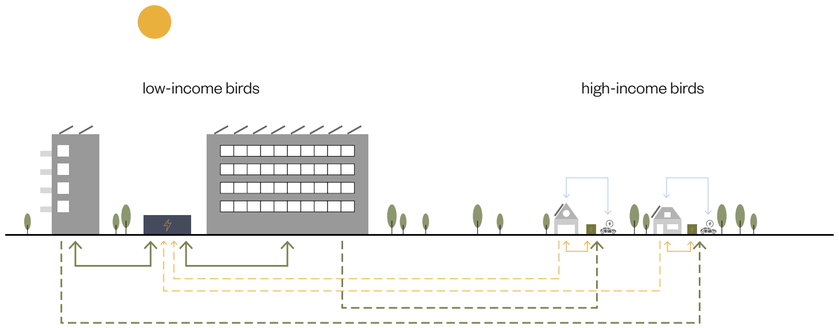


VISIONVISIONVISION
VISIONVISIONVISION
VISIONVISIONVISION

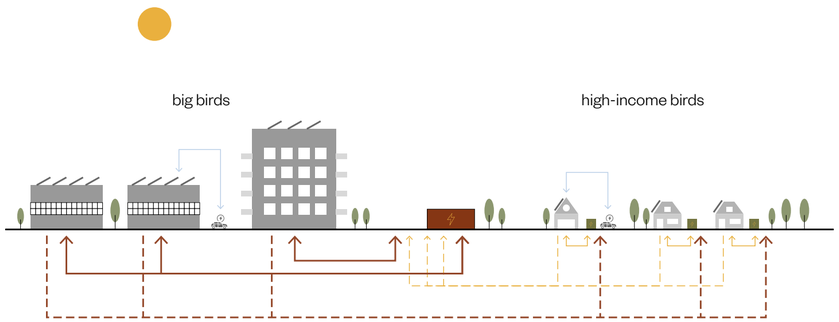
## 5.2 Vision Narrative



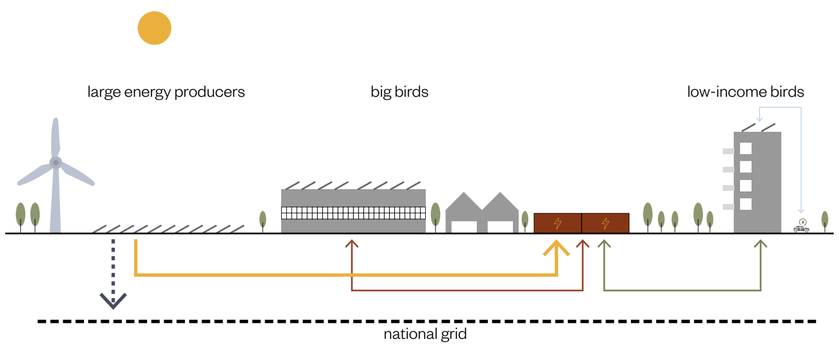
# 5.3 Vision for Energy Circulation




In a scenario where, for example, low-income birds live next to high-income, both could have different ways of storing their energy. High-income would have their home batteries or their electric vehicle while low-income the communal storage. The exceeding energy could be stored in the communal battery for those who need it and it could represent a way to get money back for those who sell it.




In the same way, when big birds are in need of a lot of energy they could access to the one stored in the communal betteries. This energy was partially procued in excess by the households that later sold that.

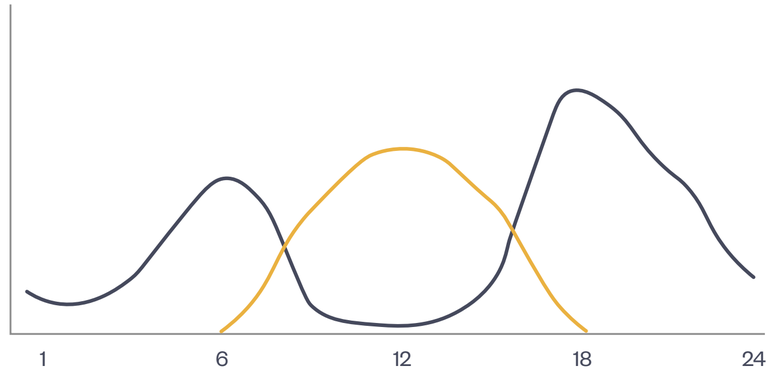



Communal batteries could be used to store not just households' energy but also the energy produced by, for examples, turbines or solar fields. In any case, using the actual grid would still be needed.

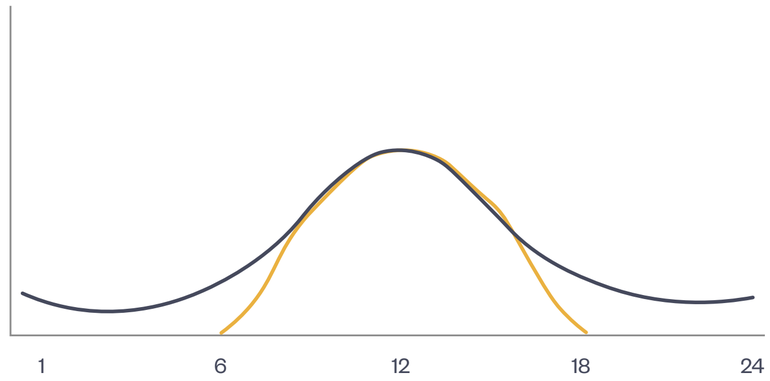


## Average daily household power consumption and solar production

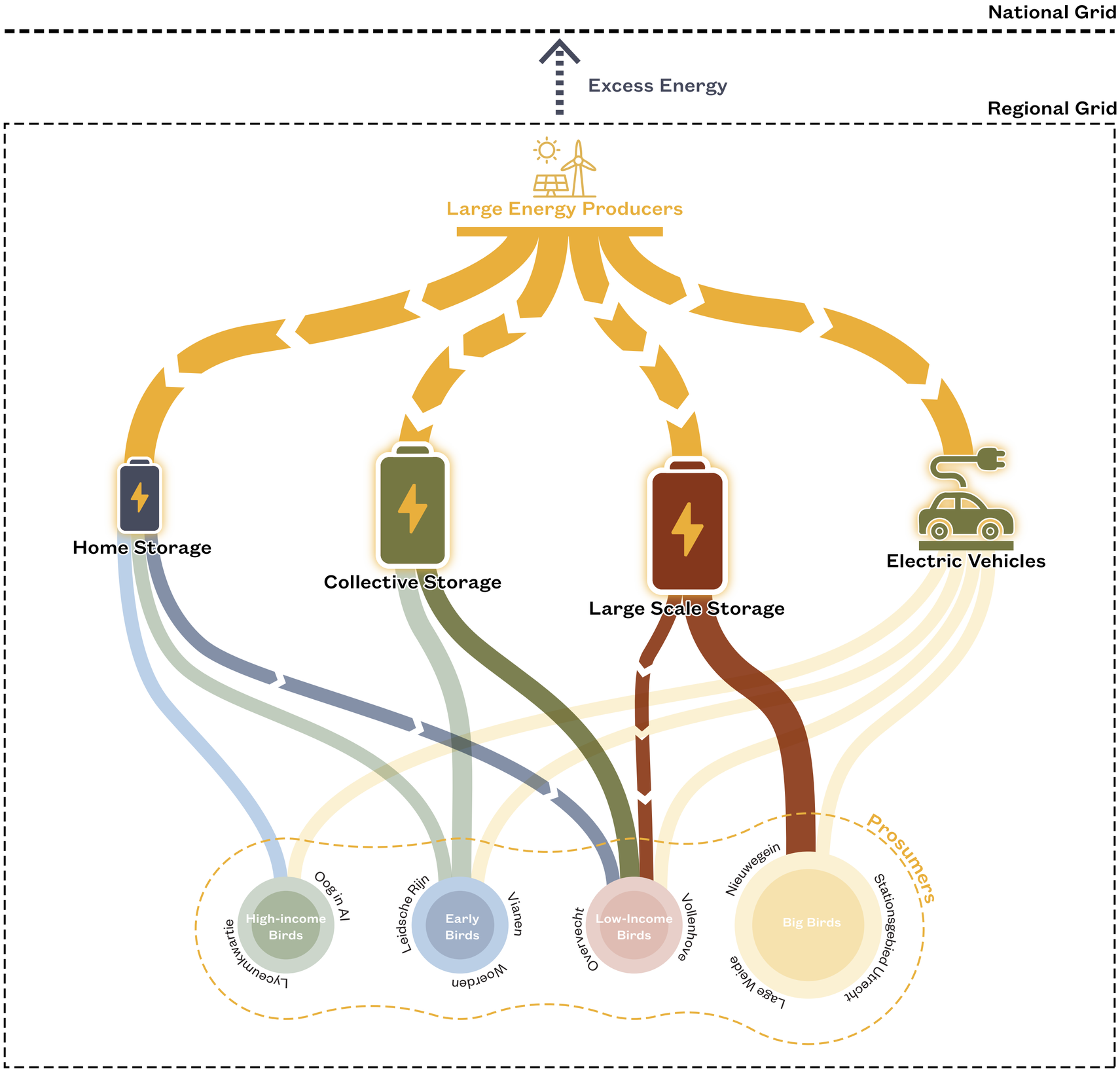
(Sunrayspower, 2019)




## Ideal average daily industry power consumption and solar production




One of the main problems causing grid congestion is the discrepancy between when we use energy in our home and when the energy is produced by solar panels. When the solar panels produce energy that has not been used, it get stored in the grid and this is way it is congested. Because the usage timeframe of households will hardly change, a solution could be for industries to compensate it by using energy in a specific moment. This could be done, for example, with dynamic energy contract that incentivise the industries.




The mentioned neighbourhoods are just examples. There's more of them.

# 5.4 Values and Sustainable Development Goals

## The values followed in the context of the topic



**Energy Autonomy**

Providing energy autonomy to communities is a method of empowerment in response to the growing energy uncertainties that are emerging.



**Spatial & Social Justice**

Unfortunately, the energy transition is not always intrinsically just from a social and spatial point of view. It is essential to ensure that the transition alleviates social inequalities rather than increasing them.



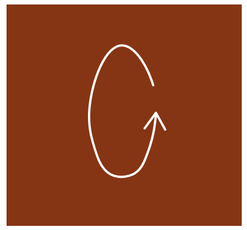
**Inclusivity & Participation**

The energy transition is a common theme that affects us all, so the response we must provide must be equally unanimous and take into account all the actors involved.



**Sustainability**

In a context where an immediate response to the climate crisis is needed, it is essential that every stage of the energy cycle is sustainable.



**Circularity**

Focusing on the topic of energy storage, it is essential to consider the issue of recyclability of the necessary materials.



**Residential Solutions**

To ensure sustainable solutions that reach every social class and are immediately effective, thinking of proposals that enter directly into people's homes is not to be excluded.






**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 7: ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL.**
Given the problem of energy transition and grid congestion, with the addition of the growing cost of energy, it is clear that a sustainable energy model that is affordable for everyone needs to be provided. Solar energy has already been proven to be reliable and sustainable. The missing piece is making it affordable and accessible to all. Investing in residential production, distribution or storage systems, keeping the cost low, could represent a solution. Investing in a solar energy model for all means, in the long term, also investing in the well-being and self-sufficiency of citizens.




**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 8: PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL.**
The energy transition, however necessary, represents a major factor of destabilization for the current economy, especially for those sectors linked to fossil fuels. If the economy to continue to grow is wanted, but also for the energy transition to be implemented, we need to promote a sustainable development model. Investing in solar energy would mean both strengthening an already strong market that provides thousands of jobs, and ensuring the country has a far-sighted proposal for sustainable economic development.




**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 10: REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES.**
The energy transition is intrinsically linked to the concepts of energy justice and social justice. Access to energy, its prices and the possibility of being more or less energy independent are all social issues. The risk of an energy transition that does not take into account the reduction of inequalities inevitably risks leaving the most marginalized and poor classes as such. Economic and residential solutions for energy storage and production can represent a form of economic emancipation for the less well-off classes.




**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 11: MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE.**
Rethinking how renewable energy, like solar, is produced, stored and consumed could be a truly great opportunity to make our cities and the communities that live there more resilient to an energy future that is currently uncertain.




**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 12: ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERN.**
Two of the central components of the energy cycle are consumption and production. As for sustainable production, as already mentioned before, using sustainable technologies is essential but this alone is not enough. Sustainable energy consumption is based on the concepts of equity, reuse and distribution. Energy consumption tailored to people's consumption patterns is needed so that everyone can enjoy what they need. What is produced in excess in terms of energy could for example be redistributed and put back into circulation in order to minimize waste.




**U.N.'S SUSTAINABLE DEVELOPMENT GOAL 13: TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS.**
Finally, to summarize all that has been said, in a context of climate crisis, the way in which energy is not only produced but also consumed, distributed and stored represents a significant component of the actions needed to respond to the crisis. There can be no plan to combat climate change that does not take into account the energy component and such action must, now, be immediate. Developing new technologies or innovating the way in which we relate to energy can represent a turning point.

(Sustainable Development Goals, United Nations, n.d.)

# 5.5 Vision Map

The vision map presents the overall goal for the U16: creating a decentralized and equitable energy region. This future scenario is organized around four energy systems: energy production, storage, distribution, and consumption. These are spatially integrated across diverse communities.

Regarding energy production, existing solar parks and wind farms serve as main contributors to the regional grid, supplying energy to all communities. Additional renewable production is introduced in areas with high solar or wind potential. At the same time, every community becomes a prosumer, producing its own energy through renewable energy systems.

Energy storage is adapted to the needs and capacities of different communities.

-Industries utilize large-scale battery systems.

-Low-income communities are supported by collective storage placed strategically across their neighborhoods.

-High-income households rely primarily on individual home batteries.

-Solar panel owners use either home or collective storage, depending on spatial and social context.

For energy distribution, a circular system is envisioned.

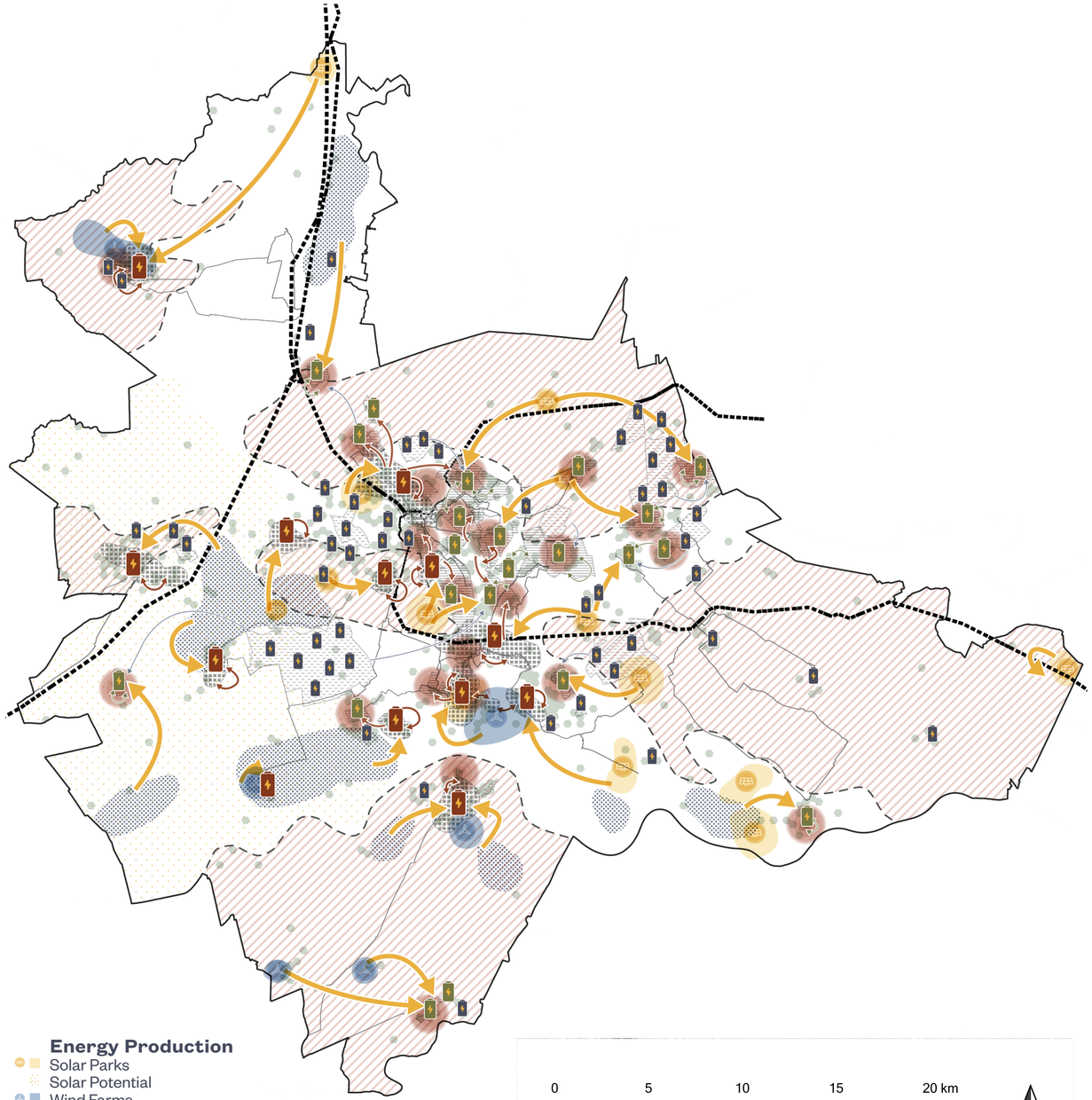
-Industries consume from their storage but also distribute surplus to low-income renters.

-Low-income renters access energy through their collective storage systems, which are managed through cooperatives. They can also feed energy back into the system.

-High-income users and solar panel owners function mainly as independent prosumers but retain the option to share surplus with low-income renters.

A key principle of the vision is distributing excess energy to support the most vulnerable communities, particularly low-income renters. Through this model, industries, high-income users, and early solar adopters are positioned as energy prosumers and contributors to a more just and balanced energy region.

Together, these production, storage, distribution, and consumption systems form the foundation of a decentralized energy region.



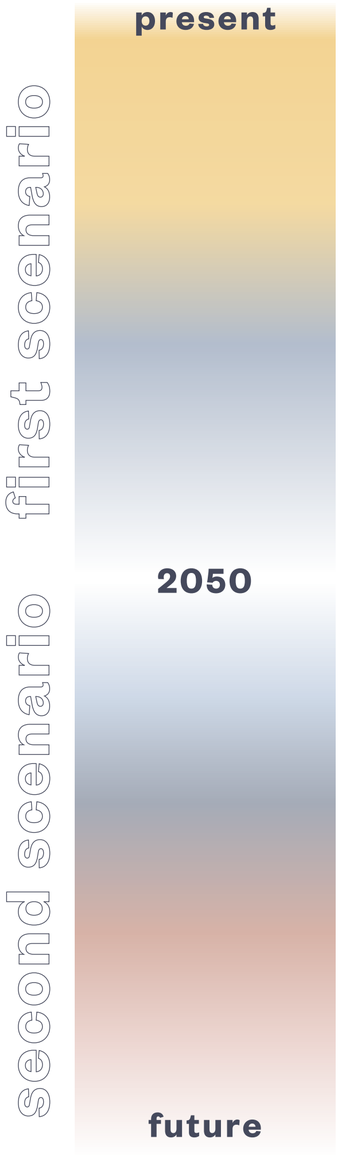
# STRATEGY

## 6.1 Program

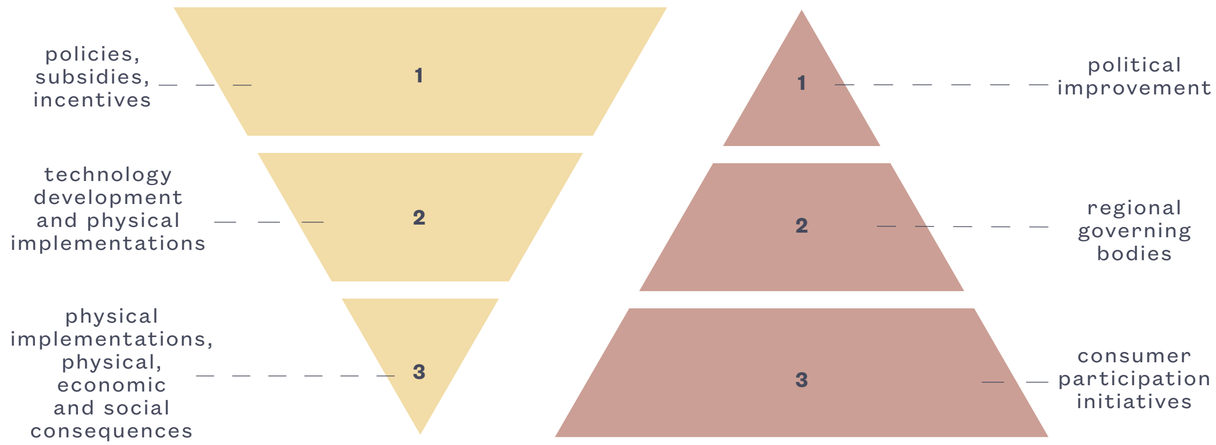
**VISION**
The vision includes a residential implementation of new energy production and storage technologies. This energy is then redistributed in a circulation system that connects all local actors. In this circulation system there are various energy storage systems - residential, medium or large municipalities and electric cars - from which the various communities can draw or pay according to their capabilities, also receiving money for the excess produced.

**APPROACH**
In the strategy a top-down and a bottom-up approach were combined in order to balance a certain degree of central government decision-making with a healthy dose of flexibility based on citizen feedback. In addition to the specific strategies that will be better explained later, in essence the project involves starting with a package of incentives, funding and government policies. This mostly cash flow serves to implement the new energy storage technologies needed for a sustainable future and to allow more regional administrative bodies to apply these technologies on site. At the same time, these incentives also serve to lower the prices of technologies already on the market so that they spread among the population and local industries. These solutions naturally have social, physical and economic implications and consequences on the population.
Through participation initiatives - mostly community energy initiatives - citizen feedback can then reach the regional government bodies for energy - similar to those already in place for water - and then bring changes and improvements upwards.

**SCENARIOS**
The strategy is divided into two scenarios. One starts from the present and goes up to 2050 - the year in which the EU sets energy neutrality as a goal - and the second starts after 2050. The first scenario is the best defined and realistic one, in which we use already tested technologies that only need to be spread or improved. The second scenario is the one in which more experimentation with the possibilities that energy storage and its subsequent distribution can provide us, was allowed. Each scenario is marked by specific milestones but this will be further explained in the Projection cheaper.




1. Central governance-level stakeholders
2. Regional level-stakeholders and big industries/producers
3. Small scale stakeholders (mostly citizens)



# 6.2 Fundamentals of New Technologies

## 2050 Scenario

**SODIUM-ION BATTERIES.**
Battery technology is rapidly evolving, with new and promising technologies always on the horizon that could increase battery density, safety and longevity while decreasing costs and the use of rare earth elements. While many of the new battery technologies being developed never progress beyond the laboratory, there are some promising developments which could revolutionize the battery landscape.
Currently, commercially available batteries use lithium to store electricity. These batteries are widely used because of their long life cycle, high energy density and low rate of self-discharge (Fu et al., 2025). There are technical and social issues with this technology. Battery production is constrained by lithium supply, and shortages are expected as global battery production grows. Lithium reserves are unevenly distributed worldwide and extraction requires large amounts of water (Vera et al., 2023). Recycling lithium-based batteries is so difficult that it is currently often cheaper to mine for new materials (Hirschlag, 2022). That is why researchers and companies are trying to find different materials that could replace lithium in the cathode.
A well-researched, promising technology of which the first generations are already commercially available is sodium-ion batteries. The material is much more abundant than lithium and is more evenly distributed over Earth, as it is stored as salt on land and in oceans. (Fu et al., 2025). There are many advantages to sodium-ion batteries. They have excellent thermal stability, making them very safe. Also, they have better charge-discharge performance which means that they can be charged up to 100%, and down to 0% without damaging the battery as much (L. Zhang et al., 2025). While the current lifecycle is shorter than that of lithium-ion batteries, development is ongoing and there are many proposed methods to design batteries with very long cycle life (H. Wang et al., 2024; Zheng et al., 2024). The main limitation of sodium-ion batteries compared to lithium-ion is their lower energy density. This is due to the chemical aspect of $Na^+$ ions which are larger than $Li^+$ ions. This makes sodium batteries a viable alternative for applications where energy density is not the main concern, like stationary energy storage (Lei et al., 2024). Energy density is expected to increase in the future. Current models have an energy density of 250Wh/L (Q. Wang et al., 2019), but researchers are actively developing technologies to double battery density (Garayt et al., 2024).

**ALUMINUM BATTERIES.**
Another potential alternative to lithium batteries is using aluminum batteries. This technology is not as proven as sodium-ion, and there are many hurdles to overcome, but it does have potential. Just like sodium-ion, aluminum is significantly more abundant, and cheaper than lithium. Only recently, researchers in China created a new design in which aluminum fluoride salt with a 3D structure was added to the battery, creating a solid-state electrolyte. Additionally, they applied a special coating to the electrodes which prevent the formation of aluminum crystals that degrade battery health (Guo et al., 2025). In testing, the battery displayed a very long life of over 10.000 cycles, without losing significant capacity. Recycling this type of battery is also much easier than with lithium (American Chemical Society, 2025).
For the energy transition it is important that alternatives to lithium-ion batteries can be commercialized. Using less critical materials, while being easier to recycle and with a longer lifetime will make grid-scale energy storage more feasible, economical and sustainable.

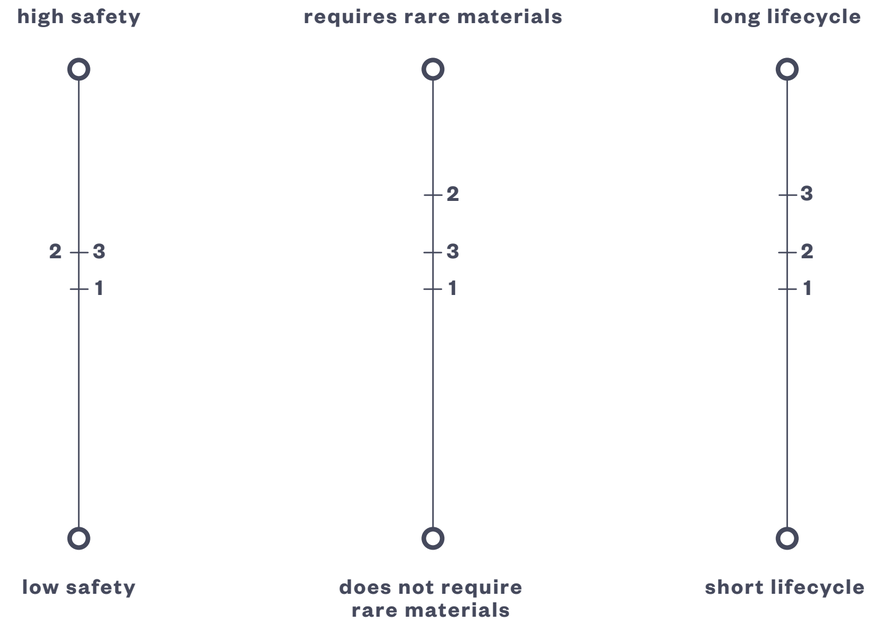
## Post 2050 Scenario

**HYDROGEN-ION STORAGE.**
For long term energy storage, we might have to apply different methods than using batteries. One method that appears to have potential is hydrogen storage, Hydrogen is created using an electrolyzer, which can separate water ($H_2O$) molecules into oxygen ($O_2$) and hydrogen ($H_2$). Afterwards the hydrogen gets compressed and stored under high pressure. When the power is needed again, a fuel cell can generate electricity using hydrogen as fuel (Park et al., 2025). Hydrogen storage is a proven technology that has found several applications like powering cars, and industrial processes. There are drawbacks to hydrogen that make batteries more suitable for short term storage. Most important, the round-trip efficiency of hydrogen storage is around 30% (Aneke & Wang, 2016), while round-trip efficiency with battery energy is around 90% (Peter et al., 2022). There are also safety concerns with hydrogen storage. The element is highly flammable and is ignited much easier than other flammable fuels (Jang et al., 2022). The cost-competitiveness of hydrogen is also weak against batteries.
Nevertheless, hydrogen is still widely considered an option for long-term storage. One benefit over batteries is that hydrogen does not slowly lose energy over time. Batteries slowly discharge over time which makes them unsuitable to generate and store electricity in the summer and use it in the winter.
The technology is proven and has already found real-life applications. But if we want to store it long term, major developments in storage techniques are required. A widely researched storage method is storing hydrogen underground in depleted gas fields, salt caverns and aquifers. For the Netherlands, the empty gas field in Groningen could potentially be used.

**INTERNATIONAL SOLAR FIELDS AND TRANSMISSION NETWORK.**
A second future strategy for year-long renewable energy is generating electricity is places where solar production is viable year-round and transporting it over large distances to where it is consumed. For this large intercontinental transmission networks will have to be built. This would allow large solar fields in locations like the Sahara Desert to be installed and assist in powering the continent of Europe during winter months. For this strategy to be viable, many risks and challenges must be overcome, like high transmission losses, high investments needed and different laws and regulations in all the countries participating (Brinkerink et al., 2019).



*this representations are merely graphical and do not have a specific scale of measurement.




1. Lithium-ion batteries*
2. Sodium-ion batteries*
3. Aluminium-ion*

# 6.3 Policies, Politics, Subsidies

## 2050 Scenario

### POLICIES

**Investments for New Technologies.** Investments for new-born or underdeveloped solar production and storing technologies.

**Feed-in Tariffs (FiTs).** Guarantee long-term payments for surplus electricity fed into the grid at above-market rates. People can give back their energy in excess for money.

**Solar Mandates.** Require new buildings, especially in sunny regions, to include solar panels and solar windows.

**Batteries Mandates.** Require new communal housing to include communal batteries.

**Electric Vehicles Mandates.** Require all new cars to be electric.

**Energy Neutral Building Mandates.** Require new buildings or renewed buildings to be energy neutral by 2050 by using solar energy producing and storing solutions.

**Streamlining Permits.** Simplify regulations and approvals for installing solar systems to lower bureaucratic barriers.

**Grid Decentralization.** Encourage microgrids and peer-to-peer energy trading, reducing reliance on central utilities.

**Research and Investments on Promising Technologies.** Development, design and implementation of promising technologies such as sodium-ion and aluminium-ion batteries.

### SUBSIDIES

**Low-Interest Loans or Grants for Solar Panels and batteries.** Provide affordable financing for individuals and businesses to invest in solar energy.

**Zero VAT on Solar Equipment.** Reduce or eliminate sales taxes on new solar production and storing technologies.

**Community Solar Programs.** Specific subsidies for home-owners corporations to invest in communal new solar production and storing technologies.

**Dynamic Energy Contracts**. Specific energy contracts for the industries that incentives the energy usage when the storage in the grid is higher. This way the consumption of the big birds can compensate the one of the other communities and avoid grid congestion.

### POLITICAL STRATEGIES

**Public Awareness Campaigns.** Educate citizens on cost savings and benefits of solar energy independence.

**Energy Independence Messaging.** Frame solar policies as a way to reduce dependence on foreign energy sources.

**Support for Residential Solar Manufacturing.** Reduce reliance on foreign supply chains and lower costs through local production.

**Community Energy Initiatives.** CEIs are local, community-led projects that focus on the generation, distribution, or management of energy to promote sustainability, energy independence, and social benefits. These initiatives often involve residents, businesses, and local governments working together to develop renewable energy solutions.

**Energieschap.** Energieschappen will regional energy authorities in the Netherlands responsible for energy management. They are similar to the existing ones in charge of water management, but in this case they will be implemented at a municipal level for the moment.

## Post 2050 scenario

### POLICIES

**Investments on Future Technologies.** Investments for future technologies such as hydrogen-based batteries.

### SUBSIDIES

**Low-Interest Loans or Grants for New Technologies.** Provide affordable financing for individuals and businesses to invest in solar energy.

**Zero VAT on New Technologies.** Reduce or eliminate sales taxes on new solar production and storing technologies.

**Community Solar Programs.** Specific subsidies for home-owners corporations to invest in communal new storing technologies.

### POLITICAL STRATEGIES

**Strategic Deals.** Develop international agreements on intercontinental transmission network.



# 6.4 Physical Strategies

## 2050 Scenario

### ENERGY STORAGE SYSTEMS

**Home Batteries.** The market for residential batteries is still underdeveloped, but thanks to the various incentives proposed, they could become cheaper and enter citizens' homes. This solution is designed for high-income birds especially who could store the energy produced directly in this residential battery and then reuse it. This solution could also be applied to early-birds, probably with smaller batteries.

**Communal Batteries.** For low-income birds, who mostly live in condos and have less money, a more community-oriented proposal is needed. The municipality could install neighbourhood-wide shared batteries where people living in condos could store the energy they produce. Even early birds who can not afford a home battery could benefit.

**Electric Vehicles.** Electric vehicles are becoming more and more common and can be another solution to store some of the energy produced.

### ENERGY PRODUCTION SYSTEMS

**Solar Panels.** Solar panels are a great sustainable technology for the production of the future and their use has been growing for years. For low-income birds, a community solution is always preferable, that is, shared solar panels for the entire condominium where they live. In this way, low-income birds can start their process of energy independence. For other communities, an increase in solar panels in use based on the available roof space is expected.

**Small Solar Panels.** The market for miniature solar panels is still small but growing. Especially for low-income birds, it is an economical solution to produce more energy. These panels are usually placed on balconies.

**Solar Windows.** This technology is also still underdeveloped but very promising. Especially for the construction of new buildings, the choice to install this type of windows would be decidedly far-sighted. Thanks to various regulations and incentives, we are aiming for a future where all windows are also energy producers.

### ENERGY DISTRIBUTION SYSTEMS

**New Local Micro Grid.** A system of free circulation of energy where anyone can sell the energy produced in excess and this can be used by those who need it, is envisioned. In addition to aiming to be self-sufficient, communities can also sell the excess energy and make money from it, in a win-win system where those who have more give to those who need it. This system would especially benefit citizens who could gain an additional source of income. Since, in the immediate future, this system would not be sustainable for the current grid, we plan to extend it with new above-ground components.

## Post 2050 scenario

### ENERGY STORAGE SYSTEMS

**New Hydrogen Storage.** The next step in terms of storage is represented by hydrogen storage facilities, much bigger but also more efficient.

### ENERGY PRODUCTION SYSTEMS

**Solar Farms Abroad.** Linked to the idea of an intercontinental grid, building solar farms in other locations where the sun shines throughout the year - like deserts - will be needed.

