

JUST POWER

A STRATEGIC ROADMAP FOR HOUSING CORPORATIONS

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COLOFON

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OpenAI was used to better writing style and correct grammer mistakes. The authors later revised and corrected sections to align with the overall report. Full responsibility is taken by the authors for the content of the publication.

PREFACE

We express our gratitude to the residents and social workers of Moerwijk and IJsselmonde for having opened up to us on delicate topics and connecting us to relevant experts. The project was further developed through the tutoring of Verena Baltz and Thomas Verbeek in studio, and as for the report by Roberto Rocco and Juliana Gonçalves.

ABSTRACT

Energy poverty is an increasingly urgent issue in the Netherlands, particularly in neighbourhoods with a high concentration of social housing. As the energy transition progresses, vulnerable populations are at risk of being disproportionately affected. Many low-income households remain heavily dependent on gas and live in poorly insulated homes, meaning that policies aimed at phasing out gas can unintentionally exacerbate existing inequalities. These low-income households generally live in social housing and is either experiencing or at risk of energy poverty. Within this context, housing corporations play a central role, while residents often lack the resources, agency, and institutional support required to improve their conditions.

This project addresses the urgent need for strategies that ensure a just energy transition, focusing on the province of Zuid-Holland as a case study. It develops an integrated spatial strategy alongside a policy-oriented rulebook aimed at guiding housing corporations toward more equitable and effective interventions. The research is grounded in a socio-spatial justice framework, structured around recognitional, procedural, and distributive dimensions, and draws on the theory of the commons to emphasize collective governance and shared responsibility (Soja, 2010) (Ostrom, 2021). Central to the approach is the inclusion of community perspectives, ensuring that strategies reflect the lived experiences, needs, and values of affected residents.

A combination of quantitative and qualitative methods was employed, including spatial data mapping and media analysis, to understand energy poverty across multiple scales. This multi-scalar analysis provided insight into spatial inequalities, power dynamics, and the lived realities of residents in Zuid-Holland. Based on these findings, a community-informed vision was developed, prioritizing health and wellbeing, improved living conditions, and the recentring of resident agency.

The resulting strategy operates across regional and local scales, with spatial interventions explored in the context of The Hague. By combining a spatial framework with a procedural rulebook, the project proposes a comprehensive approach that not only addresses the physical conditions of housing but also restructures governance processes. In doing so, it aims to create the conditions for a more just, inclusive, and future-ready energy transition.

Keywords: *Energy production, Energy consumption, Energy poverty, Social housing, Zuid-Holland*

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INTRODUCTION

URGENCY

(Copley, 2025)

CLIMATE

Clean energy is surging despite political attacks. But a slowdown may be looming

DECEMBER 26, 2025 · 4:41 AM ET

HEARD ON MORNING EDITION

By Michael Copley

(Pascoe, 2018)

The Netherlands is still lagging far behind UN renewable energy targets

March 7, 2018

SOURCE / GT VOICE

GT Voice: EU energy transition is urgent; protectionism isn't the solution

By Global Times

Published: Mar 17, 2026 11:16 PM

(Global Times, 2026)

One Year of the Trump Administration's All-Out Assault on Climate and Clean Energy

January 15, 2026 | 7:30 am

(Cleetus, 2026)

(Cakirtekin, 2025)

ENERGY EUROPE

'Wake-up call': Iran war should fuel Europe's push toward renewables, say experts

Analysts say renewable energy offers solution as policymakers look to address Europe's energy crisis amid debates over EU climate policies

Ilayda Cakirtekin

April 06, 2026 • Update: April 06, 2026

Energy Transition

Climate change is a growing reality in today's context, with unpredictable weather conditions, extreme temperatures and rising sea levels. As a result, the importance of the energy transition is undeniable; to effectively tackle climate change, the energy transition is inevitable and necessary. The energy transition mainly consists of the phasing out of natural gas and petroleum to sustain daily life, opting for renewable sources of energy instead to lower CO_2 emissions.

Governmental Action

For the energy transition to take place, political push and implementation is a necessary evil. Although, the energy transition is discussed extensively on media outlets and among political discussion, there seems to still be a large push back among world powers to transition to sustainable energy (Cleetus, 2026) (Copley, 2025). Additionally, those who stand with the transition usually act minimally in terms of the transition.