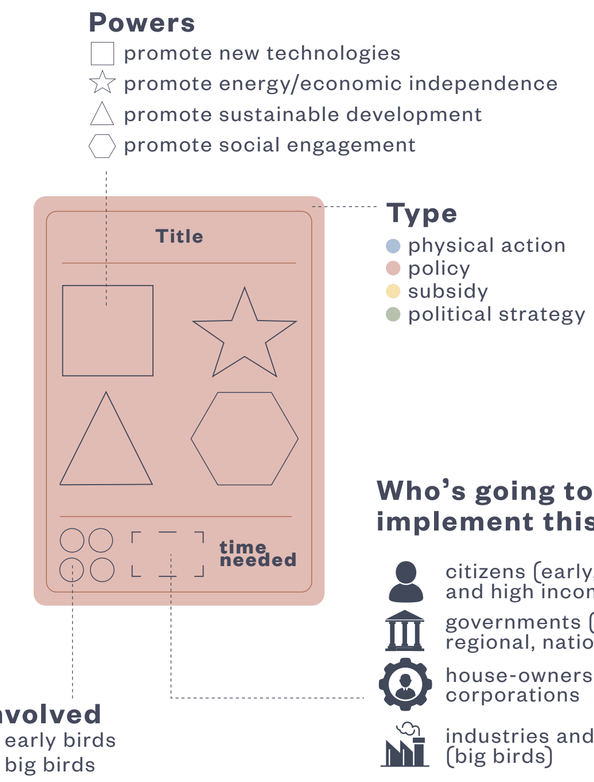
### ENERGY DISTRIBUTION SYSTEMS

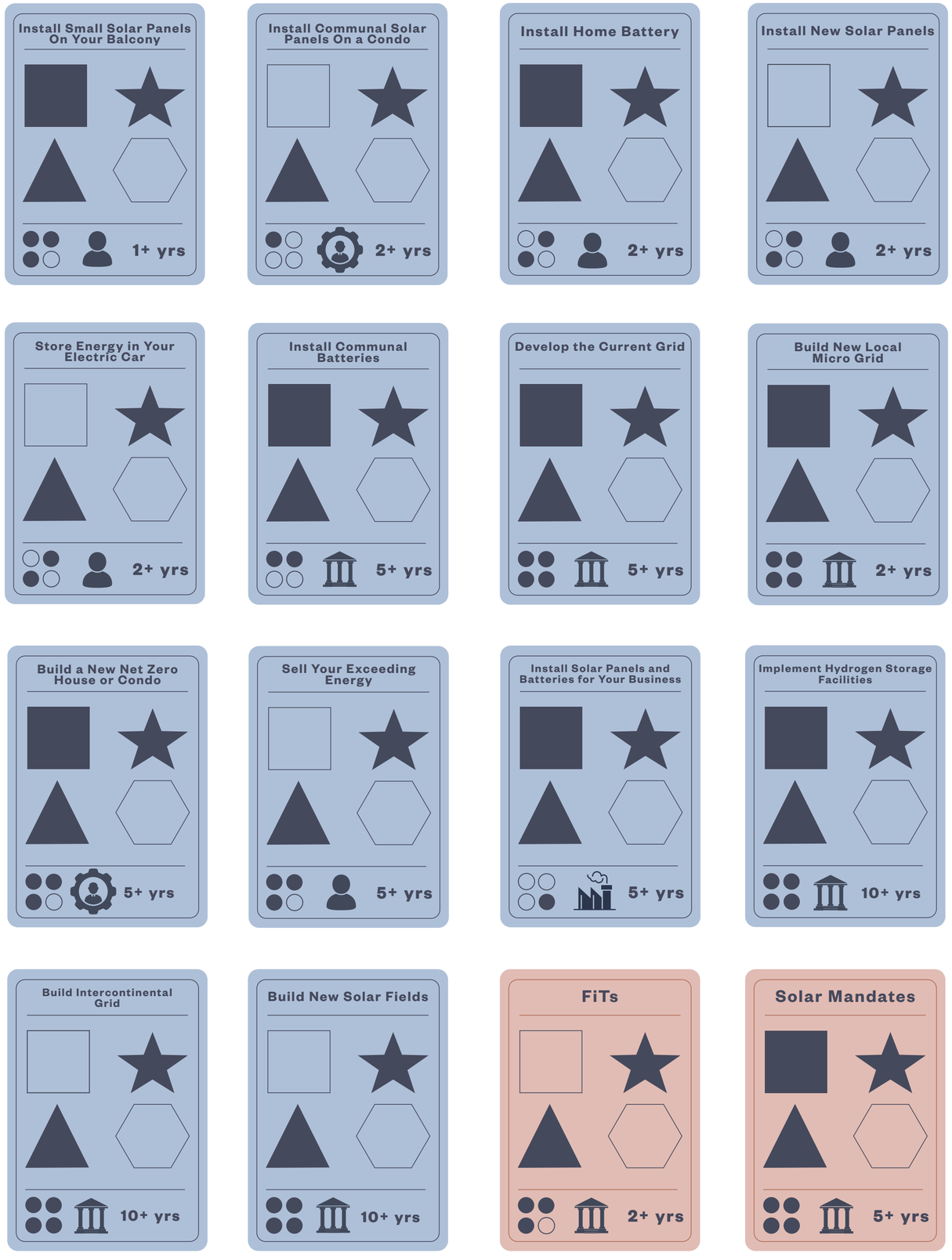
**Current Grid Major Development.** To adapt to the new needs, the current grid will need to go under major developments while the new local micro grid previously mentioned will help to distribute the energy.

**International grid.** An intercontinental grid, similar to the international we already have, that provides the country renewable energy all the year.

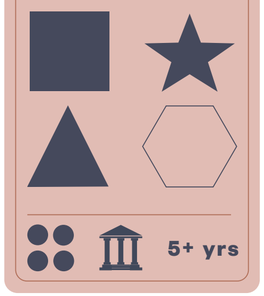
# 6.5 Actions Cards

An urban design plan often includes a complicated interrelation of physical actions, policies and subsidies. To facilitate understanding, a series of action cards have been created. As in a strategic game there are different actors with different goals and capabilities. Unlike a board game, however, here the victory of one player does not exclude that of the others. On the contrary, there is a common goal that can only be achieved by collaborating: the energy transition.



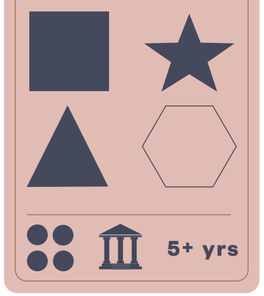



**Batteries Mandates**



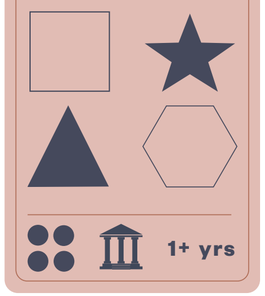
5+ yrs

**Energy Neutral Buildings Mandates**



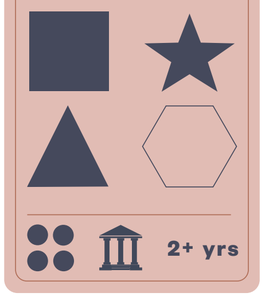
5+ yrs

**Streamlining Permits**



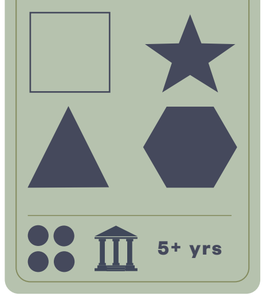
1+ yrs

**Investments For New Technologies**



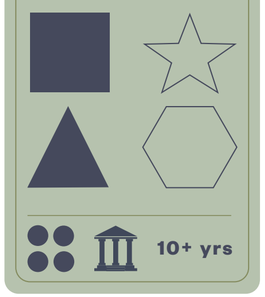
2+ yrs

**Energieschap**



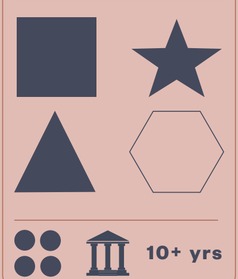
5+ yrs

**Strategic Deals**



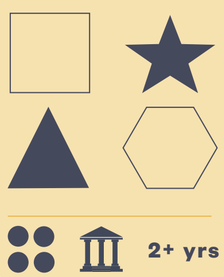
10+ yrs

**Investments For Future Technologies**



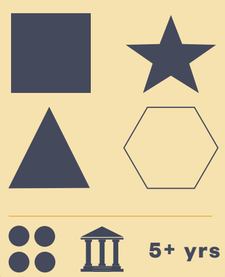
10+ yrs

**Low-Interest Loans for Solar Panels and Batteries**



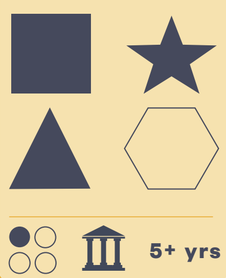
2+ yrs

**Zero VAT on Solar Equipments**



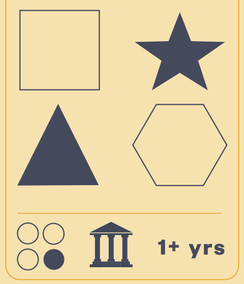
5+ yrs

**Community Solar Programs**



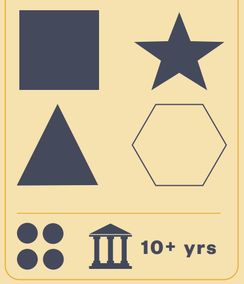
5+ yrs

**Dynamic Energy Contracts**



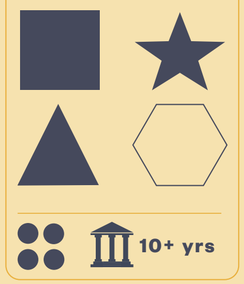
1+ yrs

**Low-Interest Loans for New Technologies**



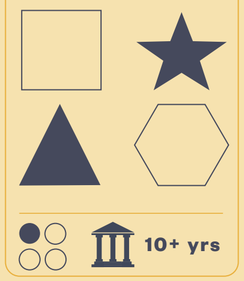
10+ yrs

**Zero VAT On New Technologies**



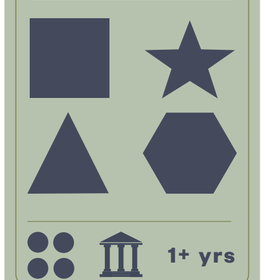
10+ yrs

**Community Solar Programs**



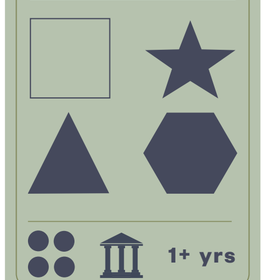
10+ yrs

**Public Awareness Campaigns**



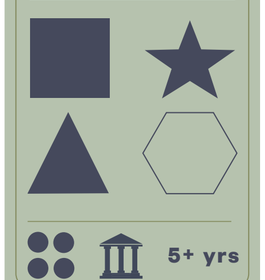
1+ yrs

**Energy Independence Messaging**



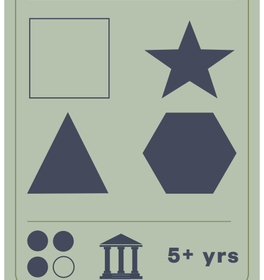
1+ yrs

**Support for Residential Solar Manufacturing**



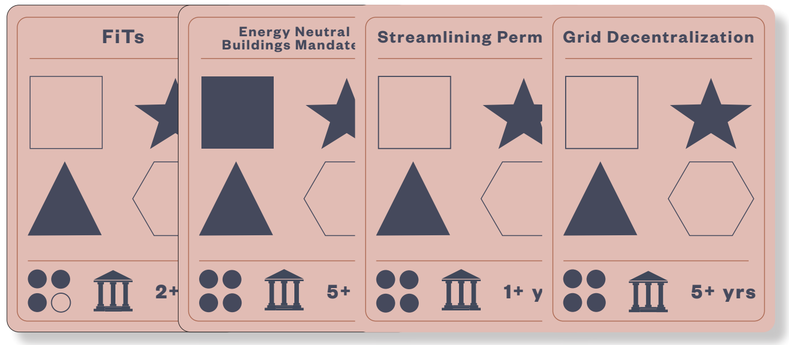
5+ yrs

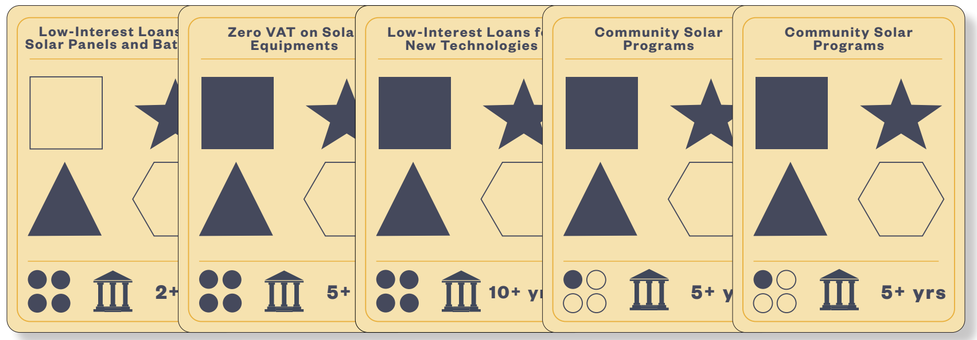
**Community Energy Initiatives (CEIs)**

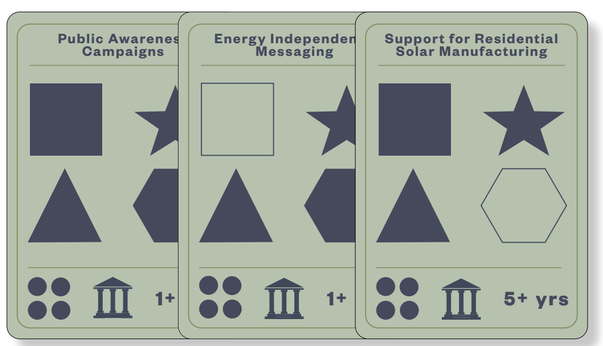


5+ yrs

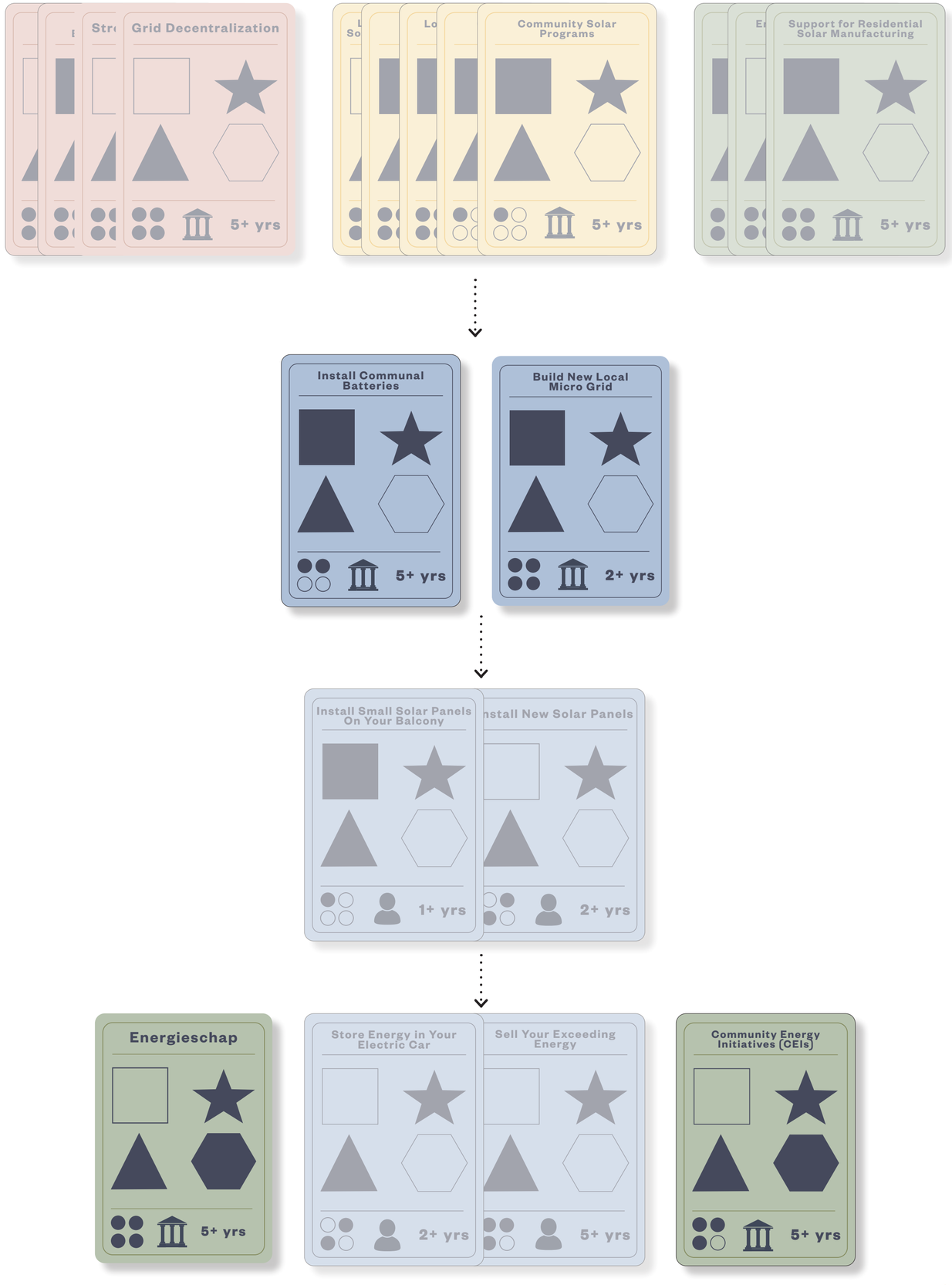
## Governance



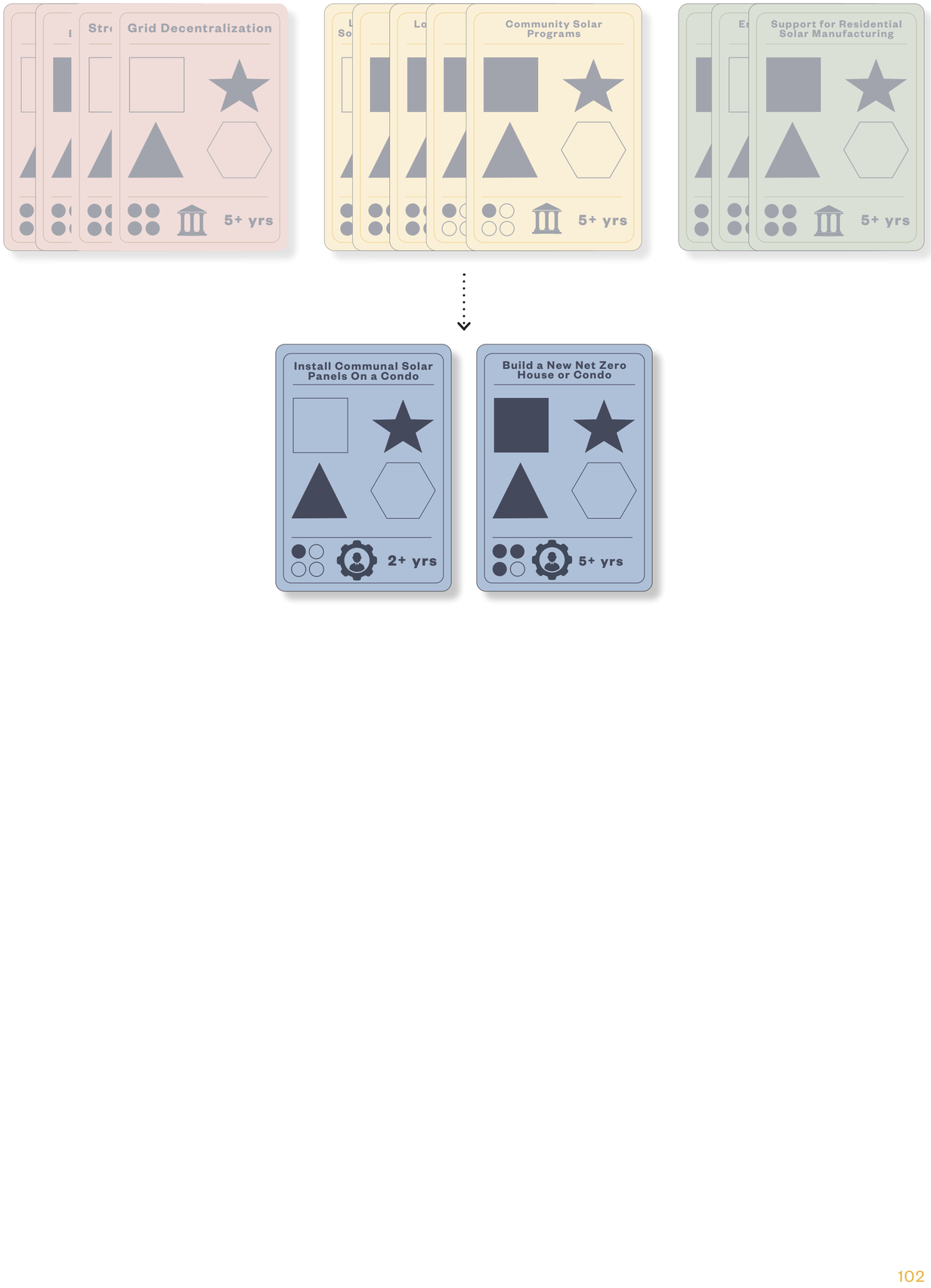



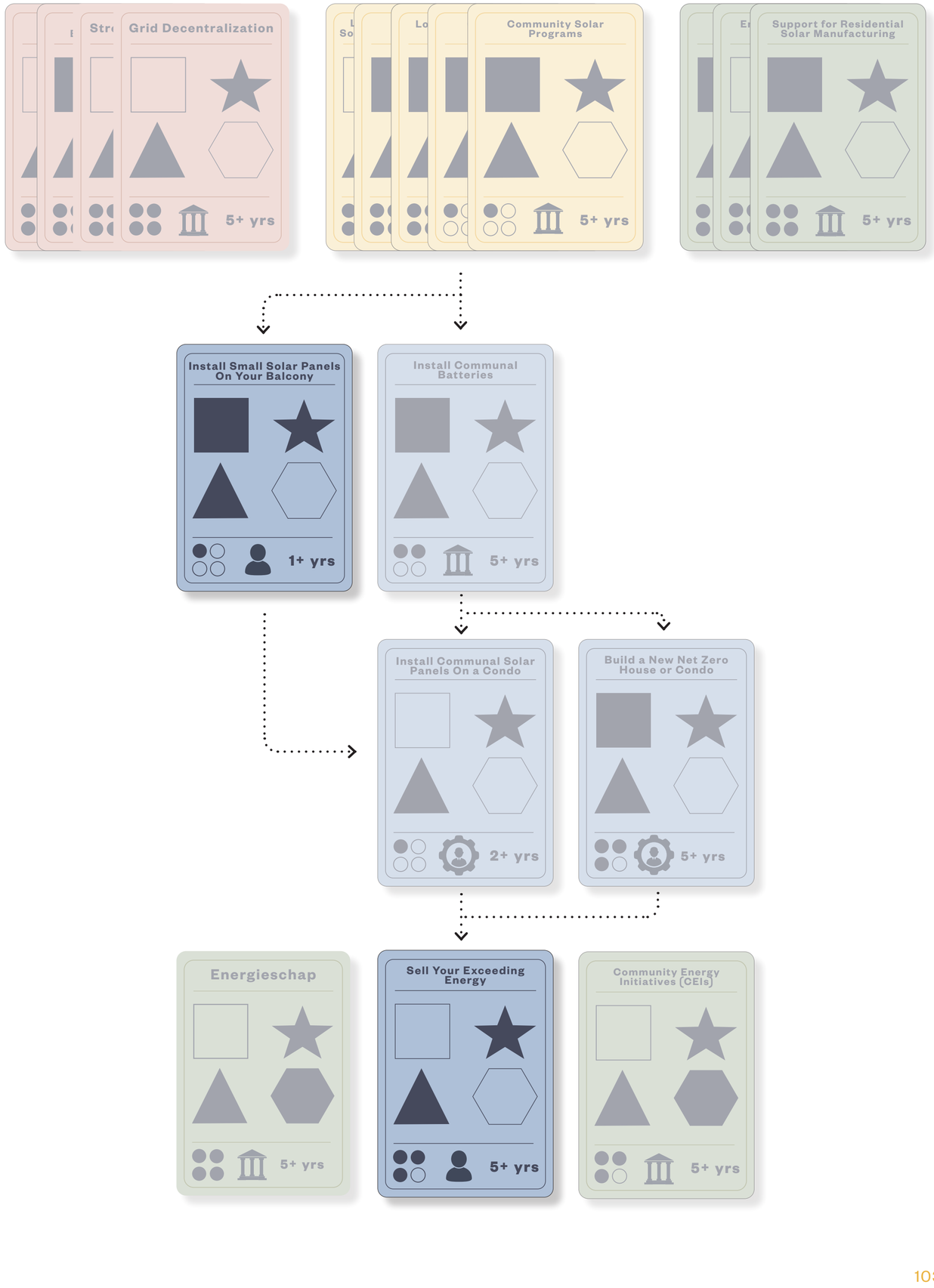

## Municipality (2050 scenario)



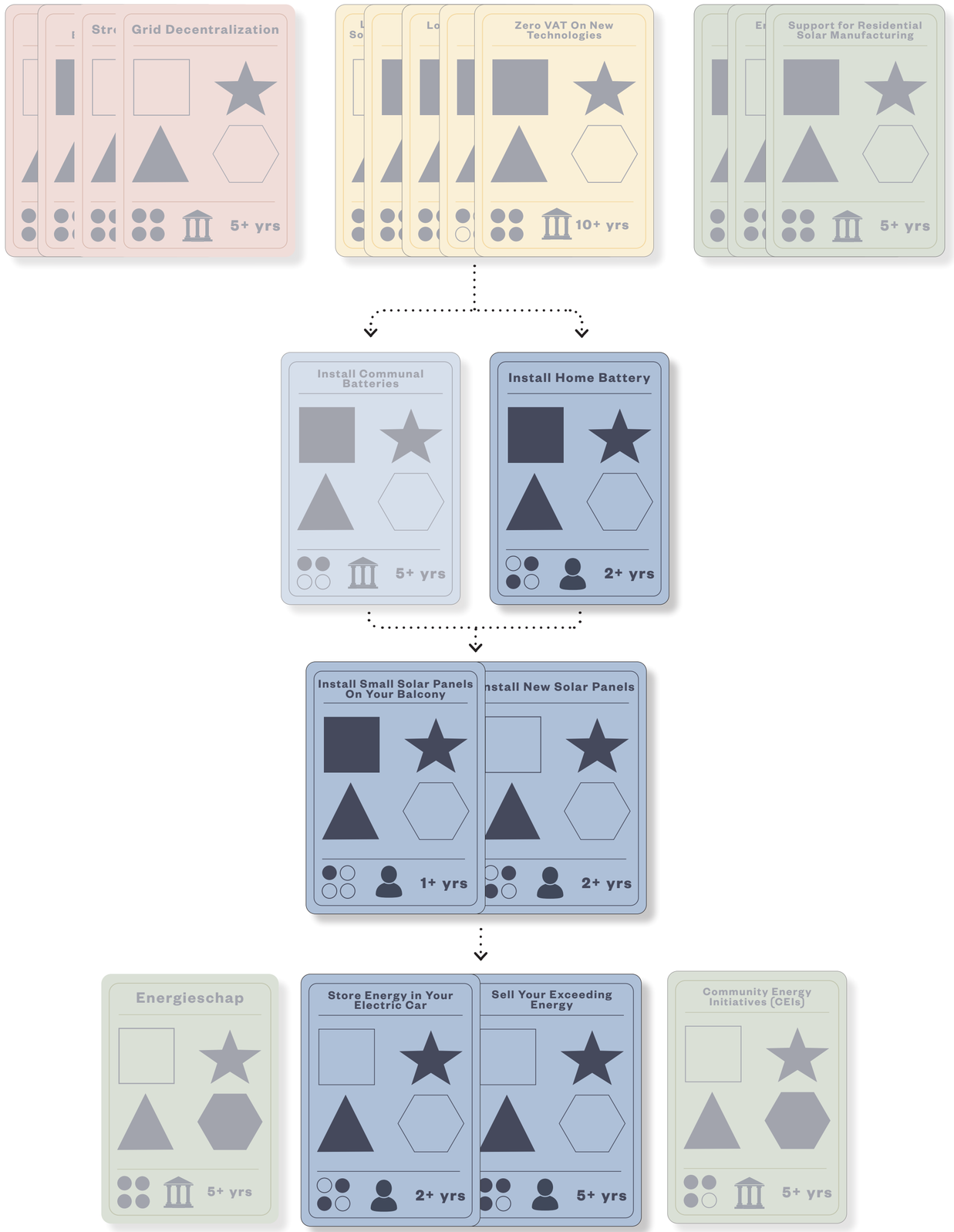
## Home-Owners Corporations (2050 scenario)




## Low-Income Birds (2050 scenario)



## Early Birds (2050 scenario)

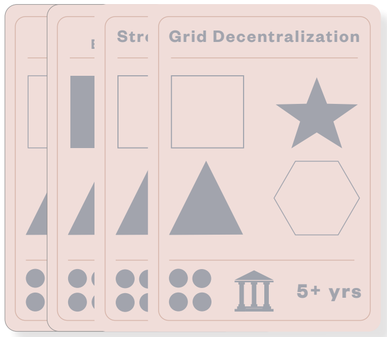


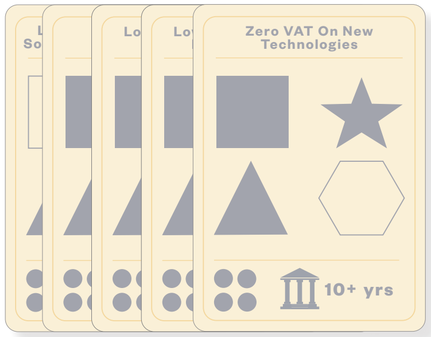


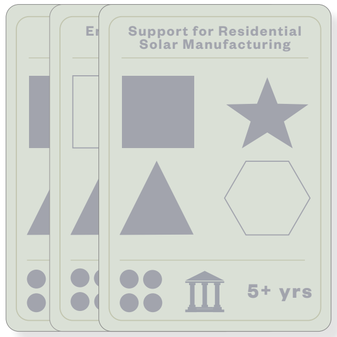

## High-Income Birds (2050 scenario)



## Big Birds (2050 scenario)

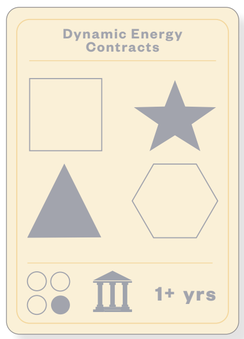


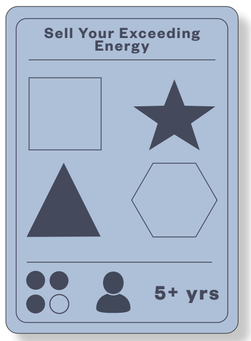



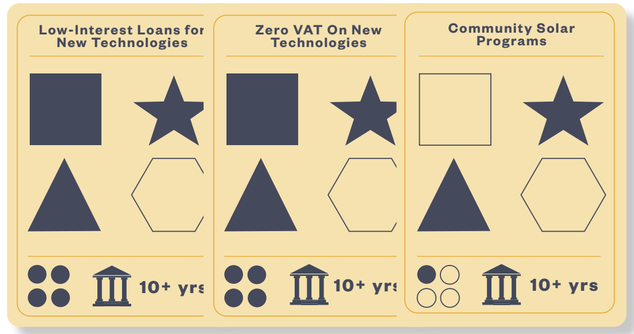


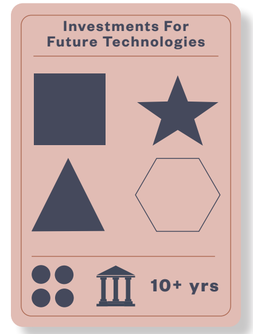


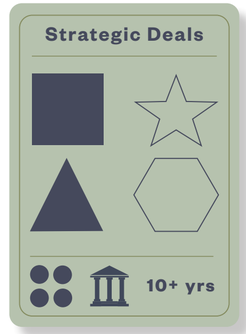


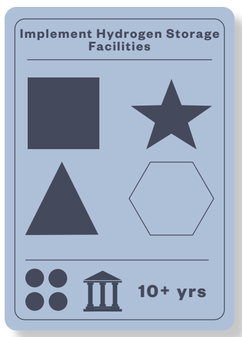



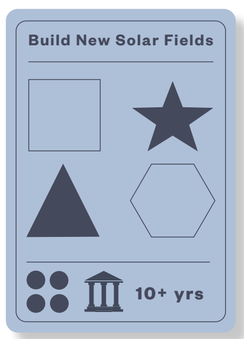

## 2050+ scenario

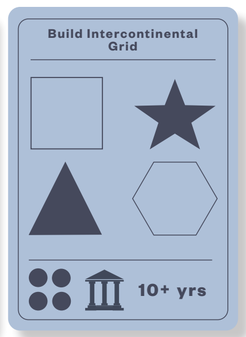


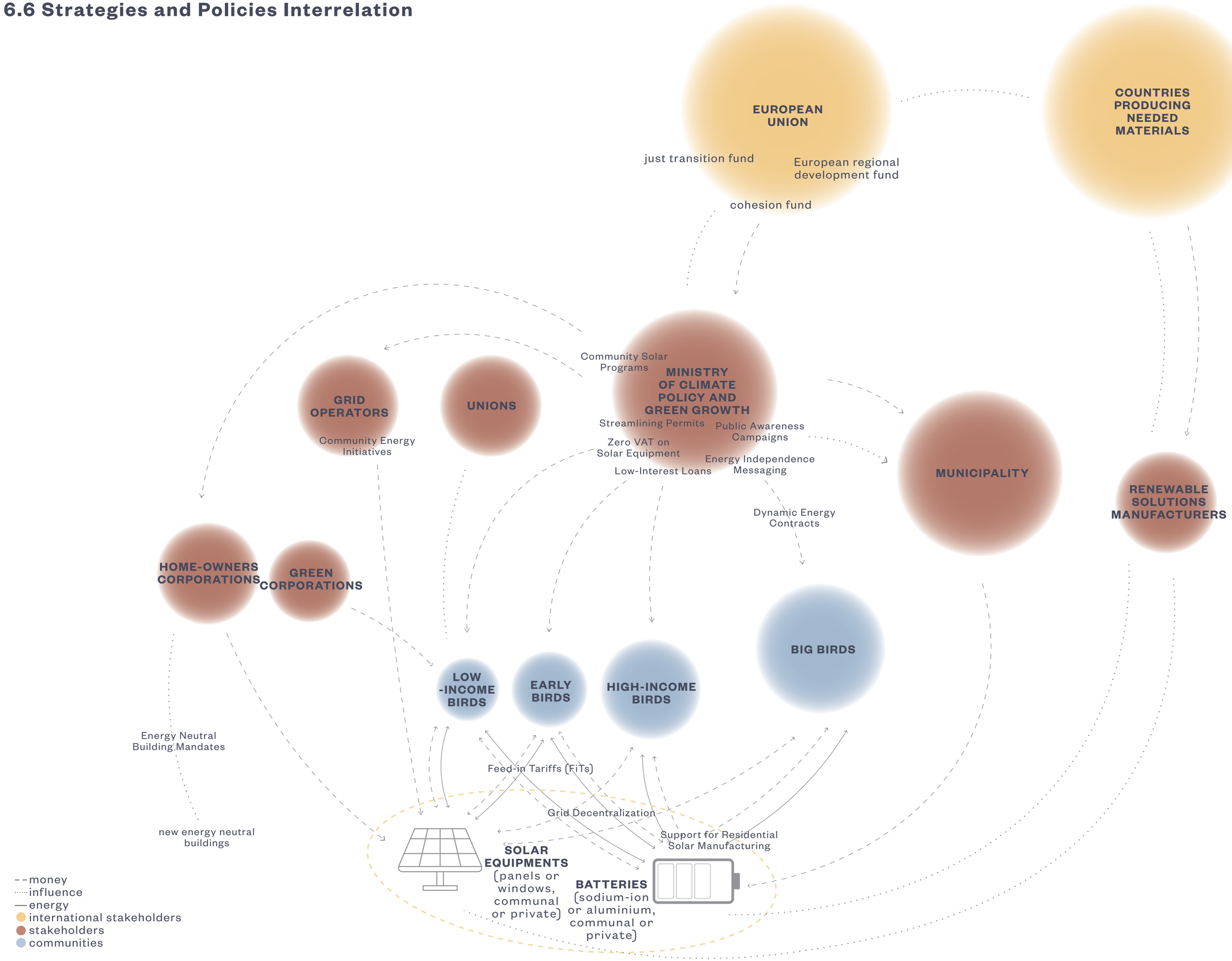



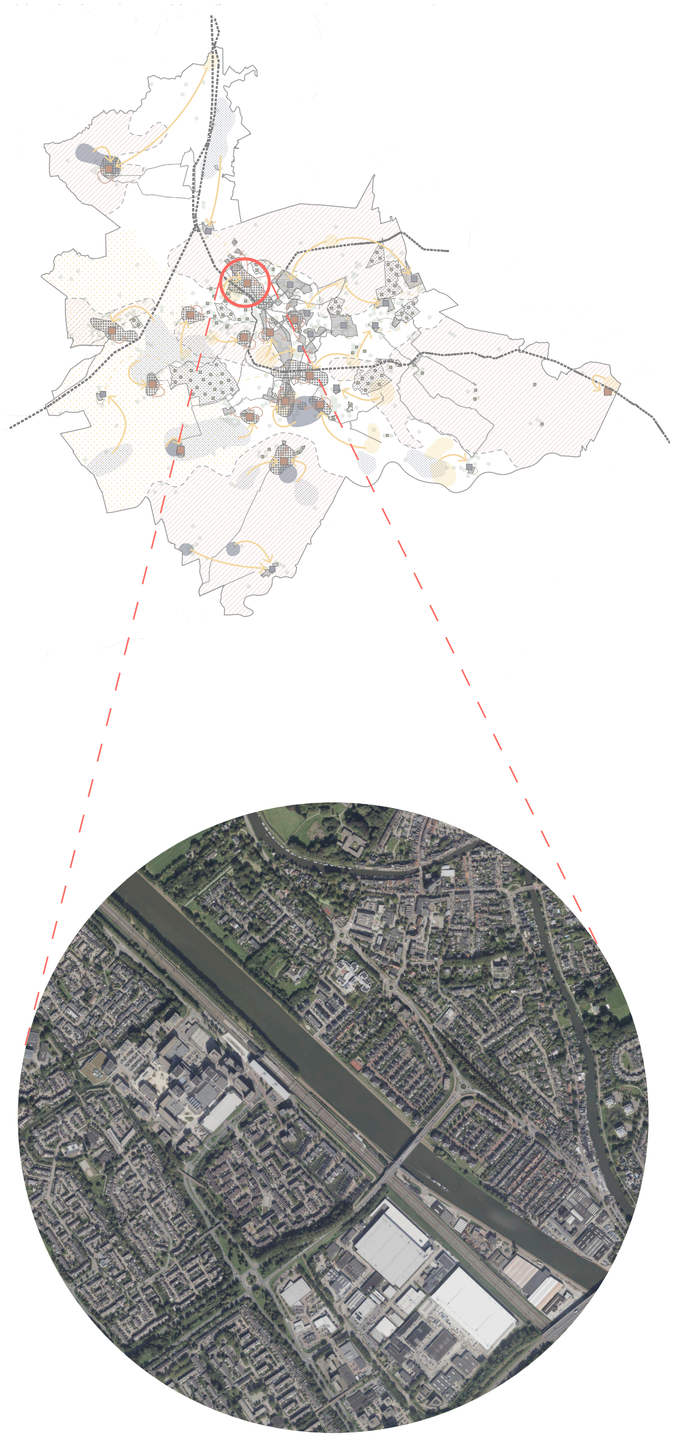



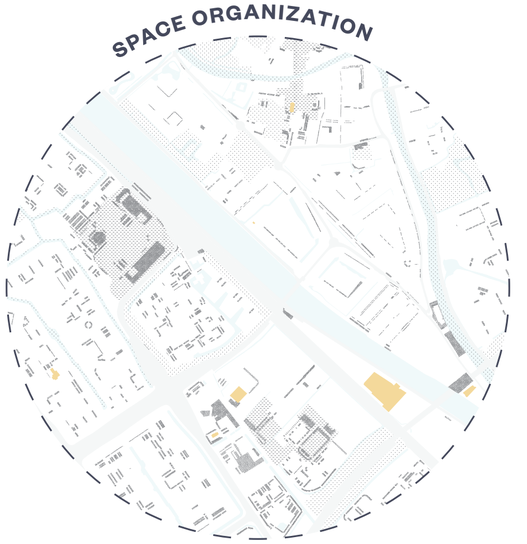
# 6.6 Strategies and Policies Interrelation



# 6.7 Pilot Area

To ensure that the energy strategy aligns with the needs of the communities in the focus area, demographic and socio-spatial data were collected and analyzed using sources such as CBS (Statistics Netherlands) and AlleCijfers. These insights were integrated into the spatial logic of the proposal and infrastructure placement.