In recent events, the war in Iran has posed a threat to an essential global source of gas and energy for the globe, increasing the urgency for energy autonomy, hence the importance of the energy transition (Cakirtekin, 2025).

WEDNESDAY, 19 NOVEMBER 2025 - 12:50

Energy poverty increases across the Netherlands, hitting single-parent families hardest

("*[Title Listed]*",2025)

(TNO ,2025)

Home / Newsroom /

1 in 12 children growing up in energy poverty

System solutions and environment 19 November 2025

(Pascoe ,2025)

Energy poverty rose sharply in 2024 as government support ended

July 25, 2025

(CBS ,2025)

Energy poverty rose to 6.1 percent in 2024

28/07/2025 15:00



© ANP / Robin Utrecht

Energy Poverty

The energy transition in the Netherlands is often framed as a necessary technological and environmental shift. However, this transition tends to misallocate the responsibility or 'punishment' on territories already marked by inequality (Pascoe, 2025). In this context, energy poverty emerges not as a marginal condition, but as a structural manifestation of uneven redistribution. The gradual move away from gas dependency, rising energy costs, and renovation pressures intersect with limited financial capacity and aging housing stock. As a result, the energy transition carries the risk of deepening socio-spatial disparities if justice, equity, and the right to energy are not explicitly embedded within strategic planning.

The Affected Community

The transition tends to leave certain vulnerable citizens, typically low-income households in the context of the Netherlands, behind through its top-down approach. Through the increase of restrictions and taxes on gas usage and low-energy-label homes, marginalized communities face struggles on a daily basis. These struggles are typically financial, but also health-related and social (TNO, 2025). The transition towards sustainable energy will continue to increase energy costs, increasing the risk of further intensifying energy poverty and marginalization of vulnerable communities (CBS, 2025).

LOCATION

Zuid-Holland is located on the Southern West part of the Netherlands. Zuid-Holland an important province in terms of economy and politics in the Netherlands, housing the major national and international banks, as well as the governmental body in The Hague (Province Zuid-Holland, n.d). This province is the most densely populated in the Netherlands, housing 3.8 million citizens, making Zuid-Holland an interesting and relevant area for the project (Province Zuid-Holland in cijfers en VCV, 2026).



Figure 1: South-Holland location map.

FRAMEWORK + METHODOLOGY

PROBLEM STATEMENT + QUESTIONS

As the energy transition advances in the Netherlands, especially within the province of Zuid-Holland; simultaneously, energy poverty is increasing significantly. Particularly low-income, low energy quality housing areas are at risk of heightened existing inequalities due to rising and volatile energy costs, insufficient retrofit solutions, and trivial communal power. Top-down planning measures taken by housing associations in an attempt to solve the issue have generally proven insufficient and inconsiderate of local communities.

Main Question

How can a strategic spatial plan ensure socioeconomic and spatial justice among the local communities of Zuid-Holland, amidst the increasing risk of energy poverty?

Justice Lens	Sub-Research Questions	Methods	Rationale for Method	Expected Insight + Outcome
Recognitional Justice	What are the current socio-spatial vulnerabilities of the local residents', including aspects such as, wellbeing, social cohesion, welfare, employment, etc?	Regional socio-economic data analysis; GIS mapping of local communities; Resident interviews; Site Visit; Media analysis	To analyse the spatial distribution of vulnerable communities and capture residents' experiences and perceptions of energy poverty, housing quality, and their relationship with housing corporations.	A socio-spatial profile of LILEQ neighbourhoods, including residents' perceptions, lived experiences, and key vulnerabilities related to energy poverty.
Procedural Justice	In what ways do existing policies, power dynamics, and stakeholders enable or constrain marginalized neighbourhoods from contributing in the evolving urban energy landscape?	Literature review; Policy and Media analysis; Interviews with Housing Corporations and Governmental stakeholders; GIS contextual mapping	To understand governance structures and decision-making processes shaping the energy transition, and to analyse how housing corporations and institutional actors influence or limit community participation	Identification of governance structures, power dynamics, and institutional barriers that affect the participation of vulnerable communities in the energy transition
Distributive Justice	What are the current and potential socio-spatial impacts of the energy transition on local residents' well-being, community dynamics, and local sustainability outcomes?	Interviews with residents and social workers; Literature review on energy poverty and just transition; Media analysis of residents' perceptions	To explore how energy transition policies affect everyday life, social relations, and spatial inequalities within vulnerable neighbourhoods	Identification of social and community impacts of energy transition policies, including risks of increased vulnerability or inequality
Transformative Design Instruments	How can bottom-up local initiatives be integrated into a larger regional spatial strategy addressing energy poverty?	Expert interviews; Case study analysis; Literature review; Research-by-design	To investigate how participatory initiatives, local knowledge, and spatial planning tools can support a more inclusive and just energy transition	Strategic spatial planning recommendations for integrating community-based initiatives and participatory governance into metropolitan energy transition strategies