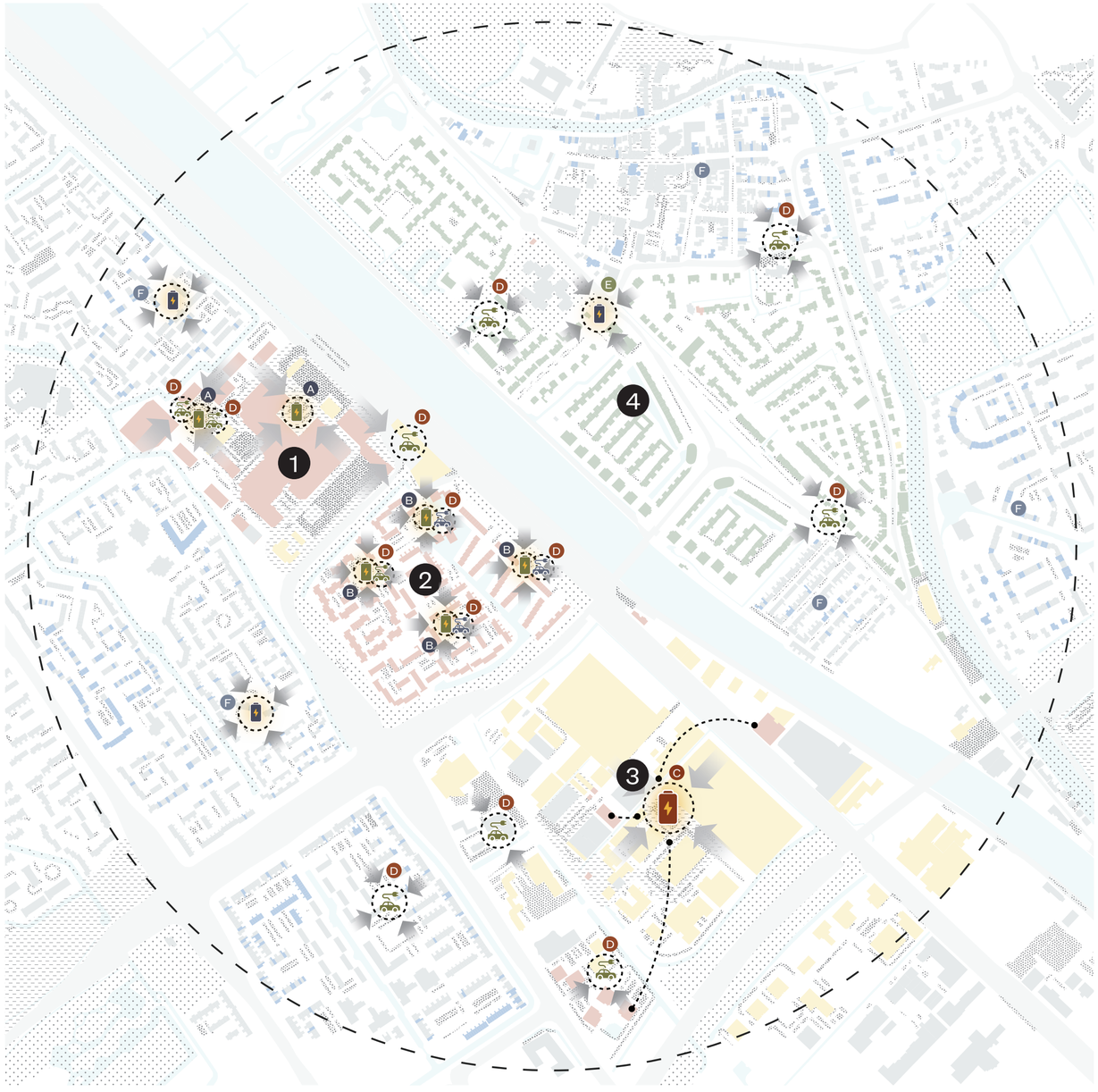




**Energy Consumption**
- Early Birds
- Low-Income Birds
- High-Income Bids
- Big Birds

**Land Use**
- Water
- Road
- Public Space
- Semi-Private Space
- Parking Space
- Social Functions
- Residential Area
- Park and Public Garden
- Other Agriculture
- Sports Area
- Business Premises
- Cemetery
- Construction Site
- Retail and Catering
- Socio-Cultural Facilities
- Construction Site

**Energy Infrastructure**
- Stedin High Voltage Line
- Stedin Medium Voltage Line
- Stedin Low Voltage Line




In the Bisonspoor neighbourhood, data revealed a relatively high percentage of low-income households, a significant elderly population, and a mix of residential, commercial, and office functions. As a result, the proposed collective storage was placed in central, highly visible locations - specifically within existing public parking lots. These sites were selected for their accessibility to elderly residents and are re-imagined as multifunctional civic spaces that combine energy storage, EV charging infrastructure, and Vehicle-to-Grid (V2G) capability.
In Antilopespoor, the social context is characterized by low income and low education percentage, along with a lack of community functions and public gathering spaces. Here, multiple small-scale collective storage hubs are distributed across the neighbourhood, embedded into everyday public areas such as parking spaces. These spaces are designed not only to deliver energy access but to serve as social and educational hubs, encouraging interaction, participation, and energy awareness.
In Industrieterrein Maarssenbroek, the area is dominated by industrial buildings, with some nearby low-income residential units. A large-scale storage facility is proposed at an open parking space of the industrial area, intended as a shared infrastructure between industrial producers and nearby renter communities. This storage site is also a potential location for renewable energy production (solar) and a public mobility hub, integrating EV charging and V2G.
This map reflects a strategy that prioritizes accessibility, visibility, and equity: integrating energy infrastructure directly into each neighbourhood's social fabric.

## Pilot Area - Social Contextualization

**Low-Income Renters**
1. Bionspoor Neighbourhood (low income average, high elderly population, mixed functions)
2. Antilopespoor Neighbourhood (low income average, high low education, no community functions)

**Large Industries**
3. Industrieterrein Maarssenbroek Neighbourhood (mostly industries)

**High-Income Homeowners**
4. Maarssen Neighborhood (high income average)

**Energy Storage**
- Large Industrial Storage
- Collective/Communal Storage
- Home Storage
- EV Charging and V2G Stations (Existing)
- EV Charging and V2G Stations (New)

**Collective Storage as Public Space**
A. Centrally located for accessibility and visibility
Located at existing semi-public parking
Proposed to be integrated with public space for the community

**Collective Storage as Social Space**
B. Located across neighbuorhood in parking spaces
Proposed to be a multi-functional storage space
Aimed to be social and educational

**Large Scale Storage Partnership Located nearby industries**
C. Proposed to be intergrated with energy production and EV charging
Aimed to be a partnership between industries and low-income renters

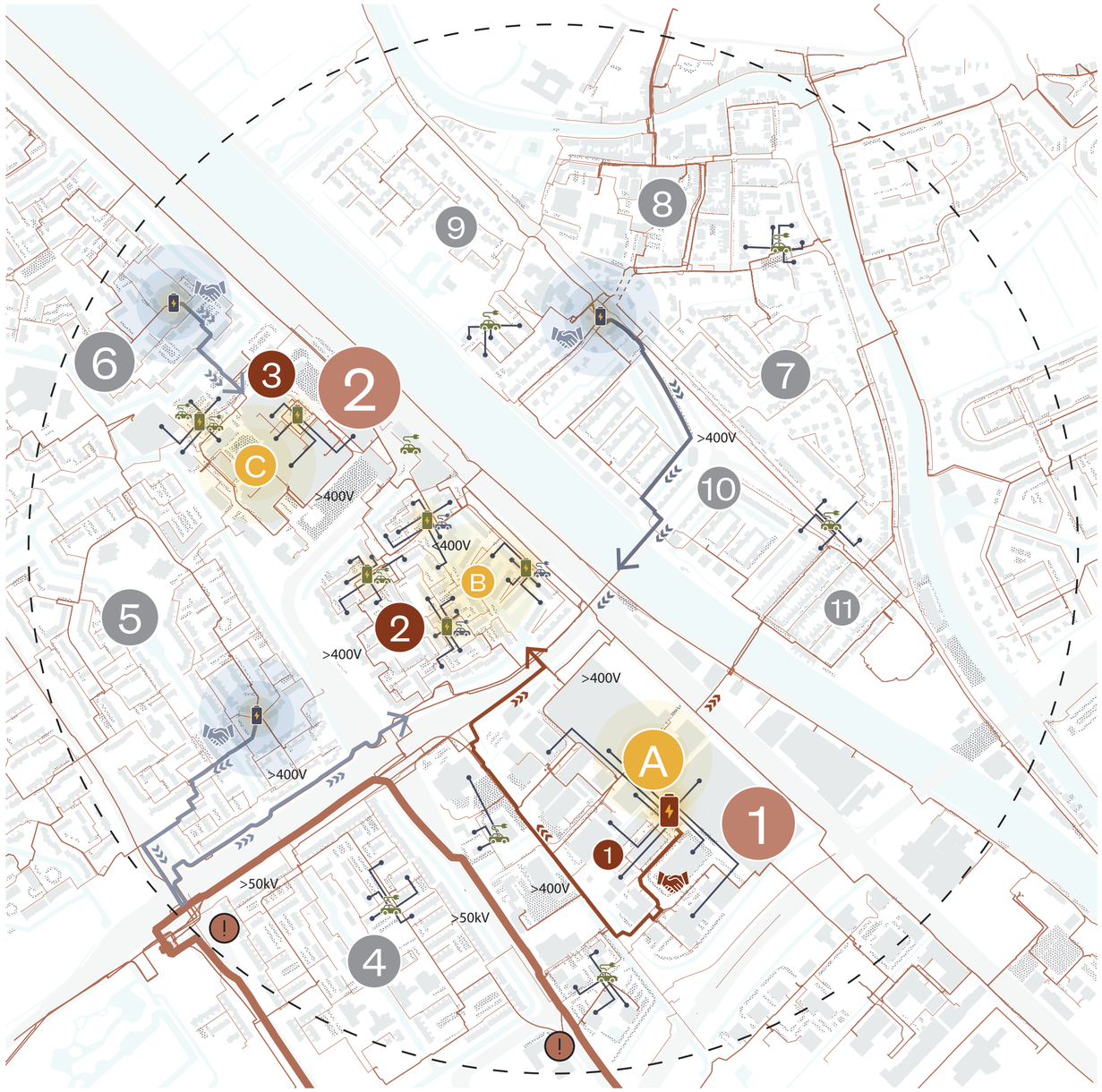
**EV Charging Station as V2G**
D. Proposed to support vehicle-2-grid system
Smart Charging

**Home Storage**
E. Home Storage

**Home or Collective Storage**
F. Home or Collective Storage

**Energy Prosumers**
- Early Birds
- Low-Income Birds
- High-Income Bids
- Big Birds

**Land Use**
- Water
- Road
- Public Space
- Semi-Private Space
- Parking Space




By 2030, 27% from all energy used in the Netherlands must be produced by renewable energy sources (Ministerie van Algemene Zaken, 2025). In order to fulfill this goal, taking into account grid congestion (Stedin, 2025), The proposal suggests that these renewable energy source production goals must be translated to a local level. In this case, based on calculations and estimations (see appendix A), this is at least 28% of all energy used in the area.

What about the distribution then? There is serious regional grid congestion present in the Utrecht region, on the National Network in the area (Stedin, 2025), and also in the Maarssen & Maarssenbroek area specifically, where new or extra big energy consumer demands are put on a waiting list (Stedin, 2024). A proposal for connecting production, consumption and storage on a 'hyper-local' distribution structure has been made. This proposal does not only efficiently and locally link supply and demand of energy, but also reduces stress on the existing grid as a lot of the energy distribution to the energy demanders bypasses the existing structure. Even though it is expected that not too long after 2030 the planned grid improvements will be in place (Stedin, 2025), it is a sustainable validation to create these independencies in energy distribution from source to user in order to create resilience and flexibility taking into account an unpredictable future.

For the Early and High Income Birds there will be policies and subsidies in place: FITs, energy neutrality mandates, streamlining permits, low-interest loans, zero VAT and community solar programs.

High Income Birds and Early Birds can increasingly (due to reducing grid stress over time as mentioned earlier) sell excess solar energy to Big Birds and Low Income Birds locally.

These incentives can make these communities self-sufficient in their energy needs and supply and in combination with the use of centralized renewable energy sources in the region over time it will be possible to reach the 2050 goals. Obstacles and challenges in the future that lie further ahead are addressed further on.

## Pilot Area - Technical Contextualization

**General Information Context**
- Regional Grid Fully Congested
- Energy Sharing Through Subsidies or Selling
- Local Microgrid From and To Storage

**Energy Production**
- A 16.300.000 kWh Annual Solar Production
- B 1.135.770 kWh Annual Solar Production
- C 3.808.000 kWh Annual Solar Production

**Energy Storage**
- Large Industrial Storage
- Collective/Communal Storage
- Home Storage
- EV Charging and V2G Stations (Existing)
- EV Charging and V2G Stations (New)

**Energy Distribution**
- Large Storage to Low Income Renters
- High Income Owners to Low Income Renters
- Solar Panel Owners to Low Income Renters

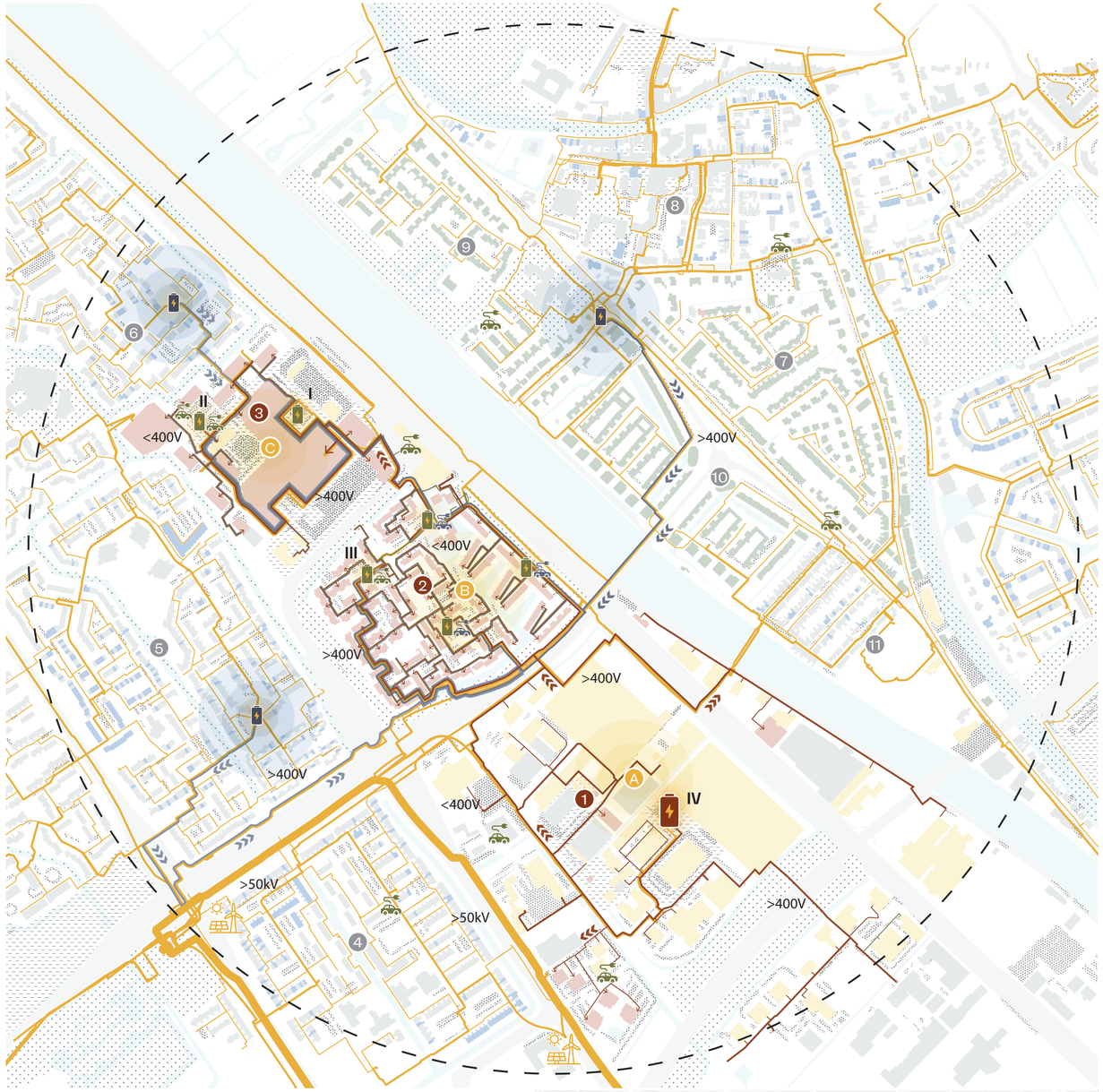
**Big Energy Consuming Clusters Consumption/Demand**
- 1 Electricity: 4.104.516kWh, Heat: 7.397.258kWh
- 2 Electricity: 309.632kWh, Heat: 13.378.570kWh

**Low-In Neighbourhood Residential Energy Consumption**
- 1 Industrieterrein: 1.344.000 kWh
- 2 Antilopespoor: 6.966.540 kWh
- 3 Bisonspoor: 4.433.870 kWh

**Other Neuighborhood Residential Energy Consumption**
- 4 Bloemstede: 7.527.910 kWh
- 5 Duivenkamp: 10.257.900 kWh
- 6 Componistenbuurt: 5.862.250 kWh
- 7 Centrum Vecht: 5.646.270 kWh
- 8 Reizende Man: 3.430.640 kWh
- 9 Hogebrug: 3.355.220 kWh
- 10 Friezenbuurt: 2.478.120 kWh
- 11

**Land Use**
- Water
- Road

**Energy Infrastructure**
- Stedin High Voltage Line
- Stedin Medium Voltage Line
- Stedin Low Voltage Line




**Pilot Area - Strategy Map - 2050 scenario**

**Energy Production**
- Large Scale Renewable Energy Production
- A 16.300.000 kWh Annual Solar Production
- B 1.135.770 kWh Annual Solar Production
- C 3.808.000 kWh Annual Solar Production

**Energy Storage**
- Large Industrial Storage
- Collective/Communal Storage
- Home Storage
- EV Charging and V2G Stations (Existing)
- EV Charging and V2G Stations (New)

**Energy Distribution**
- Large Production to Storage
- Large Storage to Industrial & Vice Versa
- Large Storage to Low Income Renters
- Collective Storage to Low Income Renters & Vice Versa
- High Income Owners to Low Income Renters
- Solar Panel Owners to Low Income Renters

**Energy Consumption**
- Early Birds
- Low-Income Birds
- High-Income Bids
- Big Birds
- 1 Industrieterrein: 12.845.774 kWh
- 2 Antilopespoor: 6.966.540 kWh
- 3 Bisonspoor: 18.122.072 kWh
- 4 Bloemstede: 7.527.910 kWh
- 5 Duivenkamp: 10.257.900 kWh
- 6 Kamelenspoor: 15,011,150 kWh
- 7 Componistenbuurt: 5.862.240 kWh
- 8 Centrum Vecht: 5.646.270 kWh
- 9 Reizende Man: 3.430.640 kWh
- 10 Hogebrug: 3.355.220 kWh
- 11 Friezenbuurt: 2.478.120 kWh

**Land Use**
- Water
- Road
- Public Space
- Semi-Private Space
- Parking Space



The spatial strategy begins with this cluster, the Pilot Area for testing community-driven energy storage and distribution approaches. Uniquely, this cluster contains all four energy communities - early birds (solar panel owners), big birds (industries), low-income renters, and high-income homeowners - making it an ideal setting for prototyping an equitable and decentralized energy model.

In this strategy, energy storage is re-imagined not merely as infrastructure, but as a public, social, and spatial asset. Each storage intervention is adapted to meet the needs of specific communities, contributing to a broader energy system which is rooted in participation, equity, and accessibility. Moreover, because of the heavily congested grid, interventions such as an above-ground temporary grid are placed to alleviate energy demand. This infrastructure is re-imagined to be an asset for the community and a reminder of the shared energy system in their neighbourhood.

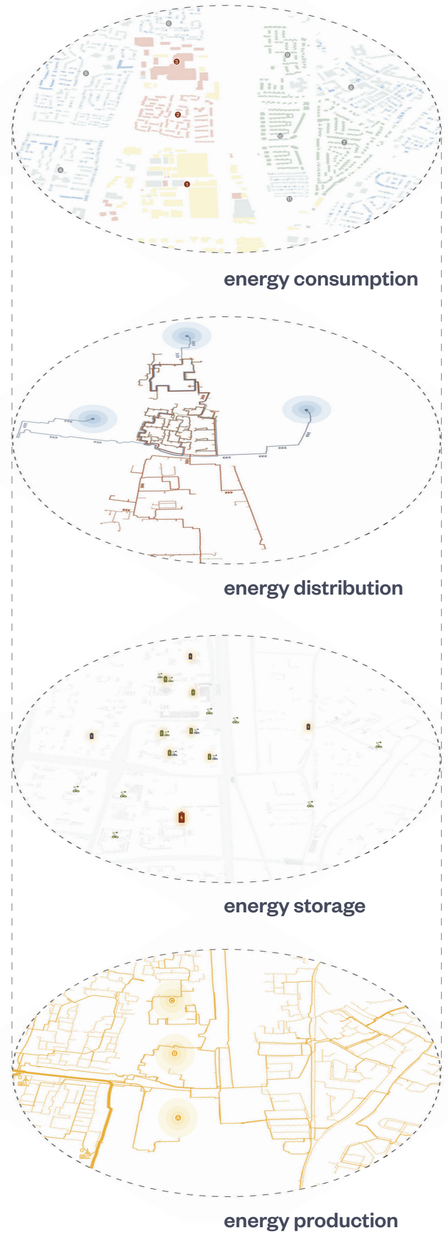
The strategy is organized around four interlinked energy systems: production, storage, distribution, and consumption.

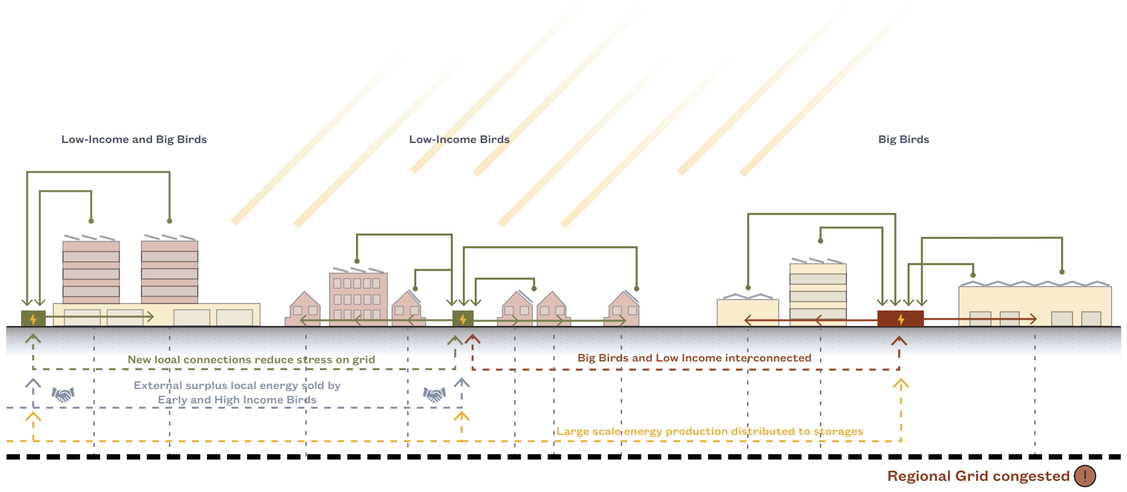
-For energy production, large-scale renewable sources such as solar parks supply energy to all types of storage: industrial batteries, collective hubs, home storage, and EV systems. Additionally, neighborhood-level prosumers generate solar energy that feeds directly into their own storage systems or nearby collective hubs.

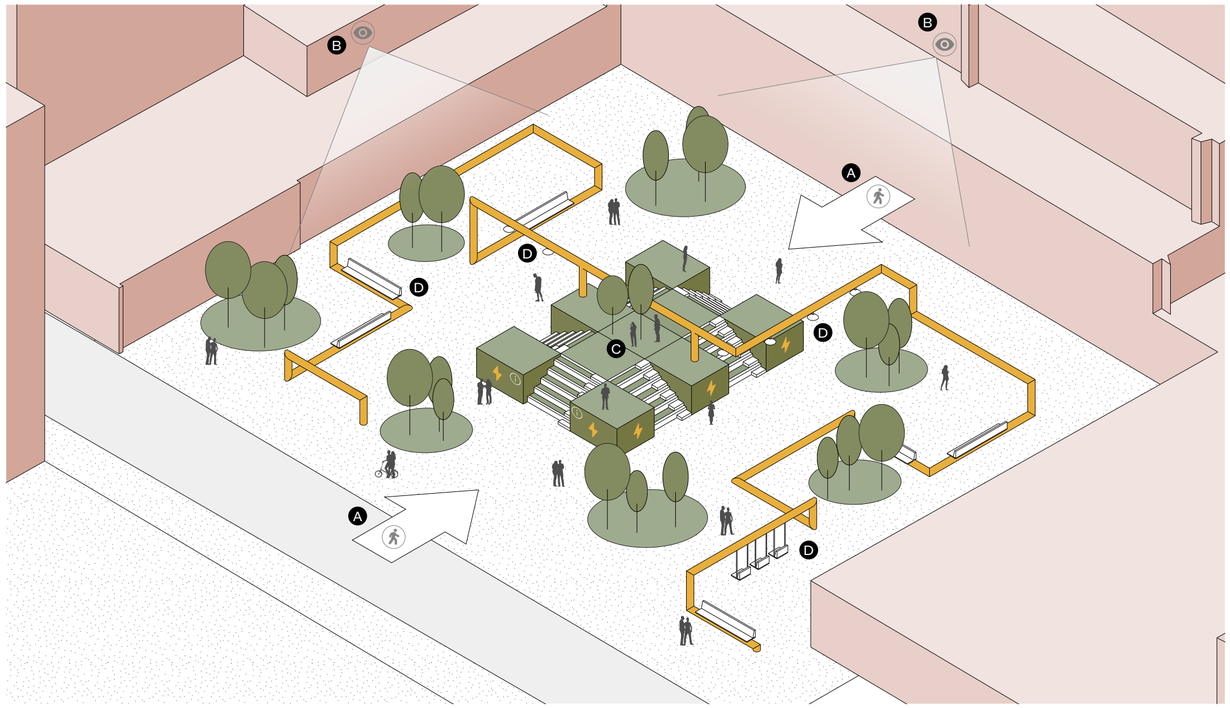
-In distribution, each community plays a role in supporting the decentralized grid. Big birds implement large-scale storage tied to their own renewable energy production and redistribute surplus energy to adjacent low-income neighborhoods. High-income homeowners and early birds share excess energy from home batteries with renters. Low-income renters access energy through collective storage managed through cooperative models.

-EV charging and Vehicle-to-Grid (V2G) are integrated across all communities, offering an additional, flexible storage and mobility infrastructure layer.

A core focus of this strategy is spatial justice, especially for low-income renters at risk of exclusion from the energy transition. Interventions prioritize visibility, accessibility, and the integration of public space with energy infrastructure, reinforcing a sense of ownership and participation in this future energy model.



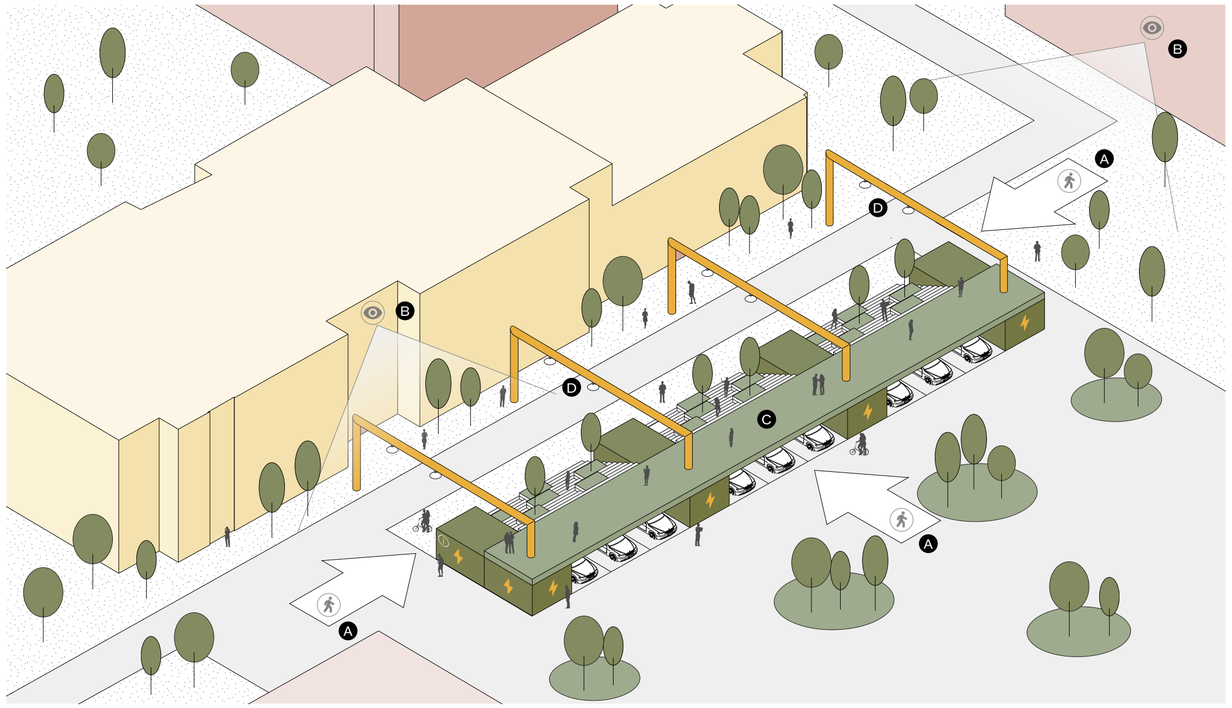






**I. Collective Storage as Public Space**

- Ⓐ Centrally located for accessibility and visibility
- Ⓑ Visible for community
- Ⓒ Integrated with public space for the community
- Ⓓ Grid infrastructure as furniture and lighting

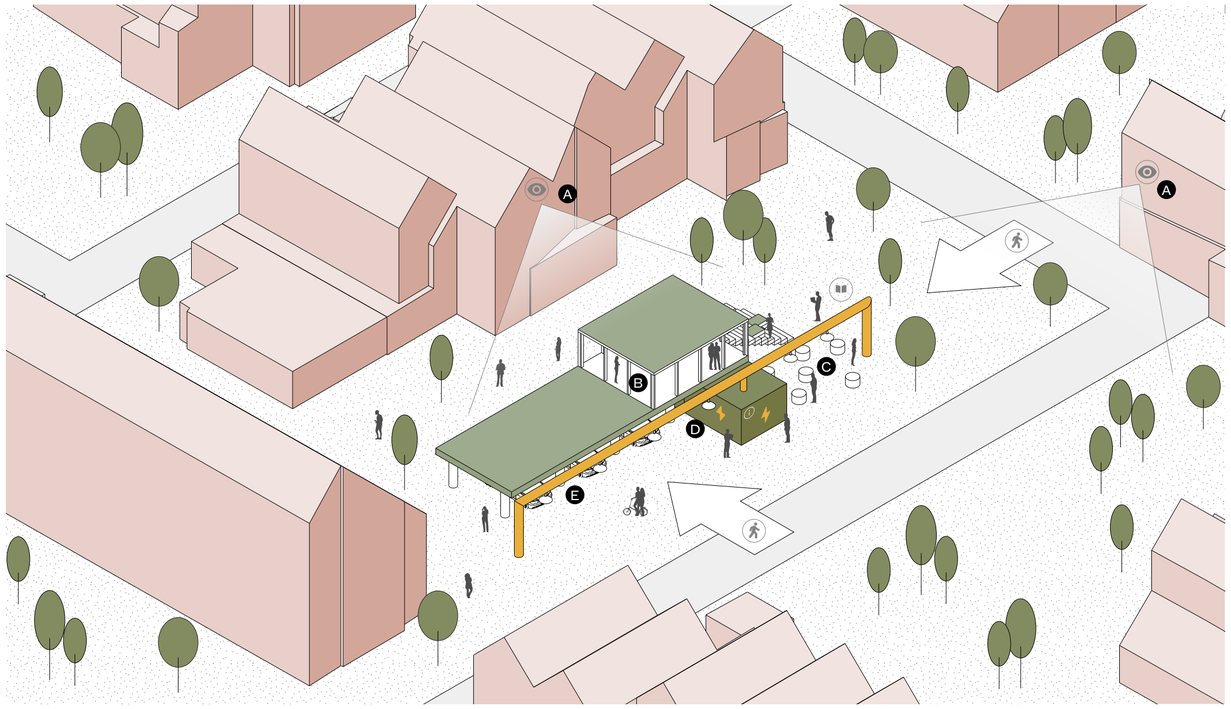
**Sodium-ion Battery Size**
8 units x 25 cubic meters each = 200 cubic meters
To accommodate 25MWh annual consumption




**II. Collective Storage as Public Space**

- Ⓐ Centrally located for accessibility and visibility
- Ⓑ Visible for community
- Ⓒ Integrated with public space for the community
- Ⓓ Grid infrastructure as furniture and lighting

**Sodium-ion Battery Size**
8 pcs x 25 cubic meters each = 200 cubic meters
To accommodate 25mWh annual consumption

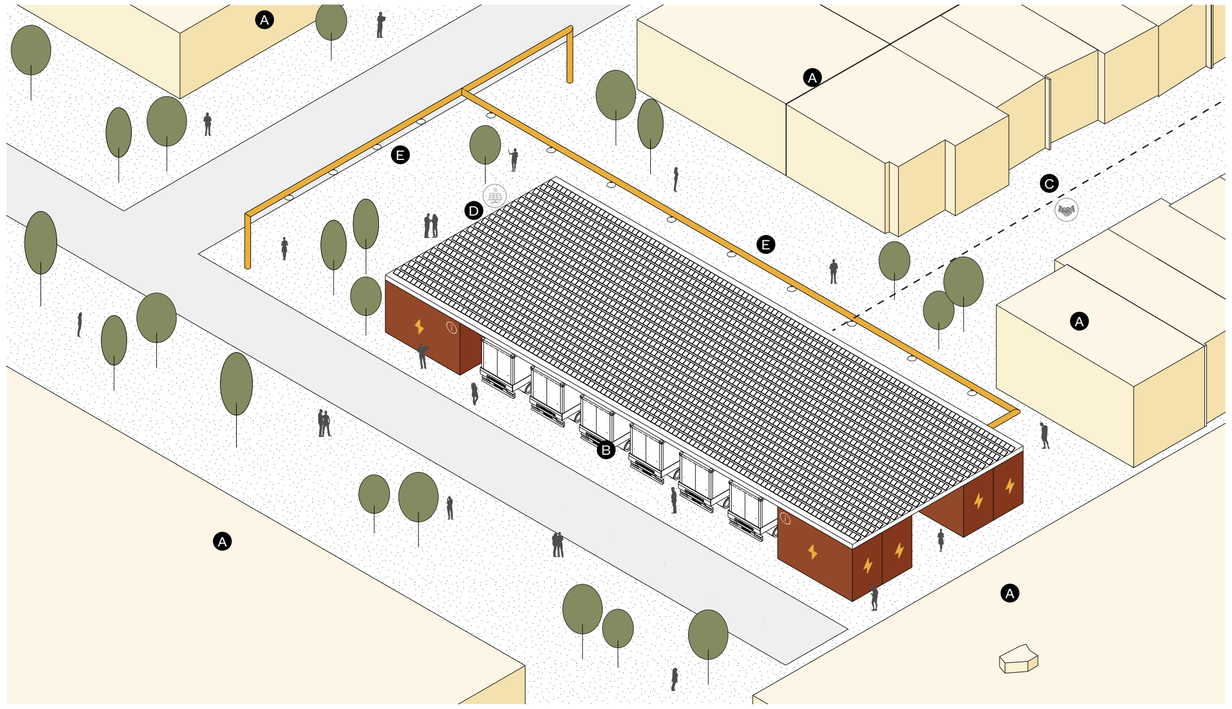



**III. Collective Storage as Social Space**

- Ⓐ Located across neighborhood for accessibility and visibility
- Ⓑ Gathering space for community
- Ⓒ Intergrated with educational spaces and information wall
- Ⓓ Grid infrastructure as lighting
- Ⓔ Intergrated with EV charging and V2G station

**Sodium-ion Battery Size**
4 Locations x 50 cubic meters each = 200 cubic meters to accommodate 20mWh annual consumption



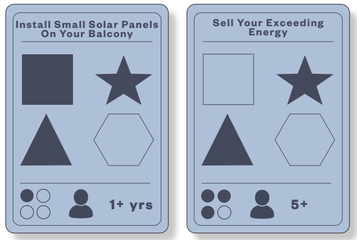



**IV. Large Scale Storage Partnership**

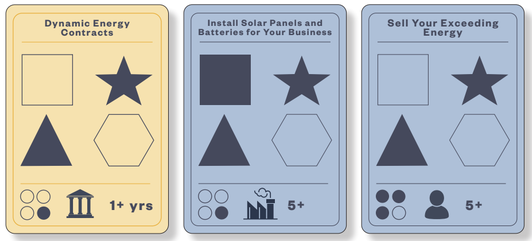
- Ⓐ Located near industries
- Ⓑ Partnership with Industries and Low-Income Renters
- Ⓒ Intergrated with EV charging and V2G station
- Ⓓ Intergrated with Solar Energy Production
- Ⓔ Grid infrastructure as lighting

**Sodium-ion Battery Size**
8 units x 50 cubic meters each = 200 cubic meters
To accommodate 35mWh annual consumption

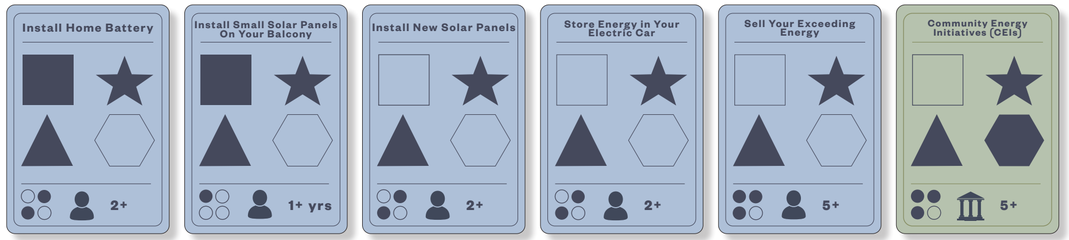
## EARLY BIRDS

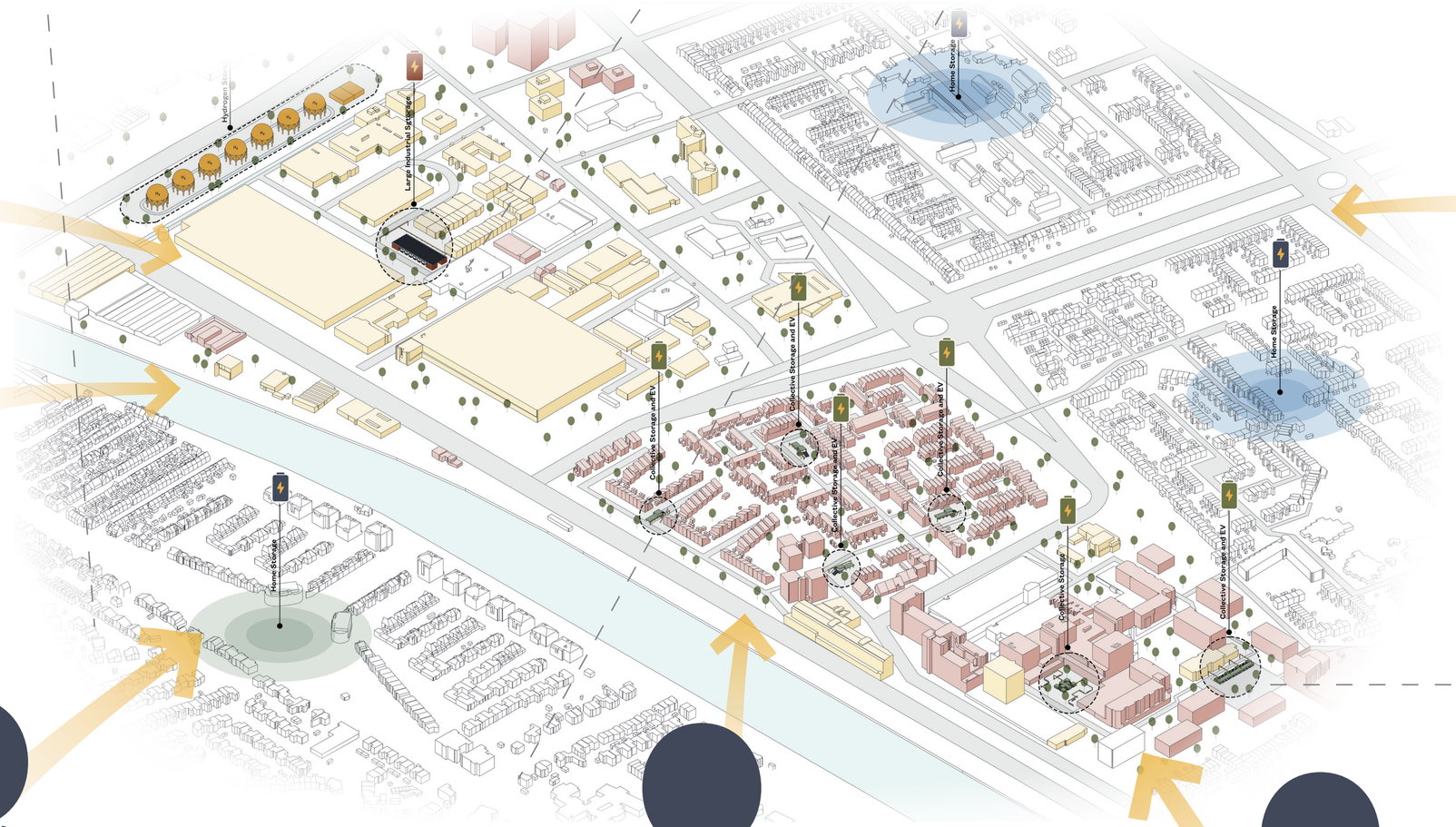



## BIG BIRDS




## HIGH-INCOME BIRDS



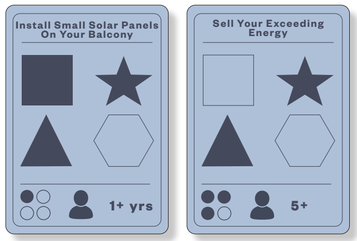




## GREEN CORPORATIONS

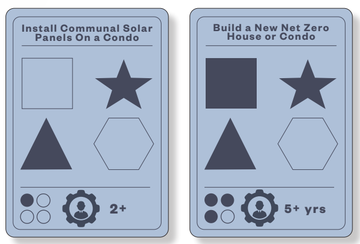
## UNIONS

## GRID OPERATORS

## LOW-INCOME BIRDS



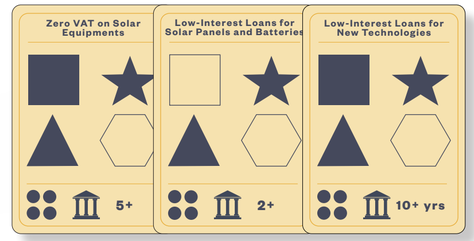

## HOME-OWNERS CORPORATIONS

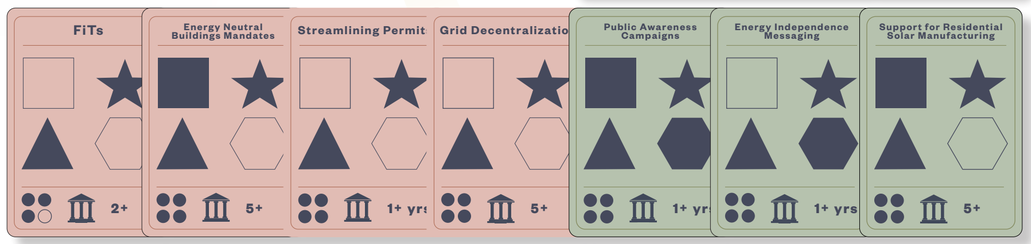



## MUNICIPALITY

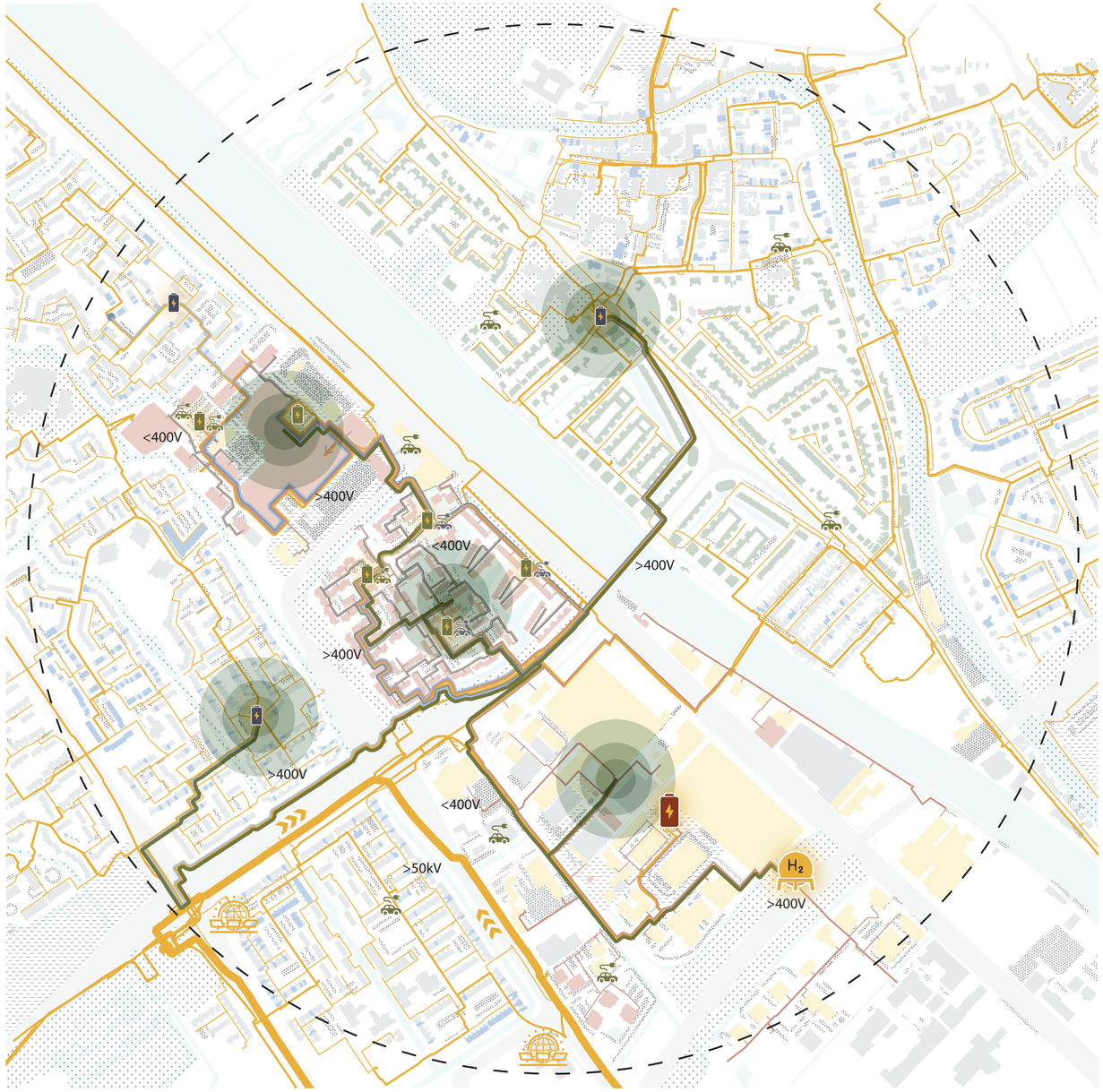



## GOVERNANCE




Pilot Area - Policies Map - 2050 scenario




Looking ahead, this scenario envisions the cluster's energy landscape beyond 2050. By this stage, the focus area will have matured into a fully decentralized energy system, where the foundation - composed of collective, large-scale, and home battery storage- supports a resilient neighbourhood-level grid. These systems, introduced during the initial transition phases, play a vital role in balancing local energy flows, enabling each community to produce and store energy near where it is consumed, creating a decentralized and more self-sufficient neighborhood living up to its fullest renewable energy potential.

However, as energy demand grows, new challenges emerge - particularly the need for seasonal energy balancing. In periods of low solar generation, especially during winter, the existing battery systems may no longer be sufficient to meet neighbourhood demand.

To address this, the cluster introduces a hydrogen storage system strategically placed at the edge of the industrial zone. This location provides spatial separation from residential areas and creates a buffer zone. These hydrogen tanks are envisioned as co-owned infrastructure of industries and local community cooperatives. During seasonal shortages, the stored hydrogen is converted into electricity and redistributed to nearby neighbourhoods, as a crucial backup for energy demand.

This future scenario anticipates international energy transmission in addition to local solutions. Energy from large-scale solar farms beyond the country is distributed into the neighbourhood, integrated into the local storage system, and shared across the grid to meet rising demand. This post-2050 strategy reinforces the pilot's values. It reflects a future in which infrastructure continues

## Pilot Area - Startegy Map - 2050+ scenario

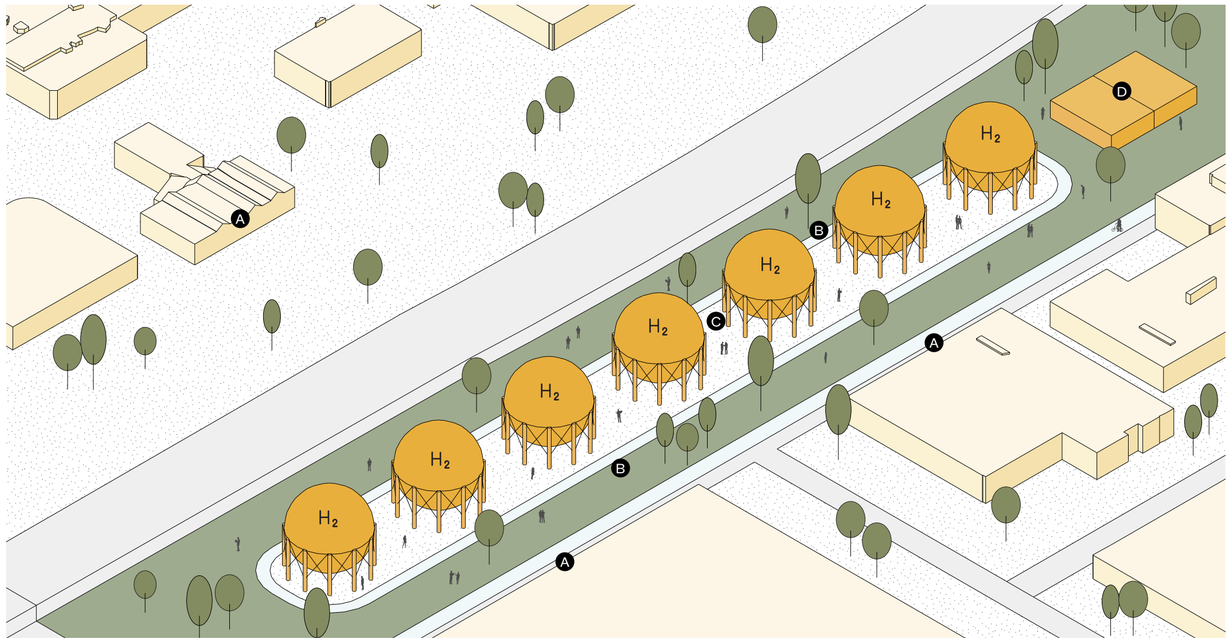
**Energy Production**
- Intercontinental Energy Transmission

**Energy Storage**
- Large Industrial Storage
- Collective/Communal Storage
- Home Storage
- EV Charging and V2G Stations (Existing)
- EV Charging and V2G Stations (New)

**Energy Distribution**
- Large Production to Storage
- Large Storage to Industrial & Vice Versa
- Collective Storage to Low Income Renters & Vice Versa
- High Income Owners to Low Income Renters
- Solar Panel Owners to Low Income Renters
- Hydrogen Storage to Communities & Vice Versa

**Energy Consumption**
- Early Birds
- Low-Income Birds
- High-Income Bids
- Big Birds

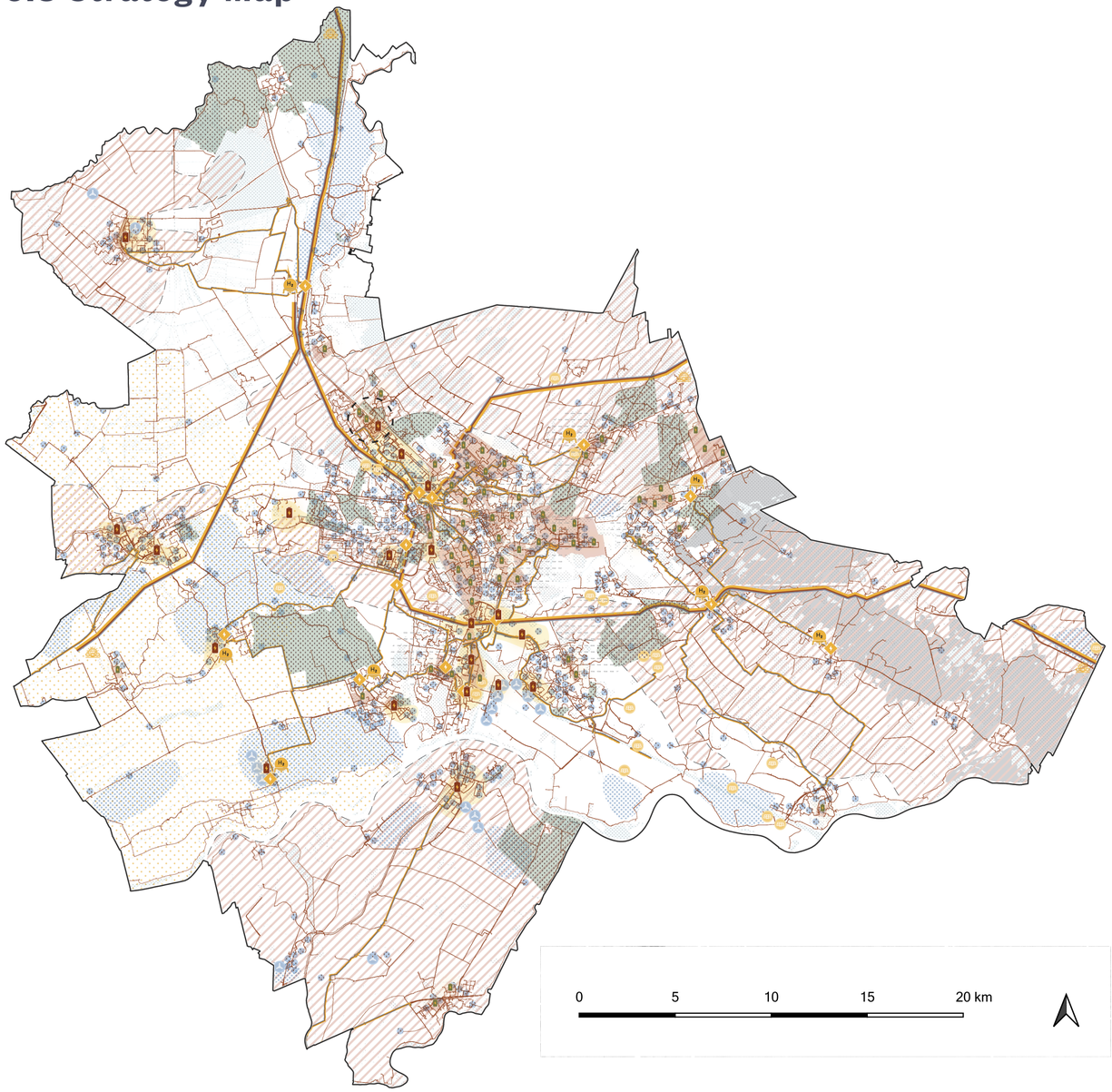
**Land Use**
- Water
- Road
- Public Space
- Semi-Private Space
- Parking Space




**Hydrogen Storage**
- Ⓐ Located at edge of industrial area
- Ⓑ Hydrogen Storage as seasonal backup
- Ⓒ Spatial Buffers for safety
- Ⓓ Hydrogen Station

**Sodium-ion Battery Size**
7 units x 300 square meters each = 2100 square meters to accommodate pilot area as seasonal backup energy

# 6.8 Strategy Map




**U16 - Strategy Map - 2050 & 2050+ scenario**

**Energy Production**
- Solar Parks
- Solar Potential
- Wind Farms
- Wind Potential
- Intercontinental Energy Transmission (2050+)

**Energy Storage**
- Large Industrial Storage
- Collective/Communal Storage
- Home Storage
- EV Charging and V2G Stations Clusters
- Hydrogen Storage (2050+)

**Energy Distribution**
- Large Production to Storage
- Large Storage to Industrial & Vice Versa
- Large Storage to Low Income Renters
- Collective Storage to Low Income Renters & Vice Versa
- High Income Owners to Low Income Renters
- Solar Panel Owners to Low Income Renters
- High Voltage Stations

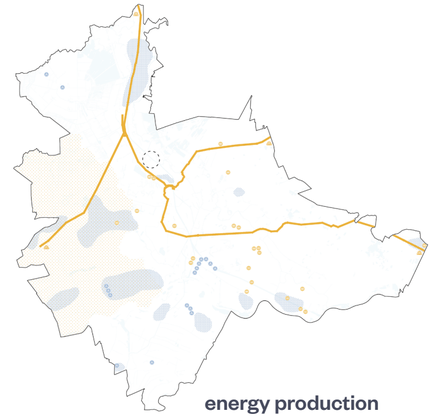
**Energy Consumption (Prosumers)**
- Early Birds
- Low-Income Birds
- High-Income Bids
- Big Birds

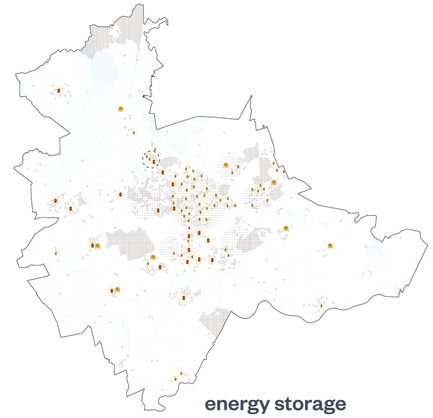
**Land Use**
- Water
- Road
- Public Space
- Semi-Private Space
- Natura 2000
- Heavely Congested Grid

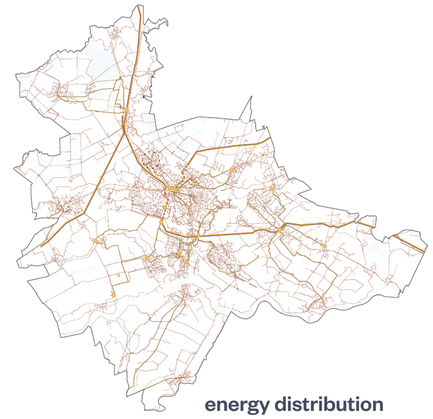


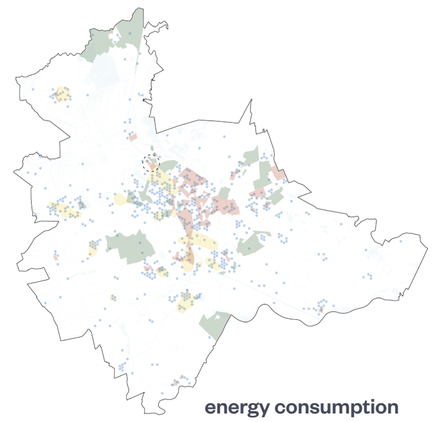
The pilot strategy serves as a scalable model for the entire U16 region and eventually, as a framework for other regions across the Netherlands. Its adaptable approach allows for the integration of new technologies over time, while keeping communities and equity at the center of the energy transition.
This strategy map illustrates the spatial development of a decentralized and equitable energy region from the present day to the long-term future. It translates the core vision, Re-Storing Power to the People, into targeted spatial interventions that address the energy transition's technical and social challenges.
Building upon the pilot, the strategy is implemented across U16 through a series of layered actions:
- Energy production is supported by existing solar parks and wind farms along with areas of high renewable energy potential. This energy is distributed into various storage systems throughout the region.
- Large-scale storage is situated in industrial zones where energy is both produced and consumed. Surplus energy from these zones is distributed into collective storage hubs, particularly in neighborhoods with a high concentration of low-income renters.
- Collective storages are placed in underutilized public spaces that are visible and accessible. These sites are managed by local cooperatives and serve not only as energy infrastructure but also as social and educational nodes.
- EV charging and Vehicle-to-Grid (V2G) hubs are distributed across the region, prioritizing areas where residents lack access to home charging. These are spatially integrated with collective and industrial storage systems.
- Big Birds redistribute surplus energy to Low-income birds
- High-income Birds and Early Birds can share excess energy to Low-income birds or Big Birds
- Low-income birds, through participation and cooperatives, access energy through collective storage.

Looking beyond 2050, the strategy anticipates the integration of intercontinental transmission lines to meet rising demand, along with the deployment of hydrogen storage facilities strategically placed for efficiency and safety. These will provide seasonal energy balancing, ensuring long-term system stability.
Overall, this strategy demonstrates that energy is not only technical but also spatial, social, and collective. Through inclusive design and participation, power could be re-stored to the people


energy production


energy storage


energy distribution


energy consumption

PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION
PROJECTIONPROJECTION

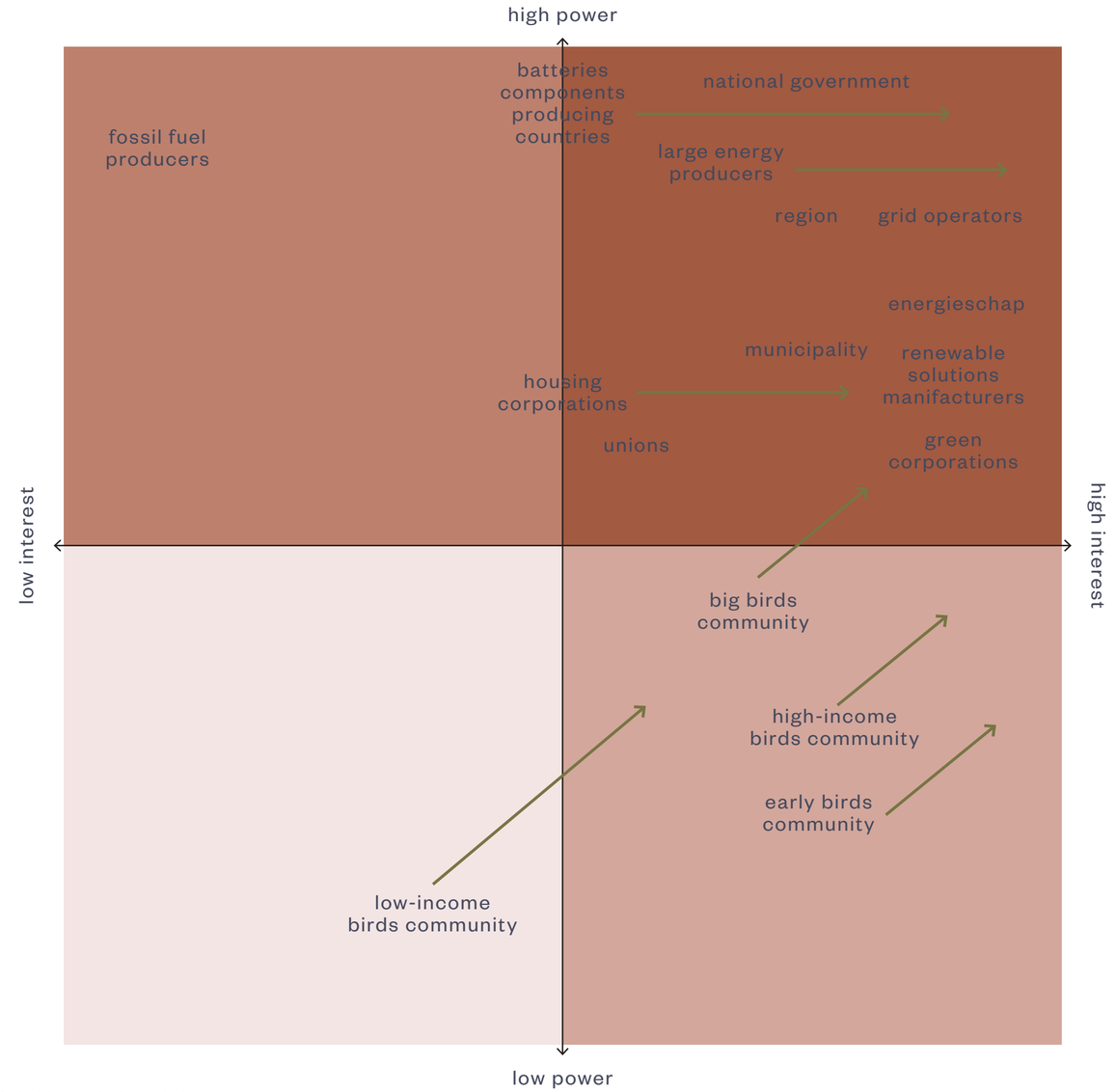
# 7.1 Future Scenarios

**CHANGING ENERGY SUPPLY AND DEMAND**
In terms of energy demand, the U16 area is expected to increase in the future due to various factors such as population growth or the arrival of new industries in the area. Fortunately, the project is specifically aimed at promoting energy independence at the household level so communities should be able to keep up with the changing times, especially if new technologies are developed. With sufficiently developed production and storage systems, energy should not be lacking, but a grid that can handle it is needed and for this reason we expect it to be expanded around 2050.