Figure 2: Overview of Sub-Questions and their Methods.

THEORETICAL FRAMEWORK

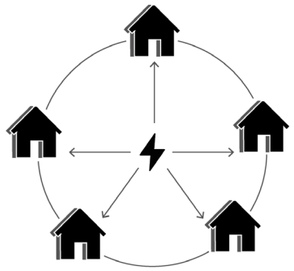


Figure 3: Energy Commons Diagram.

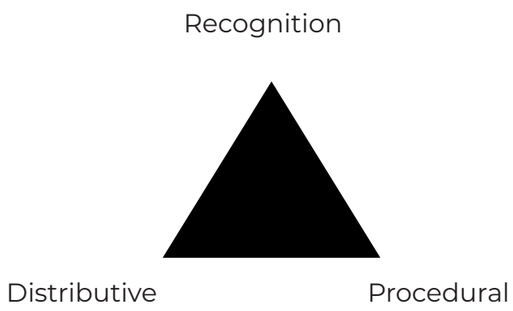


Figure 4: Spacial Justice Diagram, adapted (Rocco, 2026).



Figure 5: Communication and Participation Diagram.

Governing the Commons

Ostrom's "Governing the Commons" argues that communities can successfully manage shared resources through self-organization. Ostrom counters the notion that only privatization and governmental control can prevent resource depletion, that individuals only act in short-term personal interests.

She mentions that in order for this to happen there needs to be polycentric governance, authorities that operate on different scales, ensuring resilience and adaptability in resource management.

Ostrom identifies key conditions which support Common-Pool Resources (CPR) management and will be considered in the project:

- Clearly defined boundaries for the resource and its users
- Regulations adapted to local conditions
- Collective Participation in rule-making
- Effective monitoring and graduated sanctions for rule violators
- Minimal recognition of rights to organize by external authorities
- Nested, polycentric governance for larger systems

Spatial Justice

Spatial justice links the principles of social justice in the spatial organization of society. It explains how power, resources, rights and opportunities are distributed across space, and how spatial arrangements dictate and reproduce structural inequalities (Soja, 2010).

Spatial justice can be understood in its three dimensions: recognitional, procedural and distributive (Rocco, 2026).

Recognitional: Addressing the representation and dignity of marginalized communities in spatial governance through the acknowledgement of identity, trajectories and struggles.

Procedural: Focusing on the fairness of decision-making processes including public collective participation, inclusive governance, transparency and accountability.

Distributive: Concerning the equitable distribution of resources, benefits an burdens across space and diverse actors.

Participatory Design

"Participatory Design is an iterative, flexible design process that closely involves stakeholders, often end users" (Wacnik, 2025). To ensure the project correctly addresses participatory design, the following principles are considered:

Equalizing Power Relations: All participants have the same opportunity to contribute to the design process, regardless of their role or expertise.

Democratic Practices: Design decisions are made collectively, with all stakeholders having a voice in the process.

Situation-Based Action: The design process is tailored to the specific context and needs of the participants.

Mutual Learning: Participants learn from each other's experiences and insights, fostering continuous improvement.

Tools and Techniques: Various methods and tools are employed to facilitate participation and collaboration.

CONCEPTUAL FRAMEWORK

This conceptual framework brings together three main themes that affect the community: energy poverty, the balance of power, and the energy transition. These are not treated as separate themes, but as interdependent dimensions of the same socio-spatial condition. These three concepts are to be understood through the lens of spatial justice, to center the community in the larger context.

Energy poverty represents the material and lived condition at the centre of the project.

Balance of power introduces the institutional and political dimension, referring to power dynamics.

Energy transition, finally, refers to the current broader socio-technical transformation.

The three-dimensional composition of the framework reflects the multi-scalar character of the project. The transition is not produced at one scale alone, nor can it be addressed in this manner. For this reason, the framework is designed to move across scales, from the local-level to the wider regional and institutional structures that shape the transition. This multi-scalar reading is essential, because the issue is connected to a systemic structure, not isolated. The clear connection between the individual and national scale refers to the integration of participatory design implementation, to ensure the community is represented in the strategy

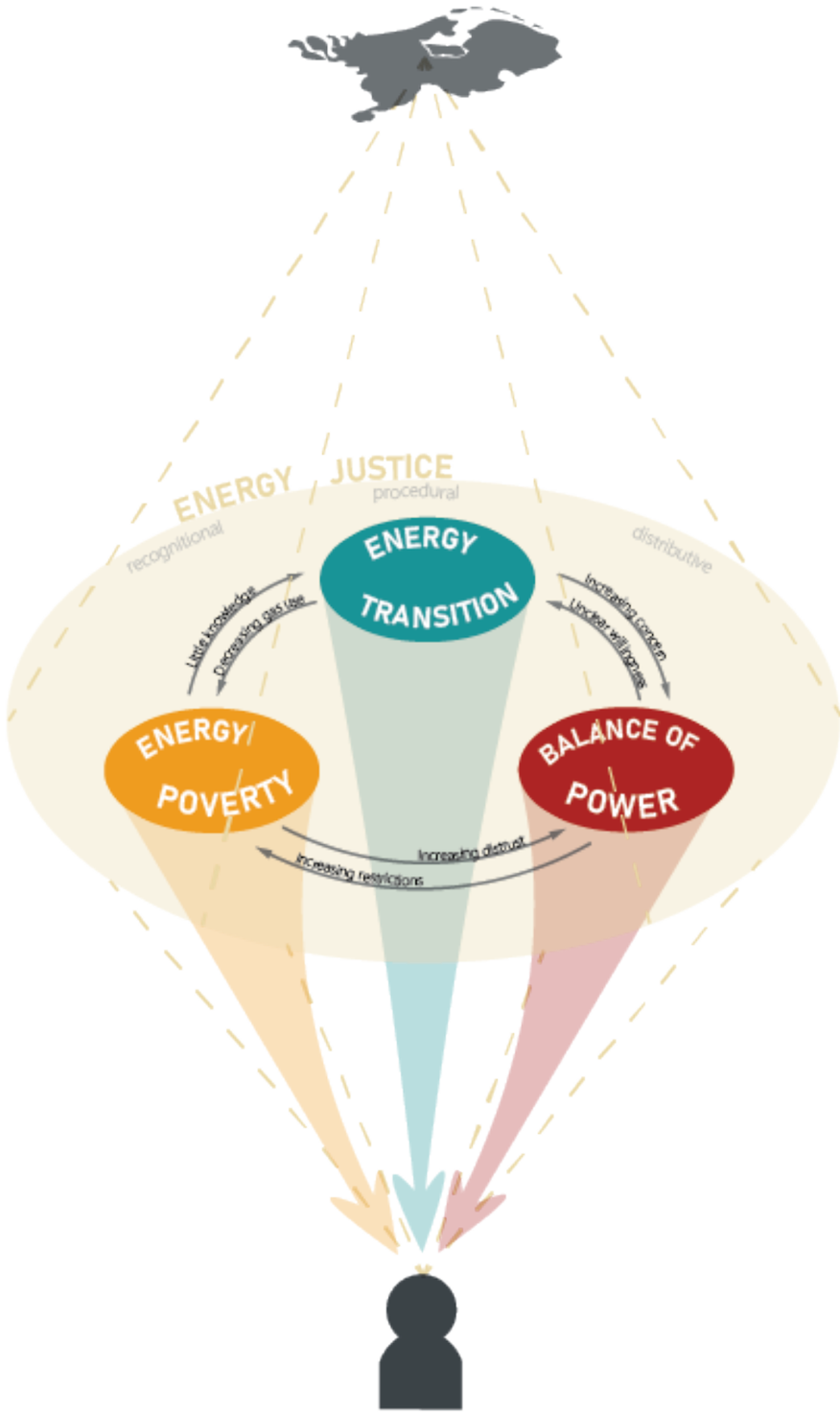


Figure 6: Conceptual Framework Diagram.