**PROJECT EXPANSION**
The project can be scaled up relatively easily, at least at a national level, taking into account that the Netherlands is a relatively homogeneous country in terms of climate and geomorphological conditions. However, an infrastructural expansion of the energy grid would be necessary. The grid is already common at European level but we aim to expand it intercontinentally, especially in North Africa. This would require infrastructural agreements and investments.

**ROLE OF PUBLIC PARTICIPATION**
As already listed above, the project foresees a continuous alternation of top-down and bottom-up phases. Public participation and citizen feedback play essential roles. This is precisely why the project has the capacity to adapt to any geopolitical or energy changes.

**LONG-TERM BENEFITS**
In a context of energy uncertainty, the main focus of the project is to provide communities with a certain degree of self-sufficiency. This is precisely the key to the prosperity of communities. Making them resilient guarantees their future survival.




Stakeholder analysis evolution.

## 7.2 Phasing

present-2050

2050-...

### Phase 1. Implementing the transition policies

Phase one begins before the 2027 netting scheme ends and aims to promote, through a series of incentives, policies and political strategies, the purchase, sale and use of solar energy storage and generation technology at various levels. On the population side, incentives aim to make the aforementioned technologies more affordable. Other incentives are aimed at municipalities and serve to lay the foundations for the construction of future community batteries at the neighborhood level. Also looking ahead, other incentives are aimed at homeowners corporations and serve to promote the adoption of sustainable technologies as well as introducing sustainability mandates for future buildings.

### Phase 2. Setting physical interventions

The second phase first of all foresees that, following the directives, the municipalities invest in the production and installation of common batteries in the cities and the construction of a secondary temporary grid. At the same time, thanks to the incentives, the various communities - including low-income birds - begin to invest in solar panels - both small and balcony ones - connecting to the new local micro grid. Together with the industries - which will have invested in the same technologies but on a larger scale - each community will be able to store the excess energy produced in the grid and in the batteries, receiving financial compensation. Those who need it most will be able to use it. This will lead to the grid being less full.

### Phase 3. The grid is not congested anymore

The third phase consists of the first physical consequences - in addition to the installation of batteries - that will be seen. After a couple of years of using the above system, the grid should be no longer congested. The proposed storage and production systems are widespread and widely used. Even low-income birds have started their transition. The energy circulation system represents a source of income for citizens and energy waste is minimal. Additionally, energy community initiatives are established and citizens are able to help each other and improve their own and others' experience through feedback and insights. Finally, every new car produced will be electric, allowing cars to become even more popular as a storage model.

### Phase 4. Every new household is energy-neutral

The fourth phase, in the decade 2040-2050, sees a series of economic and social consequences emerge strongly. The energieschap are being implemented because, like water, energy will have become so vital that it will require its own regional governing body.. Communities are almost totally energy independent. Seeing their energy needs satisfied, industries are incentivised not only to stay but also to grow, making the U16 a model for the rest of the country. Thanks to energy mandates and implemented technologies, every new building constructed is energy-neutral.

### Phase 5. Starting developing new technologies

After reaching the European goal of being net zero by 2050, the country can now focus on implementing more futuristic technologies with potentially great implications. The main reference technology is hydrogen applied to storage. At the same time, the national grid will undergo significant expansion to support future new technologies.

### Phase 6. Implementation of hydrogen storages

The sixth phase sees hydrogen technology implemented in the urban fabric. This will have significant consequences from a social and spatial point of view, as it will require large spaces. In view of the intercontinental expansion of the electric grid, diplomatic meetings will also begin to reach an agreement with other countries. After that, solar fields will be built in the countries concerned.

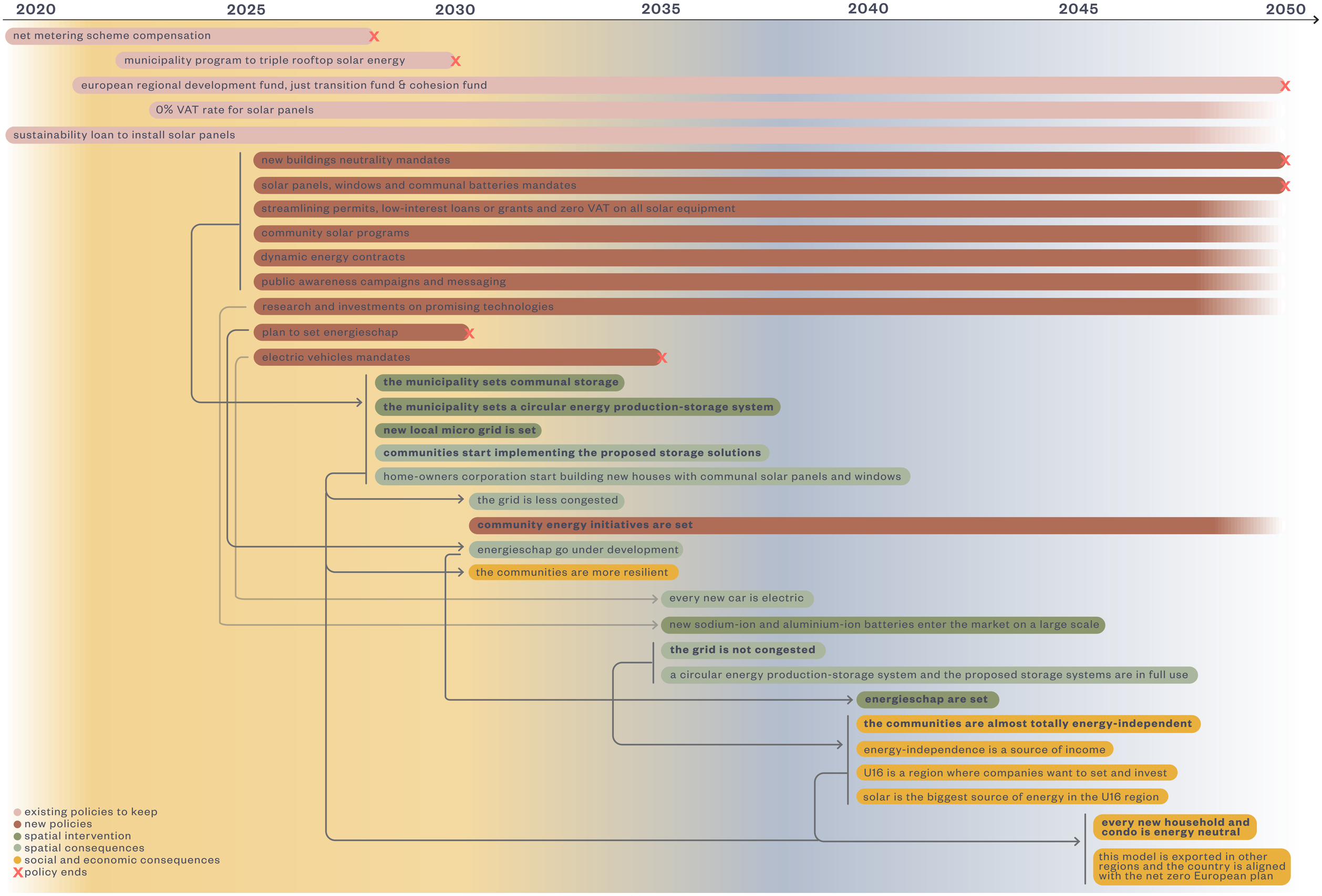
### Phase 7. Communities are energy-independent

In the seventh phase, thanks also to the implementation of hydrogen solutions, communities are expected to produce more than they consume. Thus, they will achieve total energy autonomy. This will be game-changing in the way we conceive the use of energy and will make every community way more resilient.

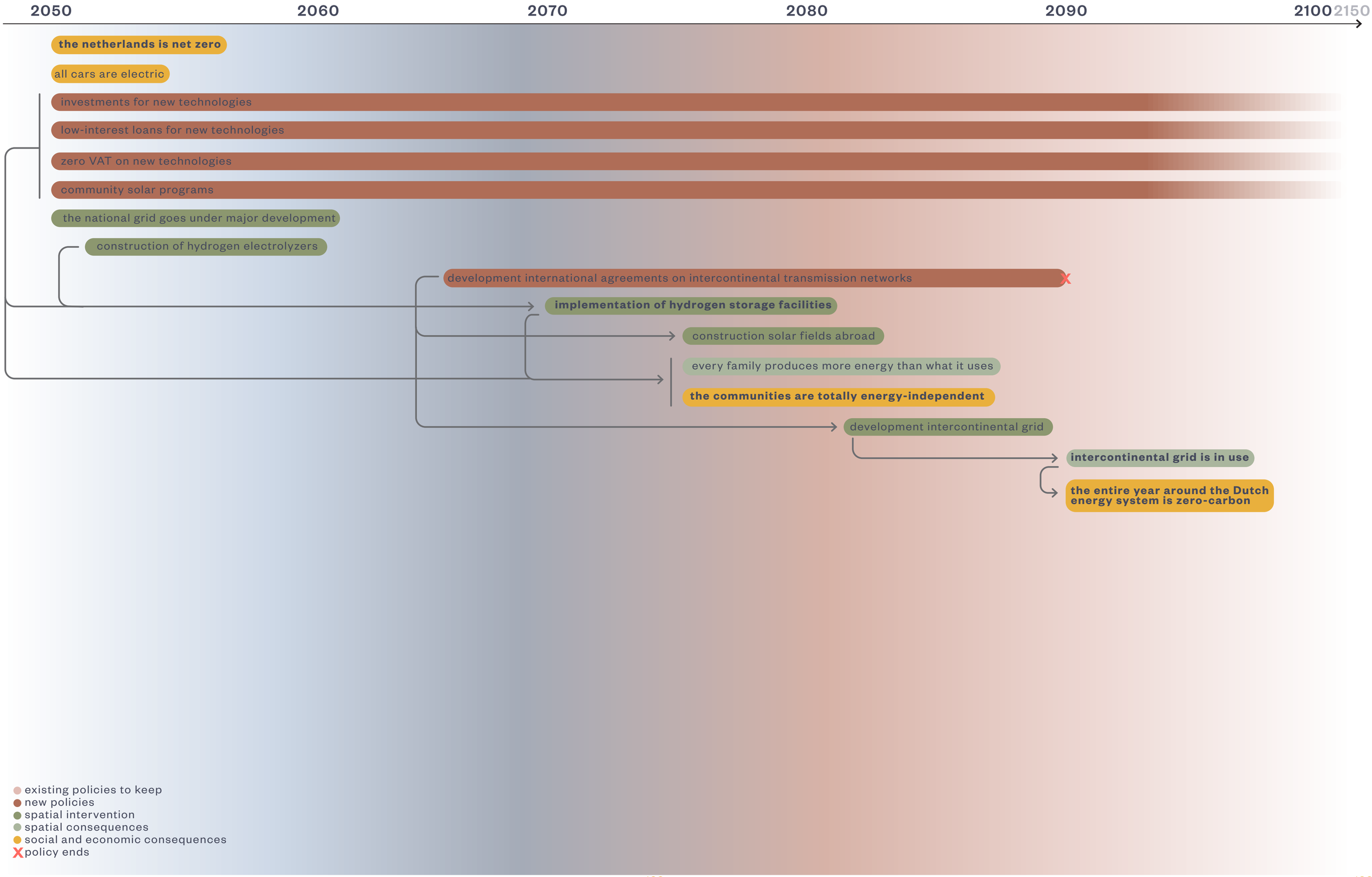
### Phase 8. The country is zero-carbon

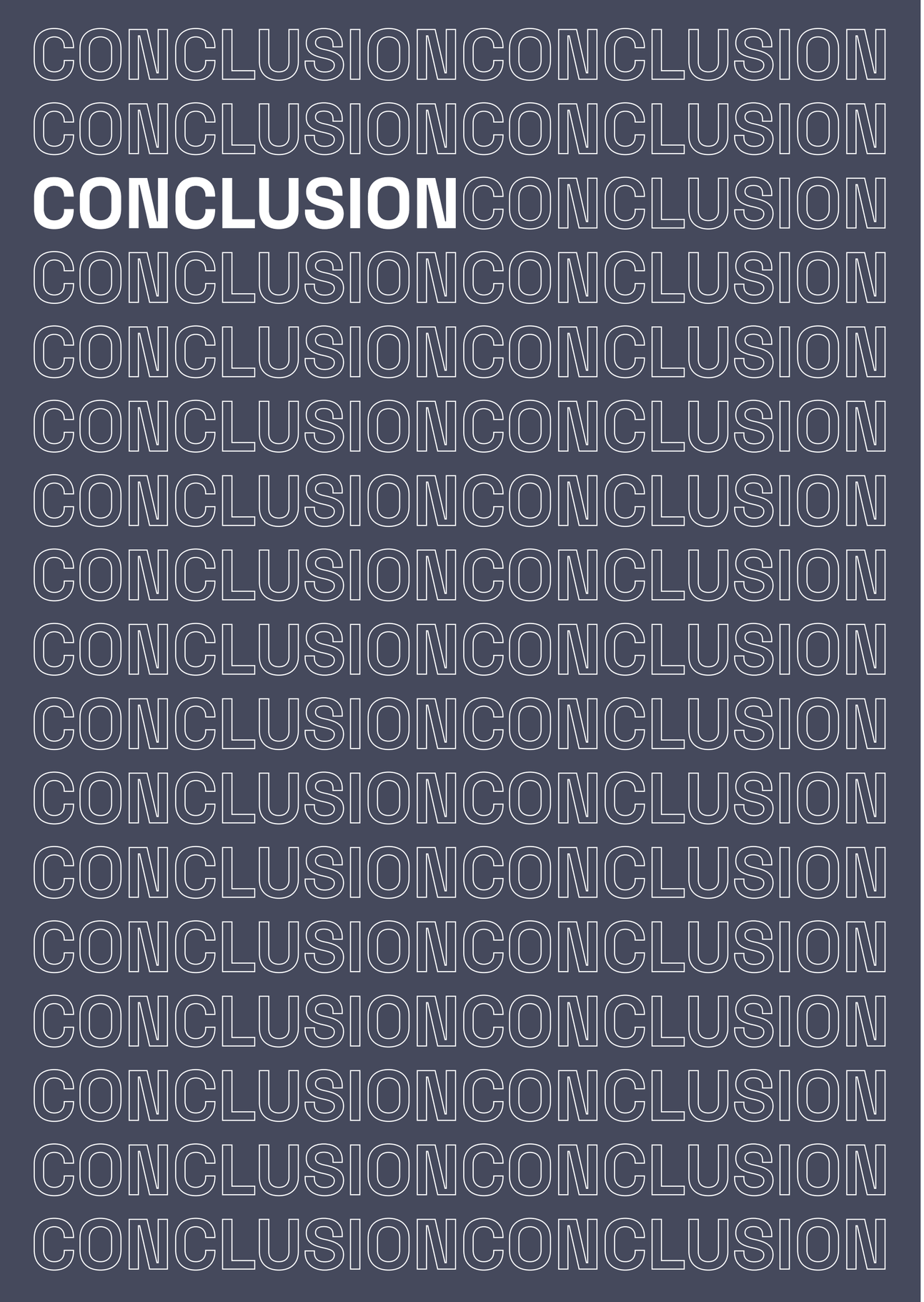
In the eighth and final phase, the intercontinental grid will be in use, transporting energy produced in far-away places to the Netherlands. This will ensure that the country will be a zero-carbon country for an entire calendar year.

## 7.3 Timeline 2050 scenario



# 7.4 Timeline 2050+ scenario




CONCLUSIONCONCLUSION
CONCLUSIONCONCLUSION
CONCLUSIONCONCLUSION

# 8.2 Personal Reflections

## Michele Francesco Bonato

### THE ROLE OF A VISION IN THE PROCESS OF PLANNING AND DESIGN

In this group project, the vision was essentially two things. First, the point of convergence of everything we developed, produced and hypothesized during the initial analysis and research phase. Second, it was the beacon we always relied on in the subsequent design process. The vision therefore represented that moment of convergence between the diagnosis of the existing and the planning of the future in which we asked ourselves ”what do we want to achieve and what would be the consequences of our actions?”. In a certain sense, the vision represented the north star for all the decisions we would subsequently make.
The vision of this project, to be more specific, is that of a future of energy independence, where anyone can not only produce but also store their own energy needs. This future, to best respond to the needs of the present, must have two essential conditions. First, it must be sustainable, because without sustainability an energy transition cannot take place. Second, it must be decentralized and fair because without including everyone, the transition would be incomplete.
It is easy to understand how such a vision is first of all the most natural response to sustainability needs from which, as demonstrated by the cessation of the net metering scheme for households, there is no escape.
Subsequently, such a vision is the yardstick for measuring priorities and guiding design choices. Through this vision it is possible to find the answer to questions that have naturally arisen, such as “where should we allocate resources?” or “who will really benefit from this choice?”.
In short, the vision has represented the healthy question “why” that has always been at the basis of critical thinking. It has given meaning, form and direction to our choices.

### DESIGNING FOR TRANSITION COMMUNITIES

Designing for communities in transition is the basis of the idea of “equity” that we were talking about earlier and that should guide every decision-making choice in this context. Thinking that we can implement an energy transition simply by changing the methods of production, storage, consumption and transport of energy but without paying attention to communities is as naive as it is destined to fail. First of all, we must take communities into account and design because ultimately, they are the end point of the energy chain. They are the ones who consume, produce, store and transport energy on a daily basis - not entirely but at least in part. Secondly, a transition that does not design for communities is a short-sighted transition that does not take the human factor into account. The transition must not only be made, but must be maintained. Designing for communities in transition means, in this sense, transmitting knowledge and propagating good practices of, for example, sustainable consumption. This will strengthen a collective ecological conscience that will ensure the permanence over time of a sense of civic duty towards the renewable perspective. Some good practices of community design are, for example, the involvement of the aforementioned communities, not only at the end of the project, but also at the beginning and during. Another way is to design trying to grasp the sense and nature of the specific context in which the project takes place and think not only about the end of the project itself, but also to ensure resilience and flexibility for the future to come. Finally, trying to organize the space in a way that communities are also strengthened from a social point of view, for example by promoting social connections and climate awareness can play a fundamental role.

### UNDERSTANDING THE COMMUNITIES

Regional planning is certainly the one where it is most difficult to identify and take into account the hopes and dreams of communities. This is due to intrinsic motivations in regional planning. Very simply, the scale is so large and the actors involved are so numerous that it is difficult to identify a single line of opinion to follow and indeed, very often, the opinions of various communities conflict. Nevertheless, trying to pay maximum attention to the needs of communities remains not only a plus, but a must. Failing to do so would mean failing the foundation of planning (not only urban, but of any kind): accommodating the future of people. As difficult as it is at a regional scale, there are various ways to include communities. As mentioned before, active listening carried out through community participation is the strongest basis. Hosting dialogues, conducting interviews and trying to understand, beyond the needs, the identity of a place are ways to take it forward. Furthermore, not only listening but also involving communities in the design phase could even more represent an excellent factor of inclusion. Finally, thinking about communities means designing not just spaces, but systems. This means designing ways in which people move, interact, feed themselves, care for themselves, and perhaps provide them with new opportunities. In this way, urban planning can have an important social role beyond mere functionality.

### SO, WHY SHOULD ALTERNATIVE APPROACHES TO THE ENERGY TRANSITION BE EXPLORED?

The final question that may arise at the end of this journey is therefore ”why explore new approaches for the energy transition?”.
The energy transition, however necessary, is not perfect. Already now - while we are carrying it forward
- it is proving to be full of complexity, conflicting interests, not always inclusive. Many question the feasibility of the 2050 deadline set by the EU.
It is in the face of these challenges that we must think of the transition not as an irreversible process that has already begun in a certain way and will end in the same way. The transition can be thought of rather as a process of continuous self-improvement, in which the critical issues encountered along the way are not enemies to be clashed with but can be incorporated and used to improve. At the same time, today’s transition is very much centered on industries and how to make them survive without asking the question of the social and spatial consequences that will occur. In this sense, new ways of thinking about the transition serve to remember the communities that are always abandoned in great historical changes and making them more resilient.

## Wessel Van Elzakker

Apple founder Steve Jobs once said “Some people say, ‘Give the customers what they want.’ But that’s not my approach. Our job is to figure out what they’re going to want before they do.” And if you read articles from the late 2000’s predicting future Apple products, it shows that it is a good thing that Apple didn’t listen to consumers on how the next iPhone should look.
I often feel that in spatial planning and design, there is a conflict between Jobs’ philosophy and actively listening to the communities’ needs and wishes. A similar situation to the Apple example often occurs when streets are redesigned to make them less car friendly. Residents raise concerns about increased traffic congestion, they fear that emergency services will have trouble reaching them, and most sacrilegiously, the loss of car parking. But after these measures go into effect, and the benefits of cleaner air, less noise, and better access with alternative modes of transportation become apparent, not many would like to reverse the measures.
While working on this research project, there were many times where I struggled with the same conflict. Are we as academics able to make decisions for (often vulnerable) communities, better than these communities themselves? Or do we risk imposing top-down approaches, which are nice in theory, but don’t actually help them? We encountered many people who were actively against investing in the energy transition or were not interested at all. It is our job to involve these people and find respectful ways to make them aware of the benefits of investing in renewable energy. But that also means understanding where their views stem from, which personal, political, and historical reasons formed their beliefs. It also goes the other direction. What can we learn from these communities? Things that sometimes will clash with our theoretical knowledge about the topic. Dilemmas like this made it so interesting to work on this project. Coming from the MSc MADE program, this was my first time studying in Delft. On top of learning so many new things, it especially opened my eyes to the qualities of others. I have never done a group project before with people from such different backgrounds, and I was amazed by their skills in Adobe Illustrator, QGIS and InDesign. I’m used to the end product of a research being a wall of text, with the occasional graph and stock art, but seeing the result of our analysis come alive so visually gave me a newfound appreciation of our work. Working with groupmates from different backgrounds also made me appreciate my own knowledge and skills more. In this project I felt like my understanding of the topic actually made a large difference, and it was actively being appreciated by my group members and teachers.
I look back positively on my elective courses in Delft. I got to know an entire new city, a new university, and great people with an exceptional skill set. It broadened my horizons and deepened my knowledge of spatial design and planning.

## Kenneth Christopher Dy

### ROLE OF A VISION IN PLANNING AND DESIGN

In regional design, a vision can be described as an imagination of an ideal future. But it is more than that, it is a strategic and normative tool that sets the direction through spatial, technical, and social elements. In our group project, our vision of ”Re-Storing Power to the People”, served as a guiding framework that allowed us to interpret and spatialize energy storage not just as infrastructure but a medium for decentralization, equity, and spatial justice.
The vision largely influenced our development strategy by guiding the location and type of storage infrastructure to be used and by defining, most significantly, who should benefit from energy systems and how. By doing this, we could shift from thinking about energy as merely just a commodity but also reimagining it as an inclusive and community-based infrastructure that meets the community’s needs. The vision also helped us justify and spatialize policies such as subsidies for neighborhood cooperatives or mandates for communal storage. Ultimately, the vision helped us balance our goals while guiding us in creating a decentralized and equitable energy future.

### DESIGNING FOR TRANSITION COMMUNITIES

We should definitely design for transition communities. This is essential in inclusive regional planning. Transition communities, being the most impacted by systemic changes, should have their voices heard. Ignoring their needs leads to energy poverty and socio-spatial exclusion. In our strategy, we identified four primary communities: early birds (solar panel owners), big birds (industries), low-income birds (low-income renters), and high-income birds (independent homeowners).
Each of these communities had specific interventions and strategies designed for them, such as collective battery hubs for low-income birds, large-scale industrial storage for big birds, and incentivized energy sharing for high-income and early birds.
To further support our design, we used tools such as Atlas.ti to analyze community sentiments. Additionally, we researched on demographics of these communities. This led us to insights that shaped how we designed energy storage as a public and social infrastructure.
Moreover, integrating policies and incentives is also a way to include communities in the energy transition. This ensures that it benefits all, not just those already in power.

### UNDERSTANDING COMMUNITIES

Understanding a community’s hopes and dreams through regional design can be done, but only if it is approached through the lens of the community and its perspectives. This can be done through community engagement and participation. In this way, their voices are heard, creating a bottom-up approach.
In our project, we combined insights and sentiments from Atlas.ti with quantitative data from CBS and AlleCijfers. This allowed us to develop contextualized interventions such as locating storage in visible and accessible spaces while creating multi-functional educational functions in low-income neighborhoods.
These strategies not only responded to the community’s needs but also visualized vulnerable communities’ desires for inclusion. By allowing communities to see the strategy in physical form, our hope was to create a sense of ownership that they could build upon.
Of course, in an ideal setting, this would not be enough. We understand there must be several meetings and compromises to create our desired future. Therefore, regional design offers a way to spark the change we want to see. In the end, understanding the hopes and dreams of a community in regional design has to include values and principles, which would then be translated into space and ensuring these are spatialized through the development strategy.

## Gijs Jeuken

**1. What is the role of a vision in the planning and design proposal of your group project and how has it influenced your development strategy?**
The vision in a practical way combines all predetermined analysis and information within the project context and creates the first translation of the overall synthesis into a global set of preferred outcomes and goals, both spatially and structurally (on social and technical level). It gives a direction to the project for the first time in the process, whereas the problem scope, analysis of the communities and the energy region merely indicate directionalities. Therefore the vision serves as a guiding instrument for the implementation or post-research & post-analysis part of the process. So that is also how it influenced our development strategy. The vision is basically the framework for the development strategy - it gives the answers to the what, for who and how when it comes to for example the storage possibilities, the infrastructure and community inclusivity through

physically present design. It also functions as a good reference point if you need to re-think about the position in the process. For example - going back to and from the vision to check if we are working in the right way.

**2. Should we design for transition communities? What are good practices in this?**
Yes we should definitely design for transition communities, but there is definitely something wrong with the position of this question; we should actually design with transition communities. Something that I sometimes found lacking in literature that I studied (from which I included some) is the lack of attention and emphasis on the actual needs and values of communities (not disregarding specific articles, but questioning some approaches within these articles). Needs and values must be implemented through a participatory process, but what do these needs and values actually mean, where do they come from and should that not also influence the approach to participation. In this case we have tried to look at this very briefly, but for the understanding of this a lot more time than just 9 weeks is needed. Good practices would be the effects it has probably shown to have on social cohesion and integration in a variety of cases in a positive way, the positive effects probably on community and energy resilience, the positive effects it has on energy flexibility and so on. If you disregard certain communities within the energy transition I fear it can lead to (or worsen in today's terms sadly) serious socio-political polarization between groups in the context of this day and age with social media misinformation etcetera.

**3. Can we understand the hopes and dreams of communities in a regional design process? How?**
- Yes we can, by understanding where they come from. This can't be done by only surveying and researching from an 'ivory tower'. I think in a practical sense it is very unrealistic, but I think in order to do this you need to bond with a community's sentiment - you maybe need to do 'field research' by living among a community and get a certain connection with them - human connection in order to find opportunities rather than just participation procedures. This is not realistic and feasible in the real world unfortunately, I started thinking about this kind of process during the community analysis, but because of these practical reasons did not implement this or a virtual resemblance to this approach.



# 8.3 References


Abousleiman, R., & Scholer, R. (2015). Smart Charging: System Design and Implementation for Interaction Between Plug-in Electric Vehicles and the Power Grid. IEEE Transactions on Transportation Electrification, 1(1), 18–25. https://doi.org/10.1109/TTE.2015.2426571

American Chemical Society. (2025, January 24). New design makes aluminum batteries last longer. https://www.acs.org/pressroom/presspacs/2025/january/new-design-makes-aluminum-batteries-last-longer.html

André Oerlemans. (2025, January 2). Stroom in 2024 voor het eerst meer dan de helft groen, maar tien dagen aan elektriciteit weggegooid. https://www.change.inc/energie/stroom-in-2024-voor-het-eerst-meer-dan-de-helft-groen-maar-voor-250-miljoen-kuub-aan-aardgas-weggegooid-41424

Aneke, M., & Wang, M. (2016). Energy storage technologies and real life applications – A state of the art review. Applied Energy, 179, 350–377. https://doi.org/10.1016/j.apenergy.2016.06.097

ASN Installaties, 050media. (n.d.). Hoeveel zonnepanelen op plat dak per m2? ASN Installaties! https://www.asndokkum.nl/hoeveel-zonnepanelen-op-plat-dak

Axon, S., & Morrissey, J. (2020). Just energy transitions? Social inequities, vulnerabilities and unintended consequences. Buildings and Cities, 1(1), 393–411. https://doi.org/10.5334/bc.14

B. (2024, February 1). Elektriciteitscentrale PEGUS Merwedekanaal en Lage Weide te Utrecht. USINE. https://www.usine-utrecht.nl/elektriciteitscentrales-pegus-merwedekanaal-lage-weide/

BAG. (2025). Pand. [GIS Layer]. PDOK. Via https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/1c0dcc64-91aa-4d44-a9e3-54355556f5e7

Bal, M., Stok, M., Van Hemel, C., De Wit, J. (2021). Including Social Housing Residents in the Energy Transition: A Mixed-Method Case Study on Residents' Beliefs, Attitudes, and Motivation Toward Sustainable Energy Use in a Zero-Energy Building Renovation in the Netherlands. doi: https://doi.org/10.3389/frsc.2021.656781

Barbour, E., Parra, D., Awwad, Z., & González, M. C. (2018). Community energy storage: A smart choice for the smart grid? Applied Energy, 212, 489–497. https://doi.org/10.1016/j.apenergy.2017.12.056

Belastingdienst, N. T. A. (n.d.-b). Solar panels and VAT. business.gov.nl. https://business.gov.nl/sustainable-business/energy/solar-panels and-vat/

Belastingdienst, N. T. A. (n.d.). Solar panels and VAT. business.gov.nl. https://business.gov.nl/sustainable-business/energy/solar-panels-and-vat/

Beshay, & Beshay. (2024, October 25). 1. What Americans think about an energy transition from fossil fuels to renewables. Pew Research Center. https://www.pewresearch.org/science/2023/06/28/what-americans-think-about-an-energy-transition-from-fossil-fuels-to-renewables

Borenstein, S., & Davis, L. W. (2016). The Distributional Effects of US Clean Energy Tax Credits. Tax Policy and the Economy, 30(1), 191-234. https://doi.org/10.1086/685597

Bosch & van Rijn. (2023). PlanMER windenergie Utrecht. Via https://geo-point.provincie-utrecht.nl/apps/a2f9c3b49080442fa80282e208da8fc6/explore

Brinkerink, M., Gallachóir, B. Ó., & Deane, P. (2019). A comprehensive review on the benefits and challenges of global power grids and intercontinental interconnectors. Renewable and Sustainable Energy Reviews, 107, 274–287. https://doi.org/10.1016/j.rser.2019.03.003

Brown, M. A., Soni, A., Lapsa, M. V, Southworth, K., & Cox, M. (2020). High energy burden and low-income energy affordability: conclusions from a literature review. Progress in Energy, 2(4), 042003. https://doi.org/10.1088/2516-1083/abb954

Bryant, J. (2025, January 16). Decentralized energy and the future of sustainable urban development. European Future Energy Forum. https://www.europeanfutureenergyforum.com/decentralized-energy-and-the-future-of-sustainable-urban-development

CE Delft, & TNO. (2024). Feitenbasis aanpassing salderingsregeling zonne-energie (Publicatienummer: 24.470). CE Delft. https://ce.nl/wp-content/uploads/2024/09/CE_Delft_230470_Kernrapport_Feitenbasis_aanpassing_salderingsregeling_zonne-energie_Def.pdf

Centraal Bureau voor Statistiek. (2017). Bestand Bodemgebruik 2017. [GIS Layer]. PDOK. https://service.pdok.nl/cbs/bestandbodemgebruik/2017/wfs/v1_0?request=GetCapabilities&service=WFS' version='2.0.0'

Centraal Bureau voor Statistiek. (2022). Buurt Energie Info: Gemiddeld Totaal Energieverbruik. [GIS Layer]. Warmteatlas. Via https://www.warmteatlas.nl/geoserver/WarmteAtlas/wfs' version='auto'

Centraal Bureau voor Statistiek. (2022). Kerncijfers Wijken en Buurten 2022. Accessed on 31-05-2025, via Kerncijfers wijken en buurten 2022 | CBS

Centraal Bureau voor de Statistiek. (2023, June 23). 46 percent more solar energy production in 2022. https://www.cbs.nl/en-gb/news/2023/24/46-percent-more-solar-energy-production-in-2022

Centraal Bureau voor Statistiek. (2024). Zonnestroom; vermogen en vermogensklasse, bedrijven en woningen, regio. Via StatLine - Zonnestroom; vermogen en vermogensklasse, bedrijven en woningen, regio

Chapman, A., Okushima, S. (2019). Engendering an inclusive low-carbon energy transition in Japan: Considering the perspectives and awareness of the energy poor. Energy Policy. doi: https://doi.org/10.1016/j.enpol.2019.111017

Chen, T., Jin, Y., Lv, H., Yang, A., Liu, M., Chen, B., Xie, Y., & Chen, Q. (2020). Applications of Lithium-Ion Batteries in Grid-Scale Energy Storage Systems. Transactions of Tianjin University, 26(3), 208–217. https://doi.org/10.1007/s12209-020-00236-w

Compendium Voor De Leefomgeving. (2024). Aanbod en verbruik van elektriciteit, 1990-2023. https://www.clo.nl/indicatoren/nl002028-aanbod-en-verbruik-van-elektriciteit-1990-2023#:~:text=In%202023%20was%20het%20totale,ruim%202%20procent%20per%20jaar.

Cooke, B. (2025, April 3). How smart homes could mean zero energy bills by 2040. The Times. https://www.thetimes.com/life-style/property-home/article/how-smart-homes-could-mean-zero-energy-bills-by-2040-t27p2739h

Cordis, C. (2020, April 29). New CENTRalities in INdustrial areas as engines for inNOvation and urban transformation. CORDIS | European Commission. https://cordis.europa.eu/project/id/869595/results

Corsetti, A., Castro, R., Geyken, C., & Mohan, A. (2024). Commercial EV fleet smart charging for cost reduction and renewables integration: A case study in Germany. Journal of Energy Storage, 100, 113765. https://doi.org/10.1016/j.est.2024.113765

Datadame. (2024). Opbrengst van zonnepanelen per jaar. Accessed on 8-4-2025 via: Opbrengst van zonnepanelen per jaar - De Datadame

Dehghani-Sanij, A. R., Tharumalingam, E., Dusseault, M. B., & Fraser,

R. (2019). Study of energy storage systems and environmental challenges of batteries. Renewable and Sustainable Energy Reviews, 104, 192–208. https://doi.org/10.1016/j.rser.2019.01.023

DNE Research. (2025). Nationaal Smart Storage Trendrapport.

Duurzaamheidslening aanvragen | Gemeente Utrecht. (n.d.). Gemeente Utrecht. https://loket.digitaal.utrecht.nl/nl/products/duurzaamheidslening-aanvragen

Duurzame Mobiliteit Databank. (2025, February). Passenger cars. Rijksdienst Voor Ondernemend Nederland. https://duurzamemobiliteit.databank.nl/mosaic/en-us/elektrisch-vervoer/personenauto-s

Electricity grid under further pressure: cabinet and grid operators take drastic measures. (n.d.). TenneT. https://www.tennet.eu/news/electricity-grid-under-further-pressure-cabinet-and-grid-operators-take-drastic-measures

Eneco. (2014). Eneco acquires heat and electricity generation in Utrecht from Nuon. Accessed on 04-04-2025 via Eneco acquires heat and electricity generation in Utrecht from Nuon

Eneco. (n.d.). Warmtenetten Regio Utrecht. Accessed on 04-04-2025 via https://www.eneco.nl/duurzame-energie/warmte-koeling/warmtenetten/utrecht/

Esri Netherlands. (2023). Laadpalen in Nederland. [GIS Layer]. OpenStreetMap. Via https://services.arcgis.com/nSZVuSZjHpEZZbRo/arcgis/rest/services/OSM_laadpaal/FeatureServer/0

European Commission. (2019). The European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Regional Development Fund. Inforegio - European Regional Development Fund. (n.d.). https://ec.europa.eu/regional_policy/funding/erdf_en

Fan, X., Liu, B., Liu, J., Ding, J., Han, X., Deng, Y., Lv, X., Xie, Y., Chen, B., Hu, W., & Zhong, C. (2020). Battery Technologies for Grid-Level Large-Scale Electrical Energy Storage. Transactions of Tianjin University, 26(2), 92–103. https://doi.org/10.1007/s12209-019-00231-w

Filho, R. D., Monteiro, A. C. M., Costa, T., Vasconcelos, A., Rode, A. C., & Marinho, M. (2023). Strategic Guidelines for Battery Energy Storage System Deployment: Regulatory

Framework, Incentives, and Market Planning. Energies, 16(21), 7272. https://doi.org/10.3390/en16217272

Fu, Y., Wang, J., Liu, M., Li, J., & Shao, J. (2025). A simplified electrochemical modeling method for sodium-ion batteries. Journal of Energy Storage, 112, 115495. https://doi.org/10.1016/j.est.2025.115495

Garayt, M. D. L., Zhang, L., Zhang, Y., Obialor, M. C., Deshmukh, J., Xing, Y., Yang, C., Metzger, M., & Dahn, J. R. (2024). Practical Alloy-Based Negative Electrodes for Na-ion Batteries. Journal of The Electrochemical Society, 171(7), 070523. https://doi.org/10.1149/1945-7111/ad5e64

GIS Workshop. (2023). Daily Solar Potential. [GIS Layer]. AR2U086

gridX Press Release: Should modern homes be completely energy self-sufficient? (n.d.). https://www.gridx.ai/press-releases/expert-tip-islanding-mode-energy-self-sufficiency-house-necessary-today

Guo, K., Wang, W., Song, W.-L., Li, S., Du, X., & Jiao, S. (2025). A Recyclable Inert Inorganic Framework Assisted Solid-State Electrolyte for Long-Life Aluminum Ion Batteries. ACS Central Science, 11(2), 239–247. https://doi.org/10.1021/acscentsci.4c01615

Han, X., Li, Y., Nie, L., Huang, X., Deng, Y., Yan, J., Kourkoumpas, D.-S., & Karellas, S. (2023). Comparative life cycle greenhouse gas emissions assessment of battery energy storage technologies for grid applications. Journal of Cleaner Production, 392, 136251. https://doi.org/10.1016/j.jclepro.2023.136251

Hirschlag, A. (2022, January 6). Lithium batteries' big unanswered question. BBC. https://www.bbc.com/future/article/20220105-lithium-batteries-big-unanswered-question

IBIS. (2022). IBIS bedrijventerreinen. Accessed via https://www.warmteatlas.nl/geoserver/WarmteAtlas/wfs

IEA. (2024). Renewables 2024.

IEA. (2025). Energy Policy Review The Netherlands 2024. https://iea.blob.core.windows.net/assets/2b729152-456e-43ed-bd9b-ecff5ed86c13/TheNetherlands2024.pdf

Jang, D., Kim, J., Kim, D., Han, W.-B., & Kang, S. (2022). Techno-economic analysis and Monte Carlo simulation of green hydrogen production technology through various water electrolysis technologies. Energy Conversion and Management, 258, 115499. https://doi.org/10.1016/j.enconman.2022.115499

Just transition fund. (n.d.). European Commission. https://commission.europa.eu/funding

Kaart met provincies, gemeenten, woonplaatsen, wijken, buurten en postcodes | AlleCijfers.nl. (2024b, November 15). AlleCijfers.nl. https://allecijfers.nl/kaart/?lon=5.0397&lat=52.1356&zoom=16

Kadaster. (2025). Basisregistratie Adressen en Gebouwen. [dataset] Via https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/9e2e977a-16a6-42a4-a208-c4f70704f383

Khalid, A., Stevenson, A., & Sarwat, A. I. (2021). Overview of Technical Specifications for Grid-Connected Microgrid Battery Energy Storage Systems. IEEE Access, 9, 163554–163593. https://doi.org/10.1109/ACCESS.2021.3132223

Kim, C.-N., Eum, J.-Y., & Kim, Y.-K. (2020). Analysis of Energy Saving Effect of the Residential BESS Connected to the Balcony-PV in Apartment Houses. Journal of the Korean Solar Energy Society, 40(3), 21–31. https://doi.org/10.7836/kses.2020.40.3.021

Kraaijvanger, C. W., Verma, T., Doorn, N., & Goncalves, J. E. (2023). Does the sun shine for all? Revealing socio-spatial inequalities in the transition to solar energy in The Hague, The Netherlands. Energy Research and Social Science, 104, Article 103245. https://doi.org/10.1016/j.erss.2023.103245

LC Energy — Shaping renewable energy. (n.d.). https://lcenergy.nl/en

Lei, L., Sun, K., Hongwei, Z., Wang, C., & Wei, T. (2024). Large scale preparation of Na3V2(P04)2F3 with cross-linked double carbon network for high energy density sodium ion batteries at −20 °C. Journal of Energy Storage, 78, 109923. https://doi.org/10.1016/j.est.2023.109923

Lennon, B., Dunphy, N. P., & Sanvicente, E. (2019). Community acceptability and the energy transition: a citizens' perspective. Energy, Sustainability and Society, 9(1), 35. https://doi.org/10.1186/s13705-019-0218-z

Li, X., & Wang, S. (2019). A review on energy management, operation control and application methods for grid battery energy storage systems. CSEE Journal of Power and Energy Systems. https://doi.org/10.17775/CSEEJPES.2019.00160

Li, Y., Qian, F., Gao, W., Fukuda, H., & Wang, Y. (2022). Techno-economic performance of battery energy storage system in an energy sharing community. Journal of Energy Storage, 50, 104247. https://doi.org/10.1016/j.est.2022.104247

Marrone, P., Fiume, F., Laudani, A., Montella, I., Palermo, M., & Fulginei, F. R. (2023). Distributed Energy Systems: Constraints and Opportunities in Urban Environments. Energies, 16(6), 2718. https://doi.org/10.3390/en16062718

Milieu Centraal. (2025). Thuisbatterij: zonne-energie opslaan. https://www.milieucentraal.nl/energie-besparen/zonnepanelen/thuisbatterij-zonne-energie-opslaan/

Mohd Razif, A. S., Ab Aziz, N. F., Ab Kadir, M. Z. A., & Kamil, K. (2024). Accelerating energy transition through battery energy storage systems deployment: A review on current status, potential and challenges in Malaysia. Energy Strategy Reviews, 52, 101346. https://doi.org/10.1016/j.esr.2024.101346

Ministerie van Algemene Zaken. (2025, March 12). Duurzame energie. Rijksoverheid.nl. https://www.rijksoverheid.nl/onderwerpen/duurzame-energie#:~:text=Nederland%20werkt%20aan%20duurzame%2C%20betrouwbare,energievoorziening%20bijna%20helemaal%20duurzaam%20zijn.

Ministerie van Economische Zaken en Klimaat. (2024). Maatschappelijke kostprijs van netcongestie. Ecorys. https://www.ecorys.com/app/uploads/2019/02/Maatschappelijke-kostprijs-van-netcongestie-2024.pdf

Ministerie van Algemene Zaken. (2025, March 12). Duurzame energie. Rijksoverheid.nl. https://www.rijksoverheid.nl/onderwerpen/duurzame-energie#:~:text=Nederland%20werkt%20aan%20duurzame%2C%20betrouwbare,energievoorziening%20bijna%20helemaal%20duurzaam%20zijn.

Nationale Energieatlas. (2024). Windturbines. [GIS Layer]. Nationaal Georegister. Accessed on 01-03-2025 via Windturbines (FeatureServer)

Netbeheer Nederland. (2025). Capaciteitskaart Regionale Netbeheerder. Accessed on 20-02-2025 via https://capaciteitskaart.netbeheernederland.nl/

Netbeheer Nederland. (2025). Capaciteitskaart TenneT. Accessed on 20-02-2025 via https://capaciteitskaart.netbeheernederland.nl/

NOS Nieuws. (2024, November 14). Lange wachttijden stroomnet: 'Soms wachten huishoudens 70 weken. NOS. https://nos.nl/artikel/2544460-lange-wachttijden-stroomnet-soms-wachten-huishoudens-70-weken

NOS. (2023, November 16). Deel nieuwe huizen Almere niet aangesloten op stroom vanwege vol elektriciteitsnet. https://nos.nl/artikel/2498097-deel-nieuwe-huizen-almere-niet-aangesloten-op-stroom-vanwege-vol-elektriciteitsnet
Over Regioplatform Woningcorporaties Utrecht | Stichting RWU. (n.d.). https://rwu-utrecht.nl/over-rwu

Oluwadayomi Akinsooto, Olorunshogo Benjamin Ogundipe, & Samuel Ikemba. (2024). Regulatory policies for enhancing grid stability through the integration of renewable energy and battery energy storage systems (BESS). International Journal of Frontline Research and Reviews, 2(2), 022–044. https://doi.org/10.56355/ijfrr.2024.2.2.0023

Park, S., Park, J., & Lee, I. (2025). Comparative analysis of hydrogen and methanol energy storage systems for large-scale applications: Thermodynamic and economic perspectives. International Journal of Hydrogen Energy, 119, 467–481. https://doi.org/10.1016/j.ijhydene.2025.03.248

Pellow, M. A., Ambrose, H., Mulvaney, D., Betita, R., & Shaw, S. (2020). Research gaps in environmental life cycle assessments of lithium ion batteries for grid-scale stationary energy storage systems: End-of-life options and other issues. Sustainable Materials and Technologies, 23, e00120. https://doi.org/10.1016/j.susmat.2019.e00120

Peter, C., Vrettos, E., & Büchi, F. N. (2022). Polymer electrolyte membrane electrolyzer and fuel cell system characterization for power system frequency control. International Journal of Electrical Power & Energy Systems, 141, 108121. https://doi.org/10.1016/j.ijepes.2022.108121

Provincie Utrecht. (2016). Economische haalbaarheid van zonnewarmte voor grootverbruikers. [dataset]. Via https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8308ce8b-bb4d-4f52-9a2e-353f6abb734a

Provincie Utrecht. (2023). Meest kansrijke gebieden voor windenergie provincie Utrecht. [GIS Layer]. Via https://services.geodata-utrecht.nl/geoserver/m01_3_energie_klimaat_lucht/wfs
Provincie Utrecht. (n.d.). Energie-infrastructuur en netcongestie. Accessed on 30-03-2025 via https://www.provincie-utrecht.nl/onderwerpen/energie-en-klimaat/energie-infrastructuur-en-netcongestie

Provincie Utrecht. (n.d.). Over het gebied Utrecht. Accessed on 02-03-2025 via https://www.provincie-utrecht.nl/organisatie/over-het-gebied-utrecht

Provincie Utrecht. (2021). Ligging zonnepanelen. [GIS Layer]. Via https://gis.provincie-utrecht.nl/server/rest/services/Milieu/m01_1_3_energie/MapServer

Rabobank. (2025). Dit zijn de gevolgen van een overbelast elektriciteitsnet. https://www.rabobank.nl/bedrijven/groei/duurzaamheid/elektrische-bedrijfsmiddelen/netcongestie-overbelast-stroomnet

Radtke, J., Ohlhorst, D. (2021). Community energy in Germany—bowling alone in elite clubs? Util Policy 72:101269. https://doi.org/10.1016/j.jup. 2021.101269

Regionale Energie Strategie. (n.d.). Wat is de RES. Accessed on 06-03-2025 via Wat is de RES | Regionale Energiestrategie

Regulatory Assistance Project. (2024). Gridlock in the Netherlands.

RES Regio Utrecht. (2025). RES regio Utrecht Herijking Onderweg naar 2050.

Rijksdienst voor Ondernemend Nederland. (2023). Stappenplan voor bedrijven: hoe gaat u om met uw energievoorziening in netcongestie-gebied? Via Stappenplan voor bedrijven

Rijksdienst voor Ondernemend Nederland. (n.d.). Salderingsregeling zonnepanelen stopt vanaf 2027. Accessed on 31-03-2025 via Afschaffen salderingsregeling vanaf 2027 | Ondernemersplein

Rijksoverheid. (2023). Regionale Klimaatmonitor. Accessed on 02-03-24 via DASHBOARD - Dashboard - U16

Rijksoverheid. (n.d.). Salderingsregeling stopt in 2027. Accessed on 31-03-25 via Salderingsregeling stopt in 2027 | Energie thuis | Rijksoverheid.nl

Rijkswaterstaat. (2024). Voorlopige Overstromingsrisicobeoordeling - OVERSTROMINGSRISICO'S IN NEDERLAND.

Rijkswaterstaat. (2025). Nationaal Wegenbestand. [GIS Layer]. PDOK. service.pdok.nl/rws/nwbwegen/wfs/v1_0?request=GetCapabilities&service=WFS

Rodrigues, D. L., Ye, X., Xia, X., & Zhu, B. (2020). Battery energy storage sizing optimisation for different ownership structures in a peer-to-peer energy sharing community. Applied Energy, 262, 114498. https://doi.org/10.1016/j.apenergy.2020.114498

Rouholamini, M., Wang, C., Nehrir, H., Hu, X., Hu, Z., Aki, H., Zhao, B., Miao, Z., & Strunz, K. (2022). A Review of Modeling, Management, and Applications of Grid-Connected Li-Ion Battery Storage Systems. IEEE Transactions on Smart Grid, 13(6), 4505–4524. https://doi.org/10.1109/TSG.2022.3188598

RVO. (2024, November 24). Klimaat- en Energieverkenning 2024: klimaatdoel 2030 raakt uit zicht. https://www.rvo.nl/nieuws/klimaat-en-energieverkenning-2024

RVO. (2025, January 21). Wat is netcongestie en wat betekent dit voor uw bedrijf? Rijksdienst Voor Ondernemend Nederland. https://www.rvo.nl/onderwerpen/netcongestie/wat-netcongestie

Scheepers, M., S. Gamboa Palacios, G. Janssen, J. Moncada Botero, J. van Stralen, C. Oliveira Machado dos Santos, A. Üslü, and K. West (2022), Towards a sustainable energy system for the Netherlands in 2050 – Scenario update and analysis of heat supply and chemical and fuel production from sustainable feedstock, TNO report 2022 P10162, Amsterdam.
Shaheen, H. I., Rashed, G. I., Yang, B., & Yang, J. (2024). Optimal electric vehicle charging and discharging scheduling using metaheuristic algorithms: V2G approach for cost reduction and grid support. Journal of Energy Storage, 90, 111816. https://doi.org/10.1016/j.est.2024.111816

Shahzad, K., & Cheema, I. I. (2024). Aluminum batteries: Unique potentials and addressing key challenges in energy storage. Journal of Energy Storage, 90, 111795. https://doi.org/10.1016/j.est.2024.111795

Sijm, J. (2024). Verkenning van toekomstige ontwikkelingen en uitdagingen voor een klimaatneutraal elektriciteitssysteem in Nederland, 2030-2050.

SOJA Edward W., 2010, Seeking Spatial Justice, Minneapolis, University of Minnesota Press.

Somerville, P. (2010). Multiscalarity and neighbourhood governance. Public Policy and Administration, 26(1), 81–105. https://doi.org/10.1177/0952076710368755

Rocco, R. (2023). CENTRE FOR THE JUST CITY. https://just-city.org/team/spatial-justice/

Stedin Groep. (2024). More and more companies are helping to reduce pressure on the electricity grid. Accessed on 30-03-25 via More and more companies are helping to reduce pressure on the electricity grid | Stedin

Stedin Thuis en kleinzakelijk | Stedin. (n.d.). Stedin. https://www.stedin.net/

Stedin. (2024, 4 juni). Onderzoek naar de toepasbaarheid van congestiemanagement voor afname in Maarssenbroek.

Stedin. (2024). Liggingsdata kabels en leidingen. [GIS Layer]. Via https://www.stedin.net/zakelijk/open-data/liggingsdata-kabels-en-leidingen

Stedin. (2025, 4 february). CONGESTIEGEBIEDEN AFNAME PER GEMEENTE IN UTRECHT.

Stedin. (n.d.). Wat is het verschil tussen kleinverbruik en grootverbruik?. Accessed on 01-04-2025 via https://www.stedin.net/zakelijk/klantenservice/veelgestelde-vragen/wat-is-het-verschil-tussen-kleinverbruik-en-grootverbruik

Stedin. (2025, 4 february). CONGESTIEGEBIEDEN AFNAME PER GEMEENTE IN UTRECHT.

Stedin. (2024, 4 juni). Onderzoek naar de toepasbaarheid van congestiemanagement voor afname in Maarssenbroek.

StichtingToegepastOnderzoekWaterbeheer.(2022).RAPPORT2022 49 ACTUALISERING IPO-SCHADETABEL REGIONALE WATERKERINGEN. Kruyt Grafisch Adviesbureau bv.

Straver, K. M., Peter; Middlemiss, Lucie; Hesselman, Marlies; Feenstra, Marielle; and S. Tirado Herrero (2020). “Energiearmoede en de Energietransitie.” TNO.

Sunrays Power. (2019, December 20) How to save money through Solar. Sunrays Power. https://www.sunrayspower.com.au/how-to-save-money-through-solar/

Tenders/find-funding/eu-funding-programmes/just-transition-fund_en

TenneT Holding B.V. (2025). Integrated Annual Report 2024.

TenneT. (2025). Netkaarten. [GIS Layer]. [Link no longer accessible]

TenneT. (n.d.). Full Grids. Accessed on 30-03-2025 via Full grids

Two million European single-family homes could abandon the grid by 2050 Kleinebrahm, Max et al.Joule, Volume 7, Issue 11, 2485 - 2510

THE 17 GOALS | Sustainable Development. (n.d.-b). https://sdgs.un.org/goals

U16. (n.d.). Over ons. Accessed on 03-04-2025 via https://www.energieregioutrecht.nl/over+ons/default.aspx
United Nations. (2025). Causes and Effects of Climate Change. https://www.un.org/en/climatechange/science/causes-effects-climate-change

United Nations. (2025). Causes and Effects of Climate Change. https://www.un.org/en/climatechange/science/causes-effects-climate-change

Vallecha, H., To, L.S. (2024). Community Energy and Community Resilience: A Multi-Dimensional Perspective. DOI: 10.1007/978-3-031-57938-7_2

Van der Steen, M., Otto, M., Hill, R., Oosterloo, S., Ganzeboom, Q., Kuipers, G., Woestenburg, A., Groenleer, M. (2024). Breder denken, anders doen. Nederlandse School voor Openbaar Bestuur.

Vera, M. L., Torres, W. R., Galli, C. I., Chagnes, A., & Flexer, V. (2023). Environmental impact of direct lithium extraction from brines. Nature Reviews Earth & Environment, 4(3), 149–165. https://doi.org/10.1038/s43017-022-00387-5

Veronique. (2022, December 21). What does energy neutral building mean? HOOG.design - Exclusive Living Inspiration. https://www.hoog.design/en/what-does-energy-neutral-building-mean

Voermans, T. (2025). Massaclaim van duizenden bezitters zonnepanelen tegen overheid: ‘Mensen zijn zich dood geschrokken’. Algemeen Dagblad. Accessed on 05-04-2025 via https://www.ad.nl/binnenland/massaclaim-van-duizenden-bezitters-zonnepanelen-tegen-overheid-mensen-zijn-zich-dood-geschrokken~afa2e7e0/?referrer=https%3A%2F%2Fwww.google.com%2F

Wang, H., Du, T., Cao, L., Cheng, Z.-Y., Liu, L.-Y., Wang, Y.-S., & Zhou, L.-F. (2024). Fluorine-doped Na0.65Mn02 with a layer-tunnel structure for high-rate and long-cycle-life sodium-ion cathodes. Journal of Alloys and Compounds, 1003, 175741. https://doi.org/10.1016/j.jallcom.2024.175741

Wang, Q., Mariyappan, S., Vergnet, J., Abakumov, A. M., Rousse, G., Rabuel, F., Chakir, M., & Tarascon, J. (2019). Reaching the Energy Density Limit of Layered 03-NaNi 0.5 Mn 0.5 0 2 Electrodes via Dual Cu and Ti Substitution. Advanced Energy Materials, 9(36). https://doi.org/10.1002/aenm.201901785

Warmteatlas. (2025). Energietopo: Zonnepark. [GIS Layer]. https://www.warmteatlas.nl/geoserver/WarmteAtlas/wfs’ version=’auto’ [link no longer accessible]

Why circularity is key to a sustainable energy transition - Ramboll Group. (n.d.). https://www.ramboll.com/insights/resource-management-and-circular-economy/why-circularity-is-key-to-a-sustainable-energy-transition

Wolbertus, R., Van den Hoed, R., Kroesen, M., Chorus, C. (2021). Charging infrastructure roll-out strategies for large scale introduction of electric vehicles in urban areas: An agent-based simulation study. Transportation Research Part A 148 (2021) 262–285. Doi: https://doi.org/10.1016/j.tra.2021.04.010

Yildiz, Ö., Romme,I J., Debor, S., Holstenkamp, L., Mey, F., Müller, J.R., Radtke, J., Rognli, J. (2015). Renewable energy cooperatives as gatekeepers or facilita tors? Recent developments in Germany and a multidisciplinary research agenda. Energy Res Soc Sci 6:59–73. https://doi.org/10.1016/j.erss.2014. 12.001

Zare Ghaleh Seyyedi, A., Gitizadeh, M., Fakhrooeian, M., & Jabareh Nasero, M. (2025). Achieving the goals of energy arbitrage, peak-shaving, and PV self-consumption using PV-BTM BESS microgrids coupled with a distribution network. Journal of Energy Storage, 112, 115479. https://doi.org/10.1016/j.est.2025.115479

Zhang, L., Huang, S., Ding, Y., & Zeng, T. (2025). Research progress in the preparation of sodium-ion battery anode materials using ball milling. RSC Advances, 15(8), 6324–6341. https://doi.org/10.1039/D4RA08061K

Zhang, R., Lee, M., Huang, L., & Ni, M. (2024). Optimization of battery energy storage system (BESS) sizing in different electricity market types considering BESS utilization mechanisms and ownerships. Journal of Cleaner Production, 470, 143317. https://doi.org/10.1016/j.jclepro.2024.143317

Zheng, Z., Wang, Y., Zhang, Y., Li, X., Zhang, Y., He, Y.-S., Che, H., Li, L., & Ma, Z.-F. (2024). Sodium iron sulfate cathodes with ultra-long cycle-life and high safety for sodium-ion batteries. Nano Energy, 128, 109907. https://doi.org/10.1016/j.nanoen.2024.109907



## News Articles

De Utrechtse Internet Courant. (2019). Dit zijn de meest gemiddelde wijk en inwoner van Utrecht. Via Dit zijn de meest gemiddelde wijk en inwoner van Utrecht | De Utrechtse Internet Courant

De Telegraaf. (12 februari 2025 woensdag). Fors minder zonnepanelen geplaatst op daken van huizen. De Telegraaf.nl. https://advance.lexis.com/api/document?collection=news&id=urn%3acontentItem%3a6F3V-2N13-RRT5-N1HG-00000-00&context=1519360&identityprofileid=Q6FFCK68393.

Van Dijk, J. (2021, May 15). Krapte op het net frustreert energietransitie. Nieuwe Oogst.
Borst, T. (2021, June 15). PBL waarschuwt overheden: sluit ogen niet voor nadelige effecten klimaatbeleid. NRC.nl. https://www.pbl.nl/en/publications/climate-change-measures-and-sustainable-development-goals

Geijp, J. (2023, October 28). Han Fennema ging voorgas en groen. Leeuwarder Courant.

Van den Berg, J. (2024, February 13). Overvol stroomnet leidt steeds vaker tot rechtszaken. De Volkskrant.nl.

Kok, R. (2024, June 4). Deltalinqs-voorzitter: “Netcongestie is showstopper van energietransitie”. Nieuwsblad Transport.nl.

Koos Schwartz. (27 januari 2023 vrijdag). Een topjaar voor zonnepanelen, maar dat vergt veel van het stroomnet. Trouw.nl. https://advance.lexis.com/api/document?collection=news&id=urn%3acontentItem%3a67DK-69V1-DY0X-908P-00000-00&context=1519360&identityprofileid=Q6FFCK68393.

Nederlands Dagblad . (2024, August 17). Industrie raakt achterop door hogere netwerkkosten. Nederlands Dagblad, p. 6.

Dagblad van het Noorden. (2024, September 6). Zorgen bij ondernemers in Meppel over de profielschets van de nieuwe burgemeester. Dagblad van het Noorden.nl.

Martijn Klerks. (23 november 2023 donderdag). Vermogen particuliere zonnepanelen in Utrecht groeit in jaar tijd met 15 procent. De Gelderlander.nl. https://advance.lexis.com/api/document?collection=news&id=urn%3acontentItem%3a69PG-TRX1-JBHV-K0V5-00000-00&context=1519360&identityprofileid=Q6FFCK68393.

Van der Wielen, P., Peeters, J., & Terpstra, D. (2024, December 13). Help! File op het elektriciteitsnet. Eindhovens Dagblad.nl.

Van der Wielen, P., Peeters, J., & Terpstra, D. (2024, December 13). Help! File op het elektriciteitsnet. Eindhovens Dagblad.nl.

(2025, January 9). “Dit is een complexe uitdaging in een dichtbevolkte regio”; Protest vindt gehoor, Oostkamp wil geen windturbine van 235 meter hoog. De Krant van West-Vlaanderen, p. 72.

Lammertse, M. (2025, January 23). Laren en Blaricum ondersteunen inwoners met duurzame keuzes. De Gooi- en Eemlander, p. 10.

Ermstrang, A. (2025, February 1). Bedrijven zoeken “achter de meter” oplossing voor stroomtekort. Reformatorisch Dagblad, p. 6.

Volkskrant Redactie. (2025, February 7). Eigenaren zonnepanelen bereid ze tijdelijk uit te zetten als stroomnet overbelast raakt. De Volkskrant.nl.

Greijn, D. (2025, February 11). Burgemeester weigert kritische inspreker tegen zonnepark: ‘Ze willen geen storende factor’. Brabants Dagblad.nl.

Vinkenborg, R. (2025, February 20). Moegestreden voor Noord: Eva Bollen neemt afscheid van haar Red Amsterdam Noord. De Telegraaf, p. 5.

Besteman, T. (2025, March 11). Oproep om huishoudens extra geld te geven tegen energiearmoede: ‘Er is geen tijd te verliezen’. De Telegraaf.nl.

Besteman, T. (2025, March 12). TNO: Kabinet geef steun aan huishoudens in energiearmoede. Friesch Dagblad.

Thijssen, W. (2025, March 20). Bedrijven op de Spaarpot pakken energievraagstuk aan: “Samenwerking is cruciaal”. BN De Stem.nl.

De Jong, Y. (2025, March 20). ‘Woningzoekende de klos’: Stroombeheerder Liander kan nieuwe woningen niet op net aansluiten. De Telegraaf, p. 20.

Vogelsang, B. (2025, March 25). Massaclaim over zonnepanelen tegen de overheid in aantocht: Boosheid en onbegrip over afschaffen salderingsregeling. De Telegraaf, p. 23.

## National Maps

Production: Warmteatlas. (2025). Energietopo: Grote Stookinstallaties. [GIS Layer]. https://www.warmteatlas.nl/geoserver/WarmteAtlas/wfs’ version=’auto’

Production & Grid: TenneT. (2025). Netkaarten. [GIS Layer]. [Link no longer accessible]

Solar: Rijksdienst voor Ondernemend Nederland. (2024). SDE Projecten. [GIS Layer]. Accessed 03-03-2024 via https://services.arcgis.com/kE0BiyvJHb5SwQv7/ArcGIS/rest/services/SDE_projecten/FeatureServer/2
Consumption: Warmteatlas. (2025). Energietopo: Gemeente Energie Info. [GIS Layer]. https://www.warmteatlas.nl/geoserver/WarmteAtlas/wfs’ version=’auto’

APPENDIXAPPENDIXAPPENDIX
APPENDIXAPPENDIXAPPENDIX
APPENDIXAPPENDIXAPPENDIX

# 9.2 Appendix B

## Interview with SSHXL (social husing corporation)

Speaker 1
00:03 - 00:13
Nee, gewoon meer toevallig. Als het geregeld is, dan ga ik even een link aanmaken. Even kijken hoor. Stop recording.

00:13 - 00:18
Ik denk dat die nu... Ja, helemaal top. En dit is ook...

00:18 - 00:20
Ik ga hier zometeen even dit verwerken en dan...

00:20 - 00:26
Die opname komt ook nergens terecht of zo, maar dat... Dan weet je dat.

00:26 - 00:28
Oké, dan eventjes voor mezelf.

00:28 - 00:31
Niet voor mezelf, maar om te beginnen. Dus van SSH.

00:31 - 00:39
Eigenlijk is het wel leuk, want SSH is een andere organisatie dan de meeste sociale huurorganisaties.

00:39 - 00:43
Dat het vooral studenten zijn. Ja, klopt.

00:43 - 00:50
Maar, als nadat studenten kluismoet studeren, heeft SSH ook doorstrandwoningen. Hoe is dat precies?

Speaker 2
00:54 - 00:57
Ja, we hebben wat aanbod voor starters, zeg maar.

00:58 - 01:01
Maar we zijn wel steeds meer aan het focussen op studentenhuisvesting.

01:01 - 01:04
Eerst hadden we ook al een tijdje ook echt geïnvesteerd in startersbewoningen.

01:04 - 01:07
Dat hebben we wel nog gedaan, omdat sommige fastfood duurt natuurlijk langer.

01:07 - 01:11
Dus dat duurde even voordat dat helemaal gebouwd was.

01:11 - 01:17
Maar in principe is het aanbod bijna allemaal echt studentenhuisvesting met een campuscontract.

01:17 - 01:22
Maar daarnaast inderdaad kun je wel doorstromen naar startersappartementen en die hebben dan

01:23 - 01:25
een contract voor meer onbepaalde tijd.

01:25 - 01:30
Maar we willen eigenlijk zo min mogelijk onbepaalde tijd, omdat je anders je doorstroming natuurlijk niet op gang krijgt.

01:30 - 01:32
Dus dan zit je meer in jongere contracten, heet dat.

01:32 - 01:35
Dus dan mag je dan nog blijven tot 27, 32 uiterlijk echt.

Speaker 1
01:39 - 01:45
Oké, nou ja, top. Wat wij van doen zijn, het is een project aan de TU Delft, maar het is een

01:45 - 01:48
focus op de regio Utrecht.

01:48 - 01:54
En we zijn eigenlijk een soort energie-strategie aan het maken voor de regio en de toekomst,

01:54 - 02:03
met een groot focus op het verhelpen van de problemen van de netcongressie, zodat het elektriciteitsnetwerk vol zit.

02:03 - 02:10
En voor onze tuur gaan we gewoon verschillende verschillende gemeenschappen, van bedrijven tot

02:10 - 02:14
aan mensen in sociale huurwoningen of appartementen.

02:14 - 02:18
En hoe die gemeenschappen elkaar, daar kunnen wij kunnen helpen.

02:21 - 02:22
Dus dat is het een beetje.

02:22 - 02:27
En dan, goed, sommige hebben dan bijvoorbeeld mensen die een koopwoning hebben, die kunnen natuurpanelen hebben.

02:27 - 02:34
Maar mensen die op een studentenkamer wonen, die hebben misschien minder mogelijkheden daartot.

02:34 - 02:42
Dus dit soort interviews zijn we vooral aan het doen om een beetje in het profiel te schetsen van deze verschillende groepen. Wat vinden zij belangrijk?

02:42 - 02:43
Wat zien zij als mogelijkheden?

02:43 - 02:45
En wat kunnen we daarmee doen?

02:46 - 02:51
Wat vindt de gemeenschap zelf belangrijk is een grote vraag in deze energietransitie.

03:03 - 03:08
Aangezien die misschien een wat ander profiel hebben dan werkende mensen in een appartement of een sociaal huur.

03:08 - 03:14
Want hoe komt dat vanuit de studenten richting SSH? Wat willen zij daarmee? Hebben ze vaak kwetsers?

Speaker 2
03:14 - 03:17
Ja, want je vraagt het aan mij.

03:17 - 03:21
Denk het vanuit de gebruiker of dus vanuit ons als woningcorporatie?

Speaker 1
03:21 - 03:25
Nou ja, van wat jullie meekrijgen als woningcorporatie vanuit de gebruikers.

Speaker 2
03:28 - 03:32
Nou, ik denk dat studenten van de ene kant heel erg betrokken zijn.

03:32 - 03:35
Wat ik merk, de contacten die ik heb, zijn ze heel erg betrokken en zijn ze ook heel redelijk

03:35 - 03:42
in dat ze snappen dat het een hele ingewikkelde opgave is om alles vast te kunnen verduurzamen.

03:42 - 03:48
En ze zijn ook wel bezig met kleinere dingetjes, dus het vergronen van een tuin, het willen

03:48 - 03:52
vergronen van daken, het van het gas af willen qua koken.

03:52 - 03:56
Dus dat soort kleine dingetjes zijn ze wel echt mee bezig en blij natuurlijk met de zonnepanelen

03:57 - 04:03
die we leggen en dat soort dingen. blij met het dubbelglas wat ze krijgen als ze dat niet hebben.

04:03 - 04:08
Dus wat ik terugkrijg, ik heb niet zo heel veel contact met huurders hoor, maar is dat ze wel

04:08 - 04:12
enthousiast zijn en wel begrijpen dat het lang duurt, maar dat ook natuurlijk soms wel moeilijk

04:12 - 04:18
vinden, omdat het soms moeilijk is als je in een huis met enkel glas woont, dat dat misschien

04:18 - 04:22
nog even twee of drie jaar duurt voordat je een keer dubbelglas krijgt.

Speaker 1
04:22 - 04:27
En in dezelfde zin ook, want hoe ziet het beleid van het SSH eruit met betrekking tot het verduurzamen van deze woningen?

Speaker 2
04:29 - 04:32
Nou, in principe verduurzamen wij...

04:32 - 04:38
Ja, deels gaat het op projectniveau, dus bijvoorbeeld grote renovatie van gebouwen.

04:38 - 04:42
En deels is het vanuit de natuurlijke onderhoudsmomenten.