APPLICATION OF METHODS

Site Visit

As a group, we conducted a site visit on February 16th across several areas in Zuid-Holland, selecting locations identified through preliminary studies as having high levels of energy poverty, based on data from TNO (2024). The objective was to observe the buildings, facilities, and communities in these areas, taking visual cues on their condition while also using the opportunity to speak with local residents and social workers. We traveled primarily by public transport, using the train network to move between sites. Beginning in Moerwijk, we visited the local commercial area and walked through surrounding side streets to observe different housing typologies. We then continued to the community centre, where we spoke with a social worker. Following their recommendation, we also visited a community garden before heading to the "Buurt Kamer", where we had further conversations with another social worker and local resident. Then we took the train to IJsselmonde (Rotterdam), where we continued observing the urban environment. We made our way to a local energy house, which was just closing but the member of staff directed us to a nearby community centre, where we were able to gain additional insights into local initiatives.

We undertook a second site visit on February 24th to the energy house in Delft. This visit provided an opportunity to further understand local energy support systems and initiatives. We also collected informational materials, including pamphlets outlining community programs already active in the area and advice on saving energy.

GIS Mapping / Data Analysis

GIS mapping was used to identify where different forms of vulnerability overlap across the study area and to spatially locate the selected LILEQ neighbourhoods. By layering housing, socio-economic, demographic, health, and energy-related data, the method helped reveal how energy poverty is distributed unevenly and how it intersects with broader socio-spatial conditions. This made it possible to move from abstract indicators to a territorial understanding of vulnerability, supporting both the analytical phase and the spatial intervention of the project.

Literature Review

The literature review was essential both for the analytical phase and for the policy-making process. By combining academic literature with policy and institutional sources, it helped frame energy poverty as not only a technical issue, but also a socio-spatial and governance-related condition. At the same time, it provided the knowledge base needed to shape strategic directions, governance tools, and policy measures aimed at supporting a more just energy transition in vulnerable neighbourhoods.

Interview

Three informal interviews were conducted during the excursion in Moerwijk with two social workers and a resident living in a recently renovated social housing unit. These conversations helped ground the project in everyday experience, showing that energy poverty is rarely discussed as an isolated issue, but rather as part of a wider struggle with housing conditions, financial pressure, and daily survival. The interviews were especially useful in revealing the gap between institutional transition agendas and the immediate concerns of residents.

Stakeholder analysis

The stakeholder analysis mapped the main actors involved in the energy transition in vulnerable neighbourhoods characterised by energy poverty. Residents and housing corporations form the central relationship, while a wider group of institutional and social actors influences the process from around them. This made visible a key imbalance: those most affected by the transition do not always have the strongest role in shaping it.

Research by Design

Research by design allowed the project to reverse the usual transition logic by starting from social needs rather than technical solutions. Through collage-making and a simulated arena with different stakeholders, it became possible to test priorities, expose tensions, and imagine more just spatial responses to energy poverty.

Qualitative Media Analysis

The media analysis was carried out twice and focused on LILEQ neighbourhoods within the study area. The newspaper articles were found using Nexus, the sources can be found in the references section.

The first analysis explored how residents within these neighbourhoods perceive housing corporations, revealing recurring feelings of distance, frustration, and weak institutional responsiveness.

The second part examined how residents feel about their own neighbourhoods, highlighting both dissatisfaction with living conditions and attachment to local community life.

Together, these analyses helped clarify the social atmosphere of the selected areas and shaped the project's perspective around local perceptions, values and needs.

THE APPROACH

A methodological approach is employed to reach the desired outcome of a strategic plan. The insights and perspectives of the community gained in the analysis are used to create a cohesive representative community vision. The community vision is translated into an effective spatial regional vision which informs the final integral strategy.