04:42 - 04:45
Dus het is eigenlijk altijd vanuit de natuurlijke onderhoudsmomenten, maar soms komt er zoveel

04:45 - 04:48
samen dat je dus een grote renovatie doet en soms doe je het op een kleiner niveau.

04:48 - 04:54
Dus bijvoorbeeld, als er nu geschilderd moet worden, dan gaat het enkel glas eruit en komt er dubbel glas in.

04:55 - 05:06
Dat is een beetje gekoppeld aan dat we zo min mogelijk geld weggooien en zo min mogelijk de investeringen vernietigen, zeg maar.

Speaker 1
05:06 - 05:07
Oké, dus ook het combineren van projecten.

05:07 - 05:10
Als het ene moet gebeuren, dan pakken we het andere aan. Dat soort dingen.

05:12 - 05:18
Oké, en dat staat vooral op isolatie en dual glas.

05:18 - 05:24
Wordt er veel gedaan voor bijvoorbeeld zonnepanelen of een warmtepomp, opslag, van het gas af?

05:24 - 05:28
Dus meer echt die energietransitie op het gebruiksniveau in plaats van op het spaar?

Speaker 2
05:28 - 05:31
Ja, we zitten eigenlijk op alle vlakken hebben we programma's lopen.

05:31 - 05:33
Dus we hebben programma's voor de korte termijn.

05:33 - 05:38
Dat zijn inderdaad zonnepanelen, isolatieglas, Dus in de korte termijn bedoel ik een jaar of

05:38 - 05:41
drie jaar, waar je een sneller effect van hebt.

05:41 - 05:44
Zonnepanelen, isolatieglas en het verwijderen van het kookgas.

05:44 - 05:49
Dus dat wordt dan vervangen door inductiekoken.

05:49 - 05:54
En dat we het EFG labels uitfaseren, dus dat dat allemaal minstens D wordt.

05:54 - 05:55
Dat is allemaal korte termijn.

05:55 - 05:58
Een langere termijn is inderdaad het vervangen van installaties.

05:58 - 06:00
Daar zijn we nu pilots voor aan het draaien.

06:00 - 06:06
En dan vanaf 2028 gaat dat meer vanuit de onderhoudsbegroting gewoon van nature lopen, zeg maar.

06:07 - 06:11
Met het idee dat alles in 2050 volduurzaam is.

Speaker 1
06:11 - 06:16
Oké, dus 2050 is daar een streven voor.

06:16 - 06:20
En hoe zit dat dan nu met, want er zijn natuurlijk veel oude panden, tenminste, vanuit de perspectie

06:20 - 06:22
dat Utrecht veel oude panden in bezit.

06:22 - 06:28
Maar jullie bouwen ook wel eens nieuwbouwwoningen. Klopt, ja.

06:28 - 06:32
Wat is daar, is het daar gelijk 100% duurzaam?

06:32 - 06:35
Of hoe ziet het er bij nieuwbouwwoningen uit?

Speaker 2
06:35 - 06:39
Ja, je hebt natuurlijk heel veel verplichtingen vanuit bouwbesluit en de BANG-regelgeving, dus

06:39 - 06:40
daar zitten we sowieso aan.

06:40 - 06:46
We hebben nu ook nog tot nu toe ook gestreven naar een BREEAM-score met drie sterren, dus ik

06:46 - 06:48
weet niet of je dat tot zegt.

06:48 - 06:54
Maar dat is een gebouwscore voor ook een duurzaamheidscertificaat, wat dan weer onafhankelijk is.

06:54 - 06:56
Maar we weten niet zeker of we daarmee door willen gaan.

06:57 - 07:05
Maar dat gaat eigenlijk over extra verduurzamingsstappen om te zetten bijvoorbeeld.

07:05 - 07:10
Dus bij nieuwbouw zit je vaak sowieso wel goed, omdat je verplichtingen hebt vanuit de wet.

Speaker 1
07:10 - 07:15
Oké. Oké, en dan bij het verduurzamen van die woningen.

07:15 - 07:22
Het lijkt me lastig als je om grote gebouwen of woningen te verduurzamen waar heel veel mensen wonen.

07:23 - 07:28
Clashen de bewoners en de SSH daar wel eens over bepaalde maatregelen of misschien dat ze een

07:28 - 07:30
tijdje naar huis moeten of dat soort dingen.

07:30 - 07:31
Zijn daar negatieve effecten aan verbonden?

Speaker 2
07:33 - 07:37
Nou, we hebben nu bijvoorbeeld dat isolatieverlas gebeurt gewoon in bewoningstaat en dat heeft

07:37 - 07:40
best wel impact, want je ramen zijn dan natuurlijk even uit.

07:40 - 07:43
Eén dag zeg maar, dan gaan ze er weer in.

07:43 - 07:46
Maar bijvoorbeeld zo'n groot, we zijn nu 900 eenheden aan het verduurzamen.

07:46 - 07:48
Dat zijn over drie gebouwen verdeeld.

07:48 - 07:54
Het eerste gebouw hebben we eigenlijk moeten leeg verhuren, omdat dat niet in bewoningstaat verhuurd kon worden.

07:54 - 07:56
Dat heeft best wel wat te mee gebracht.

07:56 - 08:01
Maar nu merk je, nu het eenmaal loopt en de tweede flat gaat nu gebeuren, dat dat gewoon dat

08:01 - 08:07
zij dat gewoon weten dat het eraan zit te komen en meer bekend is, zeg maar.

08:07 - 08:10
Dus het heeft ook wel echt een gewenningsperiode nodig.

08:10 - 08:15
En het is, ja, liefste zouden natuurlijk iedereen willen laten wonen, maar sommige dingen kunnen gewoon niet in bewoningsstaat.

08:15 - 08:18
Dus dat wordt voor ons komende jaar ook wel zoeken, van tot hoe ver kun je gaan?

08:18 - 08:20
En blijft het voor de hurens fijn?

08:20 - 08:24
Of moeten we bijvoorbeeld gaan doorschuiven met woningen om te kunnen verduurzamen?

Speaker 1
08:30 - 08:33
Investeren in duurzaamheidsmaatregelen is natuurlijk kostig.

08:33 - 08:40
Hoe zorgt SSH ervoor dat het niet tot heel veel financiële last voor de bewoners leidt?

Speaker 2
08:41 - 08:47
Ja, dat is natuurlijk een beetje het probleem, dat de verduurzaming vaak niet terug te verdienen is bij kamers.

08:47 - 08:52
Maar er is nu een nieuwe woningwaarderingstelsel voor kamers, waarin je wel verduurzamingsmaatregelen

08:52 - 08:55
vanuit energielabels kunt gaan laten meetellen.

08:55 - 09:00
Dus dat is ook wel iets wat we moeten doen om het betaalbaar te kunnen houden en ook te kunnen blijven nieuwbouwen.

09:00 - 09:06
Kijk, als je dat niet gaat terugverdienen, dan kun je ook weer minder nieuwbouw plegen en krijg je weer minder kamers.

09:06 - 09:07
Dus daar zullen we altijd een balans in moeten zoeken.

09:09 - 09:13
Maar in eerste instantie is het vaak gratis voor de huurder en wachten we totdat een huurder

09:13 - 09:16
bijvoorbeeld verhuist en dan gaat pas die nieuwe huurprijs in.

09:16 - 09:20
Dus heel vaak hebben ze, ook met zonnepanelen voor het leggen, we nu gewoon gratis.

09:20 - 09:26
En daardoor heb je er vooral voordeel van als huurder, want je hebt gewoon minder stroomverbruik

09:26 - 09:28
op je energierekening, omdat je zelf wat opwekt.

09:29 - 09:32
Dus dat is eigenlijk nu heel gunstig.

09:33 - 09:38
We gaan dat wel op een gegeven moment, komt dat dus terug in die energy labels en dan wordt

09:38 - 09:40
dat wel indirect betaald door de huurder.

09:40 - 09:42
Maar dat is ook een probleem hoor.

09:42 - 09:47
Voor alle corporaties, ook als je het wel kan terugvragen, of zeg maar wel in die energy label

09:47 - 09:52
terug laat komen, dan komt het nog niet altijd overeen met wat je investeringskosten zijn.

09:52 - 09:55
Dus het is nu gewoon voor corporaties gewoon een grote kost om in te...

09:55 - 09:56
Ja, het kost gewoon geld.

09:57 - 10:00
En dat is het moeilijke met duurzaamheid.

10:00 - 10:06
Je kan er bijna geen rendement aan hangen en het is niet een soort winst-verlies model wat je kan maken.

Speaker 1
10:07 - 10:14
Ja, maar dus als bijvoorbeeld zonneplein, hoewel bewoners niet per se worden, de kosten worden

10:14 - 10:19
nog niet op zich gehaald, maar zij hebben wel het voordeel van een lagere energierekening?

Speaker 2
10:19 - 10:19
Ja.

Speaker 1
10:19 - 10:23
Of is dat dan wat, dat wordt.

Speaker 2
10:23 - 10:25
Dan wel doorberekend, laten we zeggen?

10:25 - 10:27
Nee, wij leggen ze gewoon neer, ze gaan werken.

10:28 - 10:35
En je hebt een voorschot met één elektriciteitsverbruik en daar gaan die zonnepanelen opbrengst gewoon vanaf, zeg maar.

10:35 - 10:39
Dus zij hebben gewoon al het voordeel wat die zonnepanelen opwekken.

10:39 - 10:44
Ook met wat er gesoldeerd wordt enzo nu nog.

10:44 - 10:47
En wij betalen gewoon voor het leggen van die zonnepanelen.

10:47 - 10:49
Dus het is gewoon gratis geld.

Speaker 1
10:50 - 10:53
Ja, oké. Het is goed dat je het leuk zegt over het salderen.

10:53 - 11:00
Want dat is natuurlijk, de situatie waarop wij nu leggen dat het is dan voor, dat is dus niet

11:00 - 11:01
zakelijk, neem ik aan, als bewoners.

11:01 - 11:06
De salderingsregeling is daar geldig voor, neem ik aan.

11:06 - 11:07
Maar dat gaat in 2027, gaat het weg.

11:07 - 11:11
Hoe kijken jullie daar tegenaan?

Speaker 2
11:14 - 11:17
Ja, ik weet dat er nu heel veel ophef over is, maar ik snap hem eigenlijk niet zo heel goed.

11:17 - 11:21
Want kijk, als je natuurlijk veel te veel panelen neerlegt en het ziet als een verdienmodel

11:21 - 11:27
om op zoiets te gaan verdienen, ja, dan ben je sowieso denk ik een beetje kwijt waar het echt om gaat.

11:27 - 11:34
Maar ik denk ook, ja, wij leggen gewoon panelen neer die voor het huishouden te gebruiken zijn. Ja, of...

11:34 - 11:39
Dus je moet gewoon zorgen, denk ik, dat je zoveel mogelijk zelf gebruikt en zoveel mogelijk zelf opwekt.

11:39 - 11:43
Dan maakt het niet zoveel uit natuurlijk, want dan gaat die salderingsregeling vooral over het

11:43 - 11:48
stroom die je teveel opwekt en dan teruglevert aan het net en daar krijg je weer geld voor.

11:48 - 11:51
Ja, in principe hebben wij...

11:51 - 11:55
Kijk, we hebben of grote complexen met een klein dak, want die zijn vaak hoog.

11:55 - 11:59
Nou ja, dan heb je lift, dan ben je sowieso al je stroom vaak al kwijt aan die centrale voorzieningen.

12:00 - 12:04
We hebben stadspanden, dat is gewoon een soort woonhuis waar je misschien met acht of tien mensen

12:04 - 12:11
woont, waar misschien ook zoveel zonnepanelen op kunnen, dus dat ben je ook vaak al aan het gebruiken.

12:11 - 12:14
Soms hebben we een heel groot dakoppervlak met wat minder verdiepingen eronder.

12:16 - 12:20
En daar moet je wel iets mee opletten, denk ik, dat je niet veel te veel panelen gaat leggen.

12:20 - 12:22
Want van alle kanten betalen wij ze toch.

12:22 - 12:26
Dus we kijken ook daarna of we dat soort panden dus wat sneller kunnen elektrificeren dan anderen.

12:26 - 12:31
Maar ik denk dat je vooral moet kijken van zorg dat je wel ruim neerlegt die panelen en dat

12:31 - 12:37
je het wel wat overcapaciteit hebt, maar niet dat je natuurlijk gaat leggen om eraan terug te verdienen.

12:38 - 12:40
Je legt het om duurzame energie op te wekken.

12:40 - 12:42
Ik denk dat je het zo moet blijven zien.

Speaker 1
12:44 - 12:51
Dat je zegt inderdaad dat panden waar waarschijnlijk meer overcapaciteit mogelijk is door groot

12:51 - 12:58
dakbedlaag, dat je die bijvoorbeeld eerder van het gas afhaalt om het stroomverbruik omhoog te halen.

12:58 - 13:00
Dit is ook een heel groot deel van het project.

13:00 - 13:02
Het is misschien nog een beetje toekomstmuziek.

13:02 - 13:07
Maar hebben jullie nagedacht om die zonnepanelen te combineren met batterijopslag?

13:07 - 13:11
Dat je dus die stroom tijdens overcapaciteit kan opslaan en dan later op de dag kan gebruiken?

Speaker 2
13:12 - 13:17
Ja, daar zijn we wel mee bezig, want dat speelt ook wel bij sommige gebouwen, vooral bij grootverbruik,

13:17 - 13:20
mogen we al niet terugleveren.

13:20 - 13:25
Daar zit ook geen vergoeding op, maar dat zegt Steling gewoon van het net kan het niet aan.

13:25 - 13:31
Dus er zijn nu, ik denk een pand of twee, drie waar dit speelt.

13:31 - 13:34
En daarvan zijn we eentje aan het verduurzamen en die gaat waarschijnlijk naar een warmtepomp,

13:34 - 13:36
dus die gaat meer stroom verbruiken.

13:36 - 13:38
En daar gaan we een buffervat toevoegen.

13:38 - 13:42
Ik weet niet of je dat wat zegt, maar dat is eigenlijk een warmwatervat waar je dus warmwater in opslaat.

13:42 - 13:44
En dat is eigenlijk een soort batterij-idee.

13:44 - 13:49
Want je slaat natuurlijk dan de stroom die omgezet is in warmwater op.

13:49 - 13:55
En daarvan zijn de eerste berekeningen dat dat interessanter is dan een batterij bijvoorbeeld.

13:55 - 13:59
Anderparts zijn batterijen misschien wel interessant, maar wat ik begrijp van onze technische

13:59 - 14:04
adviseurs is dat een batterij vooral interessant is naderhand als je inderdaad te veel panelen

14:04 - 14:11
hebt gelegd. en je van tevoren dus eigenlijk beter iets meer gericht op het verbruik of toekomstig

14:11 - 14:14
verbruik met verduurzaming je panelen kan neerleggen.

14:14 - 14:17
Dus we kijken er wel naar, maar het is niet een standaard iets of zo.

Speaker 1
14:18 - 14:24
Nee, ja goed. Je ziet inderdaad dat die markt daarvoor nog heel klein is.

14:24 - 14:30
En bijvoorbeeld in een Duitse land waar die salderingsregeling niet is, is die markt heel erg gegroeid.

14:30 - 14:32
En de prijs van de installatie gaat ook naar beneden.

14:32 - 14:37
Dus ik denk misschien in de toekomst is het wel een interessant iets.

Speaker 2
14:38 - 14:39
Ja, het komt gewoon voorbij.

14:39 - 14:43
Natuurlijk naarmate er maatschappelijke vragen over zijn wat nu een beetje speelt.

Speaker 1
14:46 - 14:51
Even kijken. Je zei net aan het begin dat je niet super wil contacten met bewoners zelf.

14:51 - 14:58
Maar ik vroeg me af, is het verduurzamingsbeleid van de SSA, is het van heel grof eenrichtingsverkeer

14:58 - 15:03
van jullie besluiten van dit pand moet dit gebeuren of gaat het wel samen met de bewoners die

15:03 - 15:07
dingen aangeven of die die zeggen van hey kan dit eerder dan dat of zo.

15:08 - 15:10
Is het eenrichtingsverkeer of is het heel erg samen?

Speaker 2
15:11 - 15:15
Nee, het kan wel. Er staat altijd een vraag uit van mensen die mee willen denken.

15:15 - 15:16
Kunnen we dat gewoon doen?

15:16 - 15:20
Maar in de praktijk blijft dat toch wel een beetje weerbarstig, want je hebt gewoon...

15:20 - 15:25
Kijk, een bewoner heeft natuurlijk niet het overzicht over onze hele portefeuille en wat de onderhoudsplanning precies is.

15:25 - 15:30
Maar bijvoorbeeld bij dat isolatieplas hebben we wel in die prioritering wel echt gekeken van

15:30 - 15:34
welke huizen hebben ons gevraagd en hebben eigenlijk een klacht ingediend over de kwaliteit

15:34 - 15:38
van hun klimaat binnen en zo.

15:38 - 15:40
En die hebben we wel ook extra aandacht gegeven op die lijst.

15:40 - 15:42
Dus die zijn wat naar voren gehaald bijvoorbeeld.

15:45 - 15:49
En verder zijn er altijd, we hebben altijd budgetten, bijvoorbeeld kookgaskeukens worden maar

15:49 - 15:52
één keer in de 18 jaar vervangen.

15:52 - 15:57
Ja, als je natuurlijk nu 18 jaar moet wachten tot je van het gas af kan, is wel een beetje lang,

15:57 - 16:01
dus we hebben ook een apart budget om, als je als huis eigenlijk zegt ja, we willen nu al van

16:01 - 16:06
het kookgas af, dan hebben we daar ook ruimte voor.

16:06 - 16:08
Maar ik moet zeggen dat daar dan toch niet superveel verbruik van wordt gemaakt ofzo.

16:10 - 16:16
Er zijn wel wat vragen, maar je merkt vaak toch wel bij studenten, als je dan, dat ken je misschien

16:16 - 16:21
zelf ook, als je dan zelf heel erg iets ervoor moet regelen, dan wordt het vaak wat ingewikkelder.

16:21 - 16:24
Dan denken ze, nou het komt wel een keer en zo erg is het ook niet.

16:25 - 16:29
Kijk, je bent natuurlijk als student gewoon bezig met je sociale leven en studeren en werken

16:29 - 16:30
en al dat soort dingen.

16:30 - 16:34
Dus dan ben je ook nog niet zo bezig met je huis en wat daar precies moet gebeuren.

16:34 - 16:38
Dus we merken vooral bij wat oudere studenten die al werken en ook veel met duurzaamheid bijvoorbeeld

16:38 - 16:42
doen, die komen wat meer met dat soort vragen.

16:42 - 16:47
Dus we nemen ze er wel in mee, maar in the end moeten we wel echt kijken naar waar zitten de

16:47 - 16:52
investeringen en wat is de onderhoudsplanning en hoe kunnen we dat het beste combineren?

Speaker 1
16:54 - 16:59
Oké, en je zegt dan dat er bijvoorbeeld voor het vergrassen af dat er een extra budget is...

16:59 - 17:02
...waar dan misschien minder gebruik van wordt gemaakt dan verwacht.

17:02 - 17:07
Denk je dat het dan komt dat het studenten zijn die..... ...dat de studenten er gewoon niet mee bezig zijn?

17:07 - 17:12
Of mist daar de kennis dat dingen mogelijk zijn?

Speaker 2
17:12 - 17:16
Allebei, denk ik. Bij die denk ik allebei.

17:16 - 17:19
Maar ik had bijvoorbeeld deze week een vraag van... ...oh, wij willen graag een groen dak.

17:20 - 17:24
En dat was, dus ik kijk heel snel op Google Maps en er is gewoon een pannendak met hellende daken.

17:24 - 17:26
Ja, daar kan geen groen dak op.

17:26 - 17:30
Dus dat speelt ook natuurlijk wel mee, dat je denkt, oh ja, je weet helemaal niet hoe dat precies

17:30 - 17:34
werkt en dat je dus een platdak moet hebben of in ieder geval een bitumen dak.

17:34 - 17:39
En op het pannendak kun je geen, ja, geen, hoe noem je dat, een morcedem opleggen, zeg maar.

17:40 - 17:44
Dus ik denk dat Intentsie er vaak wel is, maar ze hebben natuurlijk ook als huurder heb je maar

17:44 - 17:46
op kleine schaal echt invloed.

17:46 - 17:50
Ze hebben wel geveltuintjes, budget en je kan niet je tuin vergroenen enzo.

17:50 - 17:54
Dus dat soort acties die worden ook echt wel gedaan hoor.

17:54 - 17:57
En ze zijn super blij dat ze dubbel glas krijgen, dat is natuurlijk wel hartstikke fijn.

17:59 - 18:05
Ik zit op de strategische afdeling en de VRO-teams hebben echt contact met de huurders.

18:05 - 18:13
Ik ben wel in de gebouwen voor de pilots enzo, maar de VRO-teams hebben vooral het contact met

18:13 - 18:15
de huurders, dus dat gaat dan meer via hun.

Speaker 1
18:18 - 18:34
Oké, we hebben één strategie die we in ons project hebben als mogelijke oplossing voor het verduurzamen van dit soort woningen. Dat zijn kleinschalige zonnepanelen.

18:34 - 18:39
Je hebt er één of twee en die kan je aan een balkon vastmaken en die doe je gewoon stopcontact

18:39 - 18:40
en die leveren dan terug.

18:42 - 18:47
Dus stel dus een theoretische situatie waar een huis komt met 20 balkonnen die allemaal naar

18:47 - 18:51
het zuiden gericht staan en we zouden hier graag zonnepanelen willen.

18:51 - 18:57
Als je dan aanvraag binnenkrijgt, wat gaat er dan lopen? Hoe gaat dat?

Speaker 2
18:57 - 19:00
Nou, dit is iets wat niet dan in ons programma zit, dus dat zou iets nieuws zijn.

19:00 - 19:04
Dus dan zouden we even moeten uitzoeken hoe het werkt dat we een zonnepaneel aan een balkon

19:04 - 19:10
bevestigen, want ik weet toevallig dat je geïntegreerde panelen hebt en Kijk, los is altijd

19:10 - 19:15
bij huurhuizen en bij studentenhuizen is nooit slim, want als iets los zit dan raakt het kwijt

19:15 - 19:18
of gaat het snel kapot.

19:18 - 19:20
Dus we zouden dan denk ik liever iets geïntegreerds hebben.

19:20 - 19:23
Ik denk dat we ook liever het op het dak willen hebben.

19:23 - 19:29
Kijk, want als je hem natuurlijk Wat je denk ik ook mist in dit verhaal is dat je als huis...

19:29 - 19:30
Ik denk dan even aan kamers.

19:30 - 19:35
Ik weet niet of jij woont, maar als je in een huis met kamers woont heb je vaak één aansluiting,

19:35 - 19:37
zeg maar, voor je hele gebouw.

19:37 - 19:42
Dus je kan dan niet een paneel aansluiten op je kamer, want je hebt niet een elektriciteitsmeter

19:42 - 19:45
bijvoorbeeld op je kamer zitten, maar voor het hele huis.

19:45 - 19:47
Dus wat dat betreft is het dan slimmer om hem op het dak te leggen.

19:48 - 19:53
Stel je hebt dus niet die kant op het dak maar wel op het balkon, ja dat zou natuurlijk wel interessant zijn.

19:53 - 19:57
Maar dan vraag ik me wel af of dan zou ik hem wel integreren in het balkon denk ik.

Speaker 1
19:58 - 20:00
Ja oké, dat is een goeie.

20:00 - 20:07
En inderdaad wat je zegt dat een meter op elke kamer, ik weet niet of het soort van rendabel

20:07 - 20:14
is, maar dat zou wel misschien helpen in deze individuele duurzaamheidsmaatregelen. Als elke center zelf...

20:14 - 20:20
Stel je voor, ze willen er zelf 500 euro tegenaan gooien en dat dat echt aan een van hun energierekeningen af kan.

Speaker 2
20:22 - 20:25
Ja, maar een meter in zo'n...

20:25 - 20:27
Kijk, want dat is echt wel heel ingewikkeld hoor.

20:27 - 20:29
Want we zijn er zelf ook wel veel mee bezig.

20:29 - 20:34
Maar als jij in een studentenhuis woont, dan heb je natuurlijk ook veel gemeenschappelijke dingen

20:34 - 20:35
die je weer deelt met anderen.

20:35 - 20:37
Dus je hebt nooit alles voor jezelf.

20:37 - 20:40
Dus je zal ook altijd die centrale meter houden.

20:40 - 20:43
En per meter betaal je vastrecht voor je elektriciteit.

20:43 - 20:44
Dus daardoor wordt het snel heel duur voor de huurder.

20:46 - 20:48
De kans dat dat betaalbaarder wordt is best wel klein.

20:57 - 21:00
Beter als je inzicht hebt in je elektriciteitsverbruik om te gaan besparen.

Speaker 1
21:01 - 21:06
Ja. Ja. Oké. Dan als laatste vraag.

21:06 - 21:08
We hebben natuurlijk heel veel dingen opnieuw besproken.

21:08 - 21:17
Zijn er nog andere obstakels die je in dit veld ziet tegen verder verduurzame sociale buurwoningen?

21:17 - 21:19
Die we nog niet besproken hebben.

Speaker 2
21:19 - 21:25
Nou ja, je hebt natuurlijk de standaard dingen, tijd en geld en mensen.

21:25 - 21:29
Want dat is gewoon nu natuurlijk een probleem, om goede mensen te vinden die tijd hebben.

21:30 - 21:36
Dus leveranciers van installaties of bouwkundige aannemers.

21:36 - 21:42
Maar ook bij ons, het is gewoon moeilijk om tijd te hebben bij collega's om nieuwe dingen te doen.

21:42 - 21:44
Dat blijft gewoon in een bedrijf altijd lastig.

21:46 - 21:50
Maar het belangrijkste is dat mensen daar zin in hebben en dat ze weten dat het belangrijk is.

21:50 - 21:54
Dus dat is hier in ieder geval wel al zo.

21:54 - 21:56
En als dat eenmaal zo is, dan kun je ook stappen gaan zetten.

21:56 - 21:57
Dus daar zitten we nu ook een beetje in.

21:57 - 21:59
Maar dan nog, het vastgoed duurt gewoon alles heel lang.

22:00 - 22:03
Dat gaat gewoon jaren overheen voordat je echt ergens bent.

22:03 - 22:09
Dus dat is gewoon het lastige van stenen.

22:09 - 22:10
Ja, het is gewoon traag.

22:12 - 22:13
Ja, dus dat is wel een belemmering.

22:13 - 22:15
En verder kan financiering een belemmering zijn.

22:15 - 22:22
Bij ons valt het gelukkig wel mee, omdat we het ook wat kunnen uitspreiden over de jaren.

22:22 - 22:25
Ja, kennis ook in de markt ontwikkelt best wel snel.

22:25 - 22:30
Inderdaad, netcongressie legt eigenlijk een heleboel stil.

22:30 - 22:36
Maar ik weet ook dat er nu aanpakken moeten komen voor wat meer, ze noemen dat net bewust verduurzamen,

22:36 - 22:41
dus op lokaal niveau wat meer gaan Kijken wat er wel kan.

22:41 - 22:45
Dus ja, ik hoop dat daar wel wat meer richting voor komt eigenlijk.

22:45 - 22:49
Wat we daarmee kunnen doen.

Speaker 1
22:49 - 22:52
Oké, dan ben ik er doorheen. Dankjewel.

22:52 - 22:56
Ik zal deze stop recording...



# 9.3 Appendix C

## Interview with DE Ramplaan Chairman (energy cooperative)

Speaker 1
00:00 - 00:05
Want u zegt dat u sinds 2014 dus al bij de Ramplaan dus actief bent.

00:06 - 00:14
Is dat dus voordat eigenlijk dat zonnedak er daadwerkelijk was ook, toch? Het is in 2015.

Speaker 2
00:14 - 00:17
We hebben een bestuur opgericht, een coöperatie opgericht.

00:17 - 00:20
Of een coöperatie opgericht met het bestuur in 2014.

00:20 - 00:25
En toen zijn we met dat bestuur dus de hele projectfase ingegaan.

00:25 - 00:34
Wat er toegeleid heeft dat we in, ik geloof in augustus 2015, dat zonnedak operationeel hadden.

00:34 - 00:39
Ja, dat is zo de aanloop geweest.

Speaker 1
00:39 - 00:43
Oké. Ik zit even te kijken hoor.

00:44 - 00:48
De volgende vraag ging over...

00:48 - 00:51
Dit is een vraag die gaat wat specifieker over dat paper.

00:51 - 00:56
Maar ik kan me voorstellen dat u daar niet alle ins en outs van weet.

00:56 - 01:07
Maar daar werd gesproken over dat in de implementatiefase van... Ja, van eigenlijk het...

01:07 - 01:17
Dat was volgens mij toen in 2010. 16 dat er weinig vertrouwen was van deelnemers in, ja, dat het allemaal zou werken.

01:17 - 01:21
Hoe zijn jullie daar toen mee omgegaan?

01:21 - 01:31
Zo van mensen die dan niet, ja, zich geneigd voelden om te investeren in eigenlijk het, ja, in het zonnedak.

Speaker 2
01:31 - 01:37
Wij zijn eigenlijk van het begin nog aan hebben we heel erg Gericht op transparantie.

01:37 - 01:40
En heel veel communicatie hebben we gedaan.

01:40 - 01:43
Moet je je voorstellen, dit is een jaren dertig wijk in Haarlem.

01:44 - 01:48
Haarlem ligt natuurlijk een beetje aan de kust.

01:49 - 01:51
En aan de westkant van Haarlem heb je een randweg.

01:51 - 01:55
En deze wijk is eigenlijk een soort eilandje.

01:55 - 01:57
Het is een jaren dertig wijk.

01:57 - 02:00
Het is ook een bovengemiddelde wijk.

02:00 - 02:02
De mensen zijn allemaal wel goed opgeleid.

02:03 - 02:10
In die wijk hebben we een kerkgebouw en dat hebben we vanaf het begin af aan gebruikt als een

02:10 - 02:15
soort plek waar we steeds sessies hielden.

02:15 - 02:26
Dus wat we gedaan hebben is mensen steeds geïnformeerd over de plannen en ook de twijfels en

02:26 - 02:36
de stappen die we daarmee Een van de dingen die je natuurlijk moet doen, dit is een bitumen dak.

02:36 - 02:45
Het is een bollenhal eigenlijk, waar zomers bollen worden opgeslagen, tuinbollen, bloembollen,

02:45 - 02:47
en zwinters wordt daarin getennist.

02:48 - 02:53
En dat is een soort dak waar wat met bitumen is gedaan en dat moest zelf vervangen worden, want

02:53 - 02:55
dat was aan de einde levensduur.

02:58 - 03:02
Ja, dat moest je dus ook doen voordat die panelen erop werden geplaatst.

03:02 - 03:05
Dus we hebben ook gezegd, dat moet gedaan worden.

03:05 - 03:11
En er was natuurlijk ook al best veel zorg als je dan die panelen daarop plaatste.

03:11 - 03:13
Die moeten dan door dat dak, in dat dak geschroefd worden.

03:13 - 03:16
Gaat dat dak dan lekken?

03:16 - 03:21
De constructeur heeft daar een constructie voor bedacht met een soort U-profiel.

03:21 - 03:22
Wat dan op dat dak wordt geplaatst.

03:22 - 03:25
Dat werd afgedekt met bitumen.

03:25 - 03:27
En daarop werden die panelen geschroefd.

03:28 - 03:34
En dat hebben we ook in een van die sessies heel duidelijk door die constructeur laten uitleggen.

03:34 - 03:39
En ja, op die manier hebben we eigenlijk de mensen stap voor stap meegenomen.

03:39 - 03:43
En natuurlijk ook in het financiële verhaal.

03:43 - 03:46
Wat is de investering die ze moeten doen?

03:46 - 03:54
Hoe zit het met, het was een postcode roos project waarbij je gedurende 15 jaar een korting krijgt op je energiebelasting.

03:54 - 04:01
En hoe zit dat met de leverancier waar we de stroom aan verkopen? Het hele fiscale regime.

04:01 - 04:08
Dus we hebben veel gecommuniceerd, zowel in de indiceties als ook in een wijkkrantje.

04:08 - 04:10
Daar hebben we ook in gecommuniceerd.

04:10 - 04:12
Dus dat was eigenlijk onze aanpak.

Speaker 1
04:14 - 04:19
Tijdelijk, oké. Dan de volgende vraag.

04:19 - 04:23
Ik had gehoopt dat hij een beetje hierop aan zou sluiten.

04:24 - 04:28
Ik kan even kijken of er misschien een andere vraag aan kan stellen, met trekking meer hierop.

04:29 - 04:38
Oh ja, want u zei ook dat de wijk toch wel een bepaalde demografie is, dus voornamelijk wel

04:38 - 04:46
hoogopgeleide mensen die dat allemaal wel kunnen investeren, zeg maar.

04:46 - 04:53
Zijn er ook groepen binnen de postcode, dus eigenlijk die die dat bijvoorbeeld niet kunnen.

04:53 - 05:01
En hebben jullie daar ook in bepaalde mate rekening mee gehouden, hoe die dan daar ook in meegenomen zouden kunnen worden?

Speaker 2
05:01 - 05:06
Ja, klopt. Dus zeg maar als je nu kijkt naar het ledenbestand, we hebben ongeveer, dat wisselt

05:06 - 05:13
een beetje door de loop van de jaren heen, maar we hebben gemiddeld zo 200, 210, ergens tussen

05:13 - 05:15
de 200 en 210 leden.

05:15 - 05:24
We hebben het dak dus opgedeeld in, er liggen 1300, ik geloof, 24 zonnepanelen en die hebben

05:24 - 05:27
we opgesplitst in 1604 zonnestroomdelen.

Speaker 1
05:27 - 05:29
Een soort aandelen eigenlijk.

Speaker 2
05:29 - 05:33
Dus je dacht, mensen konden een aandeel kopen.

05:33 - 05:42
De onmiddelde hoeveelheid aandelen zit een beetje tussen de 7-8 deelnemer.

05:42 - 05:50
En de verhouding is ongeveer 60% deelnemers zijn uit deze wijk en 40% uit de omliggende wijken.

05:52 - 05:57
Dus we hebben die wijken, we hebben overal ook met de start over gevlyerd en mensen zijn dus

05:57 - 05:59
ook vanuit die wijken gekomen.

05:59 - 06:04
Wat er kan is dat je een duurzaamheidslening afsluit.

06:04 - 06:09
Dat kon dus toen en dat kan nog steeds bij de gemeente Haarlem.

06:09 - 06:18
En ook bij de, ik geloof dat dat een SVN lening is, dus dat is een lening waarbij je ook tegen

06:18 - 06:26
1% of 1,5%, in ieder geval tegen hele lage rente, je investering kan lenen.

06:26 - 06:34
En dat hebben we ook in een aantal sessies uitgelegd en ook in de communicatie die we deden met flyers.

06:34 - 06:42
Dat is dat als mensen minder financiële middelen hadden, dat je dan ook door dat te lenen en

06:42 - 06:50
dan een terugbetaaltijd hebt van 15 jaar of 20 jaar, dat je op die manier ook prima die investering

06:50 - 06:57
kan doen en dat je rendement gewoon meer is dan wat je uiteindelijk terug moet betalen.

06:58 - 07:06
Dat hebben we ook in plaatjes laten zien en daarmee ook mensen die niet het

07:09 - 07:13
dat ze dat via zo'n lening ook zouden kunnen doen.

Speaker 1
07:13 - 07:18
Oké. En wie verstrekt er dan in dat geval de leningen?

07:18 - 07:21
Dat is dan via de gemeente?