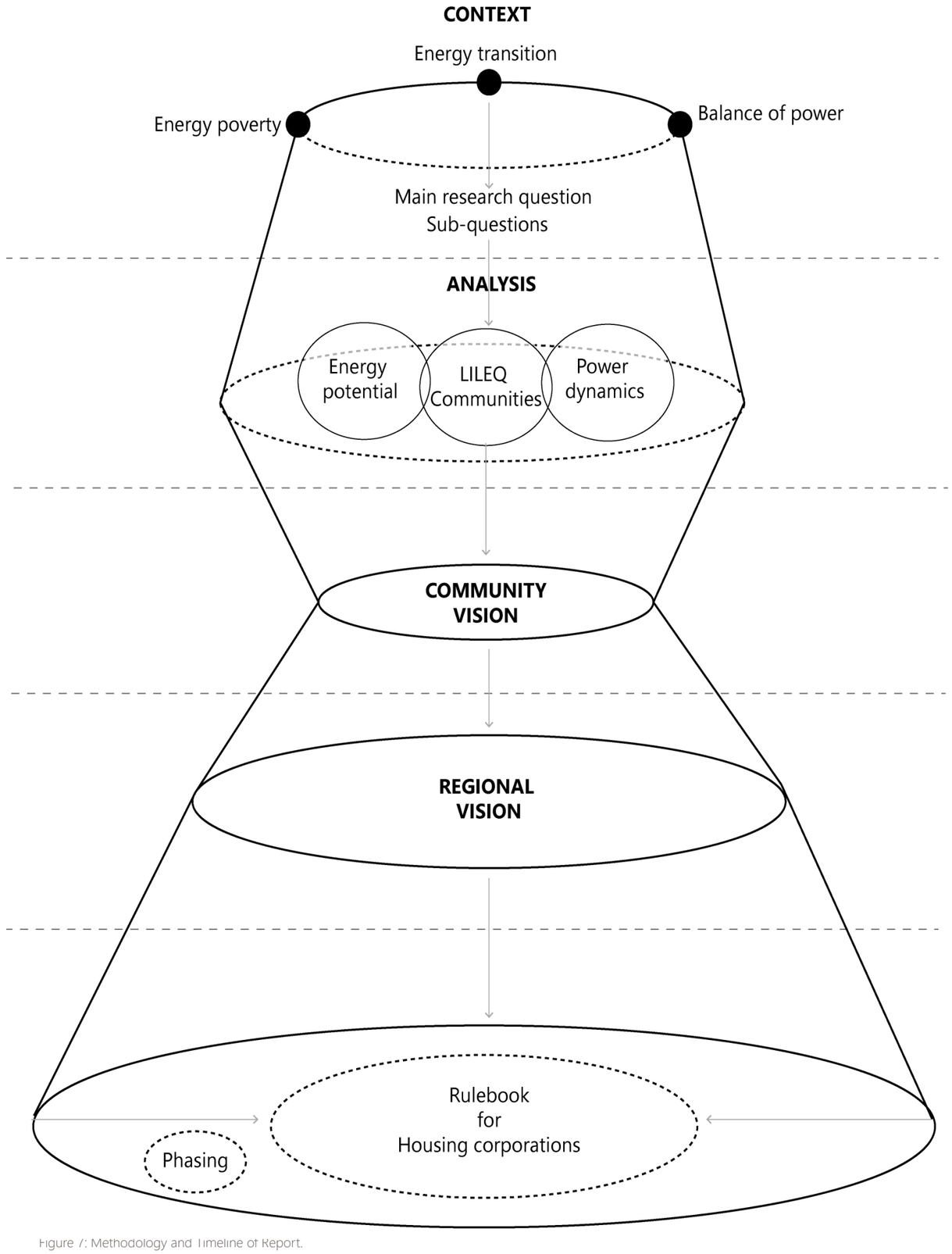


Figure 7: Methodology and Timeline of Report.