Speaker 2
07:21 - 07:24
Volgens mij via de gemeente, ja.

Speaker 1
07:24 - 07:25
Oké.

Speaker 2
07:25 - 07:29
Ja, dat loopt me de week niet uit mijn hoofd hoor. Het is een SVN-lening.

07:29 - 07:32
Ik denk dat dat via de Bank Nederlandse Gemeente gaat.

07:32 - 07:34
Maar goed, dus er is een...

07:34 - 07:36
Die moet het uiteindelijk financieren, maar dat loopt...

07:36 - 07:38
Je dient een aanvraging bij de gemeente Haarlem.

07:40 - 07:41
Je kan dat ook nu nog steeds doen.

07:41 - 07:48
Als je bijvoorbeeld dubbel glas wilt, of je wilt je dak isoleren, of je wilt duurzaamheidsmaatregelen

07:48 - 07:51
nemen, dan kan je via de gemeente Haarlem die lening aanvragen.

07:52 - 07:54
En dan word je getoetst.

07:55 - 07:58
Je mag dan niet meer dan een bepaald inkomen verdienen.

07:58 - 08:00
En dan kan je dat doen. Duidelijk.

Speaker 1
08:08 - 08:19
Ja, dan mijn volgende vraag was eigenlijk over eigenlijk de ontwikkeling die jullie hebben doorgemaakt over de afgelopen jaren.

08:19 - 08:27
Want de paper waar jullie als case-studie werden gebruikt, dat was natuurlijk uit 2016, 17, uit mijn hoofd.

08:27 - 08:29
Dat is een flinke tijd geleden.

08:32 - 08:38
En daarin stond niet echt iets over hoe de toekomst eruit zag voor de Ramplaan.

08:40 - 08:48
Ja, wat is eigenlijk de ontwikkeling die jullie hebben doorgemaakt op het gebied van... Nee, nu niet.

08:48 - 08:51
Er kwam even iemand binnen.

Speaker 2
08:51 - 08:59
Oké. Wat je ziet, zo'n project dat is best wel een groot ding.

08:59 - 09:06
Je moet leveranciers selecteren, je moet een elektriciteitsproducent, waar je dus je stroom aan gaat verkopen.

09:06 - 09:13
Toen nog moesten we gaan zoeken met allerlei Dat is best een stevige klus.

09:13 - 09:18
En dan zie je eigenlijk, je moet natuurlijk bewoners zien te mobiliseren.

09:18 - 09:20
Je moet veel communicatie doen.

09:20 - 09:23
Mensen moeten uiteindelijk wel lid worden.

09:23 - 09:24
Die coöperatie moet je oprichten.

09:24 - 09:30
Dus die eerste 1, 2 jaar was echt wel flink doorwerken.

09:30 - 09:32
Om je een idee te geven.

09:32 - 09:38
Daar was ik en ook de andere bestuursleden toch wel Nou, gemiddeld één dag in de week.

09:38 - 09:40
En dat was allemaal natuurlijk vrijwilligerswerk.

09:40 - 09:42
Dat deden we vaak dan s'avonds of in het weekend.

09:42 - 09:47
Maar zeg maar zes, zeven uur per week was je daar wel mee bezig.

09:47 - 09:54
Op een gegeven moment zie je dat die installatie staat. We gingen leveren.

09:56 - 10:00
Na die periode kom je eigenlijk in een hele stabiele, wij noemden dat steeds steady state.

10:01 - 10:08
Dan moet natuurlijk onderhoud gedaan worden aan de installatie. Wij hadden een onderhoudscontract.

10:08 - 10:15
Dus één keer per jaar gaat iemand van die firma het dak op en kijkt of de panelen netjes erbij liggen.

10:15 - 10:20
En dan moest er een keer wat aangedraaid worden en soms ging er wat roesten.

10:20 - 10:25
Maar we hebben continu monitoring van de opbrengst van die panelen.

10:25 - 10:27
Dat zag er eigenlijk allemaal prima uit.

10:27 - 10:32
We hebben eigenlijk tot, moet ik eerlijk zeggen, 1,5 jaar geleden.

10:33 - 10:42
En dan gaat het vooral over de winst die je maakt. Je verkoopt de stroom.

10:43 - 10:46
In dit geval deden wij dat in Greenchoice.

10:46 - 10:49
Dus daar krijg je een opringste van.

10:49 - 10:53
En dan moet je uiteindelijk besluiten met de coöperatie in een ALV.

10:54 - 11:01
Ga je al die opbrengsten uitkeren aan de leden of wil je nog wat bewaren voor een soort potje, een voorziening of reserve?

11:01 - 11:06
Nou, dat wordt één keer per jaar aan de aanleiding van de jaarrekening bepaald.

11:06 - 11:09
Maar dat ging allemaal redelijk stabiel.

11:10 - 11:15
En wat we wel nu, dat was aan de aanleiding van het feit dat op een aantal plekken dit soort

11:15 - 11:25
zonnedaken, dat daar brand was ontstaan. hebben verzekeraars de inspectie van dat soort zonnedaken

11:25 - 11:27
op een hoger plan gezet.

11:27 - 11:29
Bij ons is dat een scope 12.

11:29 - 11:33
Misschien hebben jullie het al gehoord.



11:33 - 11:42
Dat is een specifieke inspectie voor zonnedaken of zonnelijden.

11:42 - 11:51
En wat bij ons is gebleken is dat door voortschrijdend wet- en regelgeving, is met name de opstelling

11:51 - 11:59
van de omvormers, zoals die destijds is gedaan, is niet meer conform de huidige stand der techniek

11:59 - 12:03
en ook qua wetgeving, met name armotechnisch.

12:03 - 12:04
Dus daar moet een behoorlijke...

12:04 - 12:10
En de vraag is, is het ook brandgevaarlijk?

12:10 - 12:14
Nou, daar zijn de deskundigen het niet allemaal over eens.

12:14 - 12:20
Maar het feit is dat wij nu zo'n scope 12 inspectie hebben gekregen met een aantal afwijkingen.

12:20 - 12:23
Die moesten we natuurlijk melden aan onze verzekeraar.

12:23 - 12:30
Dus die zegt, dan ga ik het niet verzekeren, want dan moet je eerst die dingen oplossen.

12:30 - 12:38
Dus die heeft ook het eigen risico verhoogd totdat we deze maatregelen hebben uitgevoerd.

12:39 - 12:45
Dat zullen jullie ook wel weten uit jullie kennis van deze projecten.

12:46 - 12:48
De business case is heel marginaal.

12:48 - 12:56
Je wordt er niet rijk van als deelnemer. Dit zijn behoorlijke kosten.

12:59 - 13:04
Nou, €25.000, €30.000 om die maatregelen uit te voeren.

13:04 - 13:12
Dus dat betekent dat we nu dit jaar en waarschijnlijk volgend jaar minder kunnen uitkeren aan de leden als rendement.

13:12 - 13:17
En dan moeten we partijen zoeken die dat soort maatregelen gaan nemen om dat te fixen.

13:18 - 13:25
Dus ja, dat is dan iets wat ons nu als bestuur bezighoudt.

13:25 - 13:31
Dat gaan we natuurlijk ook oplossen.

13:31 - 13:36
De firma die het onderhoud deed vanaf het begin, die is inmiddels wel overgenomen door een andere partij.

13:36 - 13:39
Die partij zegt, wij doen alleen maar grote.

13:39 - 13:46
Toen waren wij een groot project, maar inmiddels heb je natuurlijk heel veel meer grote zonneweides.

13:46 - 13:47
Dus zo groot zijn we niet meer.

13:48 - 13:54
Dus die zei, ja, dit is allemaal te klein voor ons, dus wij moeten nu een nieuwe partij voor onderhoud vinden.

13:54 - 14:02
Dat zijn meer wat reguliere beheerstaken die er zijn.

14:02 - 14:08
Een keer in de drie jaar doen we ook een soort review op onze energieleverancier.

14:08 - 14:13
Willen we nog steeds aan deze partij leven of zijn er andere partijen in de markt?

14:13 - 14:14
Dus dat is een beetje...

14:15 - 14:17
Ja, wat je nu doet.

14:17 - 14:21
Maar het is echt wel ander werk dan toen het project werd opgezet.

Speaker 1
14:21 - 14:22
Ja, ik kan me voorstellen inderdaad dat.

Speaker 2
14:22 - 14:30
Dat wel... En een ander ding, die postcode rood regeling die is dus voor 15 jaar.

14:30 - 14:36
Dus deelnemers krijgen gedurende 15 jaar een korting op die energiebelasting.

14:36 - 14:41
En na die tijd hebben die panelen nog steeds wel opbrengst.

14:43 - 14:47
Alleen het grote voordeel voor de leden wordt minder.

14:47 - 14:52
Maar goed, je moet het zo zien, de mensen die vanaf het eerste begin hebben deelgenomen, die

14:52 - 14:56
hebben ongeveer in zeven jaar tijd hun investering terugverdiend.

14:56 - 15:02
Dus ja, inmiddels als je dat gedaan hebt, dan heb je nu alleen maar het voordeel.

15:02 - 15:09
Maar goed, na 15 jaar, dus in 2030 vervalt die teruggave energiebelasting en dan is het voordeel

15:09 - 15:10
wat je hebt dus nog

15:14 - 15:21
van de elektriciteit. Dus een van de dingen waar we ook over na aan het denken zijn is, hoe gaan we daarna verder?

15:21 - 15:27
Want starten met zo'n project is één, maar ja, straks is het 2030.

15:27 - 15:29
Hoe ga je dat er dan weer afhalen?

15:29 - 15:31
Want dat dak moet een keer weer vervangen worden.

15:32 - 15:35
Of ga je die elektriciteit verkopen aan de eigenaar?

15:35 - 15:37
Want we hebben nu een recht van opstalkonstructie.

15:38 - 15:41
Ja, dat zijn de dingen waar we ook nu... Of ga je...

15:41 - 15:42
Maar goed, misschien kom je daar nog wel op.

15:42 - 15:49
Wil je de elektriciteit die je opwekt ook achter de meter gebruiken voor de eigenaar van het pand?

15:49 - 15:55
Of ga je een soort constructie bedenken dat je die elektriciteit gebruikt voor het zonnewarmtenet,

15:55 - 15:57
wat ook elektriciteit nodig heeft?

15:57 - 15:59
Of kan je het opstaan in een batterij?

15:59 - 16:05
En dan ga je het niet meer aan Greenchoice leveren, maar ga je het local for local inzetten voor de wijk?

16:06 - 16:11
Ja, dat zijn dingen waar we natuurlijk wel mee willen gaan werken.

Speaker 1
16:11 - 16:21
Ja, precies. Want dat is inderdaad vanaf 2020 volgens mij toch al, dat dan inderdaad die regeling

16:21 - 16:29
ingaat dat het gewoon niet meer voor veel mensen wel het incentive van het investeren in zonne-energie

16:29 - 16:31
een beetje weggaat, zeg maar.

Speaker 3
16:31 - 16:33
Ja, dat is toch wel een andere...

16:44 - 16:47
Want gaat dat een rol spelen in dit project?

16:47 - 16:54
Of misschien als je een soort gelijkverjaard nieuws zou beginnen, met een soldeeringsregeling?

Speaker 2
16:54 - 16:57
Nee, want kijk, dit is dan een postcoderoos project.

16:59 - 17:06
Dat is inmiddels ook, ik geloof dat dat drie of vier jaar geleden is, is die regeling ook alweer aangepast.

17:06 - 17:08
Maar het zijn echt twee verschillende dingen.

17:08 - 17:13
Dus je hebt echt die nieuwe regeling, dat is op basis van ISDA-subsidie.

17:14 - 17:15
Dus het is echt subsidie.

17:15 - 17:25
Die salderingsregeling is nog steeds, maar straks was, voor particulieren die dus echt op hun eigen dak elektriciteit opwekken.

17:25 - 17:32
En dit zijn echt collectieve regelingen

waarmee je dus dat soort collectieve projecten vanuit

17:32 - 17:37
de overheid op die manier subsidieert.

17:39 - 17:44
En dus het verschil, die postcode roosregeling, was er eigenlijk de rekening waarbij je dus

17:44 - 17:53
over de looptijd van het hele project, middels die verlaging van de energiebelasting, zeg maar een voordeel krijgt.

17:53 - 18:00
En tegenwoordig zijn dat soort projecten niet meer op die manier gesubsidieerd, maar krijg je

18:00 - 18:03
bij de inleg al je voordeel.

18:03 - 18:05
Dus dan word je op die manier tegemoet gekomen.

Speaker 1
18:12 - 18:13
Ik zit even te kijken hoor.

18:13 - 18:24
Volgens mij zijn al heel veel vragen ook tussendoor al beantwoord eigenlijk, zonder dat we daar specifiek naar hebben gevraagd. Even kijken hoor.

18:24 - 18:33
Wessel, jij had ook nog een paar vragen. Even kijken hoor.

18:38 - 18:42
Oh ja, deze vind ik ook nog wel interessant.

18:42 - 18:51
Bij de oprichting, met welke bestuurlijke organen zijn jullie eigenlijk vooral in aanmerking mee geweest?

18:51 - 18:57
En wie hebben er het meeste invloed gehad, zeg maar, om het...

18:57 - 19:05
Ja, wie hebben het het meest beperkt of het meest geholpen in het opzetten van deze coöperatie eigenlijk?

Speaker 2
19:08 - 19:14
Nou ja, kijk, we hebben in het begin met de gemeente, de gemeente Haarlem.

19:14 - 19:22
Die had, daar hadden we hele goede contacten mee en die wilde dit ook heel graag realiseren.

19:22 - 19:33
Dus die hebben zowel qua, die hebben middelen beschikbaar gesteld, wat budget, want je hebt toch geld nodig.

19:33 - 19:37
Wat ik al in het begin zei, je moet af en toe van die avonden organiseren, je moet wat flyeren.

19:38 - 19:43
Je moet statuten oprichten, je moet naar de notaris, dus dat kost allemaal wel wat geld.

19:44 - 19:46
Dat zijn geen honderdduizenden euro's.

19:46 - 19:53
Maar de gemeente heeft geld beschikbaar gesteld en moet uiteindelijk ook positief hier tegenover staan.

19:53 - 19:58
Want het helpt enorm als je dus in dat soort avonden ook kan zeggen, de gemeente staat hier

19:58 - 20:05
achter en bij de opening van het dak was ook de wethouder, die heeft zijn lintje nog geknipt

20:05 - 20:06
of die heeft een plakkette onthuld.

20:07 - 20:11
Ja weet je, dat is natuurlijk fijner als je het zo kan doen dan wanneer je die support niet hebt.

20:11 - 20:16
Dus de gemeente heeft ons heel erg daarin gesupport.

20:16 - 20:25
Verder hadden we eigenlijk in de wijk een aantal mensen, als je vraagt bestuurlijk niveau.

20:25 - 20:32
We hebben met een advocaat, die heeft ons enorm geholpen om de statuten ook voor te bereiden.

20:34 - 20:40
samen met de eigenaar van het pand, zo'n opstalovereenkomst op te stellen.

20:40 - 20:50
En in de wijk zit ook een notariskantoor, dus die heeft ons daar ook in geadviseerd.

20:50 - 21:01
En verder was er in het begin van deze regeling nog wat onduidelijkheid over de over de BTW, over die panelen.

21:02 - 21:14
Dus we hebben ook op fiscaal niveau veel contact gehad, maar dat was dan vooral met een belastingadvieskantoor

21:14 - 21:19
hoe we met de BTW op deze zonnepanelen moesten omgaan.

21:19 - 21:24
En dat zat vooral over een stukje onduidelijkheid in de wet- en regelgeving.

21:24 - 21:30
En in het kader daarvan hebben we ook nog wel een keer wat Tweede Kamerleden gemobiliseerd,

21:30 - 21:35
omdat er dan op een gegeven moment een keer gestemd werd over deze regeling.

21:35 - 21:45
En dan moet je denken, tegenwoordig, ik weet niet of jullie dat kennen, heb je een belangvereniging, dat is Energie Samen.

21:45 - 21:54
Dat is een belangvereniging voor alle collectieve zonneprojecten, collectieve windprojecten, collectieve warmteprojecten.

21:54 - 22:00
Dat is nu een grote organisatie. waar al dit soort projecten bij aangesloten zijn.

22:00 - 22:02
En daar zit heel veel kennis.

22:02 - 22:05
Daar hebben ze nu standaard statuten.

22:06 - 22:11
Als je iets wil, recht van opstand, dan download je van hun pagina, van hun site.

22:11 - 22:12
Maar dat was het toen allemaal nog niet.

22:12 - 22:14
Dat stond echt in de kinderschoenen.

22:15 - 22:20
Dus wij waren daar ook een van de pioniers die dat heeft voorzien van input, zeg maar.

22:23 - 22:31
Maar goed, er was wel al zo'n belangenvereniging, die stond een beetje in de kinderschoenen.

22:31 - 22:37
Maar we hadden ook wel met hun en met een aantal andere projecten, eentje in Eindhoven, hadden we veel contact.

22:37 - 22:49
Met name om dit soort, ja, zo'n BTW-regeling, om daar te uit te zoeken hoe dat zat en hoe we daarmee verder konden gaan.

Speaker 1
22:51 - 23:00
Oké, oké, duidelijk. En hadden jullie ook nog, met het aansluiten van die zonnepanelen, welke

23:00 - 23:05
rol heeft de netbeheerder daarin eigenlijk gespeeld, die vooral...

Speaker 2
23:07 - 23:08
Liander, Liander had er ook contact mee.

23:09 - 23:17
Want er was ook inderdaad de vraag, wat voor type aansluiting je dan nodig hebt.

23:17 - 23:19
Dat hadden wij nodig vanwege de capaciteit.

23:19 - 23:28
Dus daar moest ook nog een kabel getrokken worden waar de elektriciteit via de omvormer dan

23:28 - 23:31
moest aangesloten worden op het net.

23:31 - 23:37
En dan gaat het ook over waar zit dan de meter.

23:37 - 23:45
Dit is natuurlijk een gescheiden systeem van de elektriciteit van die tennishal.

23:46 - 23:54
Dus dat stukje daar hebben we ook met Liander toen heel veel contact over gehad. Klopt, ja.

Speaker 1
23:54 - 24:09
Oké. Dan daarop aansluitend, in onze case in Utrecht die we nu hebben, daar in Utrecht is eigenlijk het gist echt overbelast.

24:09 - 24:14
En dat heeft veel implicaties voor grote grootspruikzaansluitingen in de regio.

24:15 - 24:25
Ik vroeg me af, is dat in Haarlem ook momenteel iets wat speelt en heeft dat implicaties voor jullie dan ook nog?



Speaker 2
24:25 - 24:32
Nee, in Haarlem zitten wij nog net in een wat luxere positie.

24:32 - 24:34
Dus dat moet ik even goed zeggen hoor.

24:34 - 24:40
Volgens mij het middenspanningsnet in Haarlem en ook in onze wijk, daar is nog ruimte.

24:40 - 24:44
Dus wij zitten nog niet in het Oranje of rood.

24:44 - 24:46
Tenminste, dat was anderhalf jaar geleden hoor.

24:46 - 24:48
Ik weet niet hoe dat inmiddels is.

24:48 - 24:52
Maar, dus wij zitten nog in een...

24:52 - 24:58
Nou, bij ons zitten we nog in een gunstigere positie. Ja, klopt.

Speaker 1
24:58 - 25:00
Oké, gelukkig.

Speaker 2
25:00 - 25:05
Ja, zeker. Want ook in het noorden van Noord-Holland, daar zit het ook al helemaal vol.

25:05 - 25:09
Dus wij hebben een mooie situatie hier, dat er nog ruimte is.

Speaker 1
25:12 - 25:22
Oké, even kijken. Heb jij nog een vraagwissel?

25:22 - 25:24
Ik zit even te kijken.

Speaker 3
25:24 - 25:29
Ja, ik zit even door je lijst te kijken.

25:29 - 25:34
Ik zie misschien niet per se op het project zelf meer je ervaring met dit soort projecten. Denkt u dat

25:37 - 25:43
Ja, wij zijn natuurlijk bezig met het batterijopslag, wat een probleem of een oplossing hopelijk

25:43 - 25:49
is over het hele land, waar natuurlijk ook met netbelasting overal speelt.

25:49 - 25:56
Denkt u dat dit soort community-based energieprojecten een oplossing kunnen zijn overal in het land?

25:56 - 26:05
Of moet er een hele specifieke samenstelling van mensen en motivatie en gemeenten die meewerken

26:06 - 26:09
mogelijk zijn om dit project succesvol te laten zijn?

26:09 - 26:16
Of kan het ook, door van widespread genoemd worden, dat het in zijn hele land te pasbaar is?

Speaker 2
26:16 - 26:22
Ja, kijk, weet je, als je het mij vraagt, ik denk dat je, als je naar de toekomst kijkt, dat

26:22 - 26:33
je moet primair zorgen dat bewoners, dus huizen zelf, zoveel mogelijk off-grid zijn. Dus qua elektrificatie.

26:33 - 26:36
Dus uiteindelijk heb je straks geen gas meer of whatever.

26:36 - 26:41
Er zullen de hele van Nederland zijn die misschien op waterstof gaan of whatever, maar een groot

26:41 - 26:45
deel zal op elektriciteit al moeten gaan verwarmen.

26:45 - 26:51
En dan moet je zorgen dat alle huizen zoveel mogelijk dat stand-alone kunnen doen.

26:52 - 26:59
Als dat niet kan, dan ga je met de buren uitwisselen.

26:59 - 27:07
Als mijn buurman de wasmachine aanzet en ik heb stroom over van mijn panelen, dan gaat hij naar de buren.

27:07 - 27:10
En zo ga je steeds verder kijken.

27:10 - 27:17
En dan vervolgens, als dat op buurt- of op straatniveau niet kan, dan ga je dat in de wijk doen.

27:18 - 27:20
En wat jullie al zeiden, dan krijg je een buurtbatterij.

27:22 - 27:28
Waarbij nog steeds een dag-nachtverschil overbruggen is wel even wat anders dan een seizoen overbruggen.

27:28 - 27:30
Maar goed, dat weten jullie ook.

27:30 - 27:38
Dus de vraag is, hoe ga je de periode van, zeker december, januari, februari, wanneer er weinig

27:38 - 27:45
zon is, niet altijd veel wind, hoe ga je dat overbruggen met batterijen?

27:45 - 27:50
Want die technologie moet ook nog verder ontwikkelen.

27:51 - 27:54
Maar ik geloof heel erg in dat je het op die manier gaat opbouwen.

27:54 - 28:02
En dan helpt het natuurlijk aan dat wet en regelgeving op landelijk niveau die ruimte biedt.

28:02 - 28:03
Want in België kan het al.

28:03 - 28:07
Daar kan je al naar je buren elektriciteit leveren.

28:07 - 28:10
Het is gewoon een kabeltje trekken.

28:10 - 28:11
Hoe moeilijk kan het zijn?

28:11 - 28:17
Maar in Nederland mag het niet. Zo moet je gaan.

28:17 - 28:18
En de technologie is er.

28:20 - 28:26
Er zijn allemaal appjes voor en er zijn energiemanagementsystemen die het nu ook al van een huis kunnen.

28:26 - 28:28
Dus die kunnen het ook van twee huizen.

28:28 - 28:31
We hebben hier een blok van vier huizen.

28:31 - 28:38
Hoe moeilijk moet het zijn om daar je elektriciteitsvraag en gebruik op elkaar af te stemmen?

28:38 - 28:42
Wat ik al zei, ik heb nu een dynamisch contract.

28:42 - 28:43
Ik doe dat nu zelf.

28:43 - 28:45
En dan heb ik nog apparatuur die wat ouder is.

28:47 - 28:50
Ik kan mijn wasmachine en mijn vaatwasser niet op afstand bedienen.

28:50 - 28:54
Maar ja, als je nu tegenwoordig een vaatwasser koopt, dan kan ik dat wel.

28:54 - 28:59
Dus de techniek is er, de technologie is er. Alleen dus de wetgeving.

28:59 - 29:03
Dus ik denk A, landelijke wetgeving moet daar echt...

29:03 - 29:06
En de EU-wetgeving biedt de mogelijkheid al.

29:06 - 29:10
Dus Nederland moet echt daarin stappen zetten.

29:10 - 29:17
En dan helpt het natuurlijk ook dat gemeentes en netbeheerders daar ook in faciliteren.

29:17 - 29:22
Want als die daarin gaan moeilijk doen, dan schiet het ook niet op.

29:22 - 29:29
En als dat soort dingen in beweging komen, dan gaan aanbieders, dan gaan batterijen natuurlijk

29:29 - 29:35
ook goedkoper en makkelijker en slimmer en zo ernstig worden.

29:35 - 29:37
Iedereen zit daar ook duidelijk op elkaar te wachten.

29:38 - 29:46
Dus ja, ik denk landelijke wetgeving zo snel mogelijk invoeren, gemeentes daarin faciliteren, netbeheerders daarin mee.

29:46 - 29:49
Ja, dan kunnen we daar echt enorme stappen zetten.

29:50 - 29:52
En ik denk echt, als je mij vraagt hoe ziet dat eruit?

29:53 - 29:55
Nou, ik geloof heel erg in communities.

29:59 - 30:12

Dit is dan wel een bijzondere wijk, maar we hebben in Haarlem ook met andere buurten daarover contact op gemeentelijk niveau. Dat gebeurt overal.

30:12 - 30:15
Mensen willen dat ook wel.

30:15 - 30:19
Die willen niet meer afhankelijk zijn van allemaal grote partijen.

30:19 - 30:22
Je ziet wel een tendens.

30:22 - 30:30
Als je dat zelf betrouwbaar en ook met elkaar kan doen, dan is dat zeker iets wat de toekomst heeft hoor. Absoluut.

30:30 - 30:33
Zowel qua elektriciteit als qua warmte dus.

Speaker 3
30:34 - 30:39
Ja, jazeker. En dan de laatste vraag wat van mij kan.

30:39 - 30:44
In het wetenschappelijk artikel wat wij hadden gelezen, ik weet niet zo goed hoeveel je daarbij

30:44 - 30:51
bekend bent, werd zeggen dat de schaal van Raamplan ongeveer 1000 huishoudens was.

30:51 - 30:57
Ik hoor hier net 210 leden zeggen, dus misschien dat daar Maar ik vroeg me vooral een beetje

30:57 - 31:06
af van wat denkt u als de schaal van zo'n energieproject of veel kleiner of veel groter zou zijn dan Raamplan?

31:06 - 31:13
Wat de impact is op het opzetten van zo'n bestand, van zo'n initiatief, maar ook het langdurige bestuur daarvan.

Speaker 2
31:15 - 31:21
Ja, kijk, weet je, je moet echt zo zien of je nou een, wij hebben dan een dak, nee klopt, dit

31:21 - 31:26
dak kan niet de hele wijk van stroom voorzien, want daar is het eigenlijk nog te klein voor,

31:26 - 31:30
terwijl het dus in die periode nog best een groot project was.

31:30 - 31:36
Maar als je nou een, ja, heb je een dak van honderd panelen of bij ons van dertienhonderd panelen,

31:36 - 31:39
ja, het werk wat je moet doen is vergelijkbaar.

31:40 - 31:48
Dus in dit soort situaties, hoe groter je een dak kunt hebben of een zonneweide of een veld,

31:48 - 31:52
wat heb je tegenwoordig niet, of een windmolen, hoe beter.

31:52 - 31:57
Want ja, de hoeveelheid werk en het mobiliseren.

31:57 - 31:59
Kijk of je nou voor...

31:59 - 32:02
Wij gingen hier ook foldertjes in de bus doen, flyers.

32:02 - 32:07
Ja, dan doe je toch duizend woningen, dan doe je een flyer erin.

32:07 - 32:10
Als er dan maar 200 mensen lid kunnen worden of duizend.

32:11 - 32:17
Ja, je moet duizend keer leden over rekomst printen of downloaden.

32:17 - 32:23
Je moet hem één keer maken en of je het over 200 of 1000 doet, dat is niet zo heel veel extra werk.

32:23 - 32:26
Dus in al die dingen, hoe groter, hoe beter.

Speaker 1
32:27 - 32:38
Oké, duidelijk. Even kijken, ik denk dat dat wel redelijk alle vragen waren al.

Speaker 2
32:39 - 32:40
Oké.

Speaker 1
32:44 - 32:51
Ja, ik zit ze heel even nog door te nemen, om te kijken of er nog iets is wat we missen.

Speaker 3
33:01 - 33:04
Volgens mij zijn we er wel doorheen.

Speaker 2
33:04 - 33:06
Ja, dat denk ik eigenlijk ook al.

Speaker 3
33:06 - 33:09
Ik heb heel veel aantekeningen in Word Documents, dat is mooi.

Speaker 2
33:11 - 33:16
Ik heb nog een vraag voor jullie, want inderdaad met die batterijen, hoe zien jullie die ontwikkeling?

33:16 - 33:22
Kan je daarmee ook winter-zomer overbruggen? Hoe gaat die technologie?

Speaker 3
33:22 - 33:29
Nee, ik ben inderdaad bang dat het toch wel echt de volgende stap wordt in de energietransitie.

33:29 - 33:32
Ook bij ons project zijn we wel heel erg afgebakend van

33:38 - 33:44
Je hebt van de piekdag ergens in juli, waar het het makkelijkst is en hoe meer batterijen, hoe

33:44 - 33:49
meer dagen je van tevoren en daarna kan opslaan.

33:50 - 33:58
En inderdaad, het seizoen, dat is wel echt de volgende stap.

34:01 - 34:04
Ik moet eerlijk zeggen, daar heb ik nog geen goed antwoord op.

34:05 - 34:10
Vooralsnog is daar... zijn batterijen daar nog niet helemaal goed genoeg voor ontwikkeld.

34:10 - 34:18
Aangezien je kan, als je zomers één kilowattuur opslaat en het wind is weer te gebruiken, het

34:18 - 34:23
is 20 cent aan stroom, terwijl een kilowattuur is 100 euro aan investering.

34:23 - 34:29
De terugbetaaldijd daarvan is 500 jaar, dat wordt het natuurlijk niet.

Speaker 2
34:29 - 34:30
Dus dat wil zeggen, daar word je.

Speaker 3
34:30 - 34:37
Ook afgebakend van, die batterij opslaat Het helpt heel erg in de energietransitie ook voor

34:37 - 34:41
in de zomer en laat in de lente en dat soort dingen.

34:41 - 34:46
Maar het is niet de final solution om het helemaal op te lossen.

34:46 - 34:52
Dus dat is zeker een ambt waar je misschien ook naar waterstof kunnen kijken of op een andere manier stroom kunnen opslaan.

34:52 - 35:01
Maar goed, tot nu toe is stroom zo goedkoop dat op echt heel lange termijn opstaan is ver weg voor rendable.

Speaker 1
35:02 - 35:09
Ja. En het is ook zo dat we wel redelijk hebben geconcludeerd dat we een stuk verder dan alleen

35:09 - 35:11
zonder energie moeten kijken eigenlijk ook, toch? Dus vooral...

35:11 - 35:18
We zijn nu ook een kaart aan het brengen waar nog windparken zouden kunnen komen in de provincie

35:18 - 35:23
Utrecht of in de U16-energieregio. Ja.

Speaker 2
35:23 - 35:24
Ja.

Speaker 1
35:24 - 35:26
Ja, want dan moet je dus niet.

Speaker 2
35:26 - 35:29
Zonder energie gaan werken waarschijnlijk, hè? Ja.

Speaker 3
35:29 - 35:33
Ja, zonder ze heel erg... Ik wist redelijk... predictable.

35:33 - 35:39
Je hebt in juli om 1 uur in de middag, dat zijn ongeveer alle zonnepanelen waarschijnlijk uit

35:39 - 35:42
tegenwoordig, want er is heel veel zomer teruggeleverd.

35:42 - 35:44
En in de winter heb je amper wat.

35:44 - 35:50
En met wind is het natuurlijk iets meer, waarschijnlijk juist meer in de winter is het juist

35:50 - 35:54
wat meer opslag, of meer opbrengst.

35:54 - 36:00
Dus er zal sowieso een mix nodig zijn van verschillende verschillende stroomopbrengst.

36:00 - 36:07
Maar inderdaad, het opslaan van zomer naar winter, dat lijkt echt weg te leggen.

Speaker 2
36:07 - 36:08
Voor verre in de toekomst.

Speaker 3
36:08 - 36:14
En zeker niet met de technologie en de prijzen dat de technologie kost tegenwoordig.

Speaker 2
36:14 - 36:20
Ja, ja, ja. Oké.

Speaker 1
36:20 - 36:20
Nou, heel erg bedankt.

Speaker 2
36:20 - 36:22
Leuk geworden.

Speaker 1
36:22 - 36:30
Ja, dankjewel. Heel erg bedankt voor uw tijd. Leuk. Goede informatie, zeker. Dankjewel. Fijne dag nog.



# 9.4 Appendix D

## Interview with Woonin (social housing corporation)

Hoe ziet het beleid vanuit de woningcorporatie eruit met betrekking tot het verduurzamen van sociale huurwoningen?
- 'Eens in de 30 tot 35 jaar komen woningen in aanmerking voor groot onderhoud, dan vindt ook verduurzaming plaats, de standaard is hiervoor het streefniveau. In regulier planmatig onderhoud vindt soms na isolatie plaats (isoleren platte daken, enkel glas vervangen voor dubbel)'

In hoeverre zijn bewoners bereid om deel te nemen aan verduurzamingsprojecten?

- 'In de meeste gevallen bereid, omdat het valt binnen groot onderhoud. Bewoners zijn niet zo bezig met verduurzaming vooral gericht op wat het scheelt qua geld, hoe gaan ze erop vooruit met keuken, badkamer etc.'

Hoe ervaren huurders doorgaans verduurzamingsmaatregelen?

- We doen naderhand onderzoek en halen dikke voldoendes voor de aanpak en werkzaamheden. Maar natuurlijk geeft het ook gedoe, als mensen tijdelijk hun huis uit moeten bijvoorbeeld.

Zijn er vaak klachten of juist positieve reacties?

- Allebei.

Tegen welke bezwaren of zorgen van bewoners loopt u het meest aan?

- Dat mensen niet tijdelijk het huis uit willen of de vergoeding te laag vinden. Als ze terugkomen hebben ze soms klachten over hoe in hun huis is gewerkt.

Hoe zorgt u ervoor dat verduurzaming niet leidt tot een financiële last voor bewoners met een laag inkomen?

- De afspraak is dat huurders er niet op achteruit gaan, meestal valt de energierekening lager uit waardoor ze erop vooruitgaan.

Ziet u verschillen in hoe verschillende groepen huurders (bijv. jong vs. oud, gezinnen vs. alleenstaanden, culturele achtergrond) aankijken tegen verduurzaming?

- Jongere mensen en gezinnen kijken positiever aan tegen verduurzaming.

Komen bewoners wel eens met eigen initiatieven voor verduurzaming?
Wat zijn mogelijke opties die bewoners zelf kunnen toepassen?

- Zonnepanelen, vervangen gaskachel, dubbelglas, hybride warmtepomp.

Heeft u ideeën of wensen om bewoners actiever te betrekken bij de energietransitie?
Welke obstakels ziet u nog voor verdere verduurzaming van sociale huurwoningen?

- Het duurzaam verdienmodel voor woningcorporaties> kosten blijven stijgen ten opzichte van inkomsten. Als we in bestaande voorraad echt gaan starten met de warmtetransitie wordt dit probleem nog groter> gasloze installaties leiden vooralsnog tot hogere investering en hogere onderhoudslasten

thank you!