UNDERSTANDING THE PROBLEM

ENERGY POVERTY

Introduction

Energy poverty occurs when households lack adequate access to domestic energy, often resulting in residents not heating their homes or avoiding cooking food on stoves due to the heightened prices of gas (Straver et al., 2021). It is a multi-dimensional issue surrounded by a web of consequences: financial issues, and physical and mental health complaints. The problem occurs at the intersection of energy efficiency, energy use, and income (Van Ooij, 2023). TNO (2026) estimates that around 750.000 households in the Netherlands are struggling to pay their monthly energy bills.

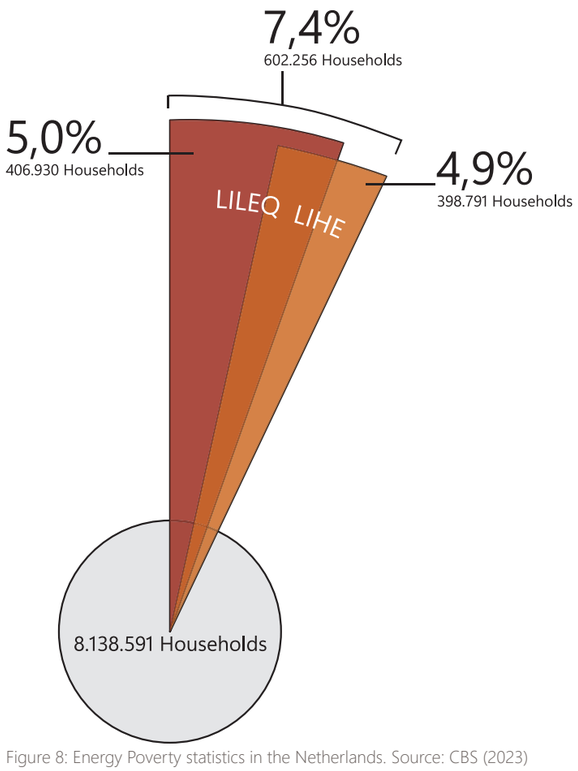


Figure 8: Energy Poverty statistics in the Netherlands. Source: CBS (2023)

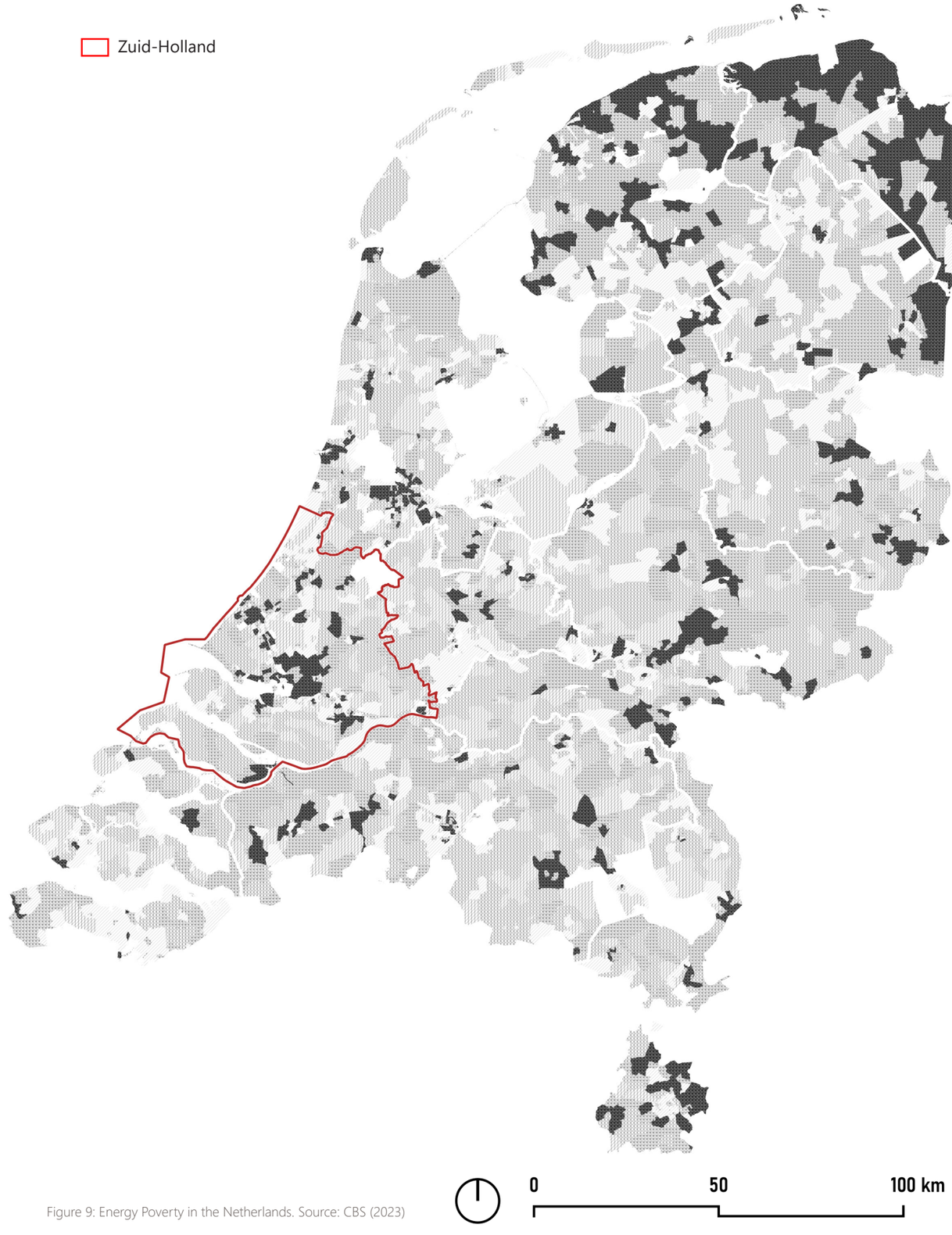


Figure 9: Energy Poverty in the Netherlands. Source: CBS (2023)

ENERGY POVERTY

Introduction

There are more ways than one to measure energy poverty, not only in terms of the affordability and expenditure on energy bills of a household. The disposable income, other necessary expenses, and any amount of debt are also taken into account for certain energy poverty indicators. Furthermore, it is important to consider the living conditions of households. Energy poverty could also be the result of the access or the lack of housing with sufficient energy quality. Ultimately, for low-income households in poorly insulated homes, the core issue lies in the structural inability to access energy-efficient living conditions (Straver et al., 2021).

While various climate and energy policies in the Netherlands offer schemes to support households in investing in sustainability practices, which can lower energy costs in the long-run, households facing energy poverty encounter significant barriers to accessing and making use of them. If a part of the population is left behind during the energy transition, it may lead to the decrease of public support due to the perception that the transition leads to increased socio-economic inequality. At the same time, reducing energy poverty will likely result in a widespread socio-economic benefit and can contribute to accelerating the energy transition. It is therefore essential that reducing energy poverty is given great priority in the designing of energy transition policies (Straver et al., 2021).

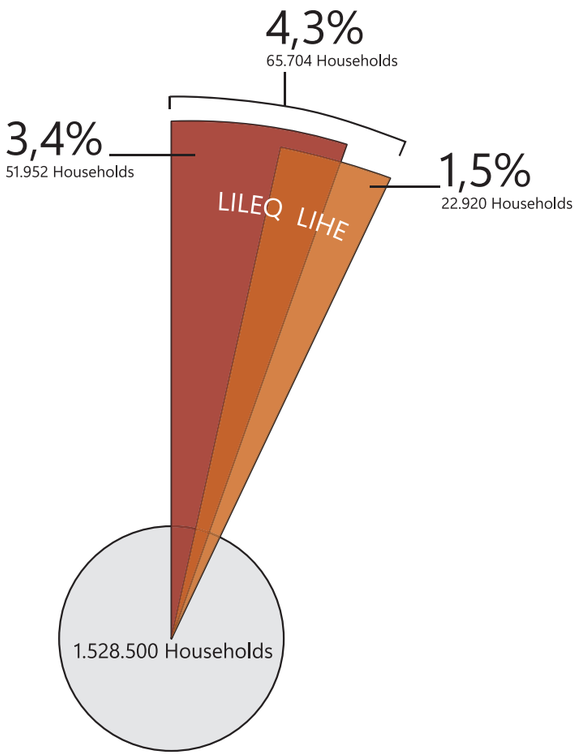


Figure 10: Energy Poverty statistics in Zuid-Holland. Source: CBS (2023)

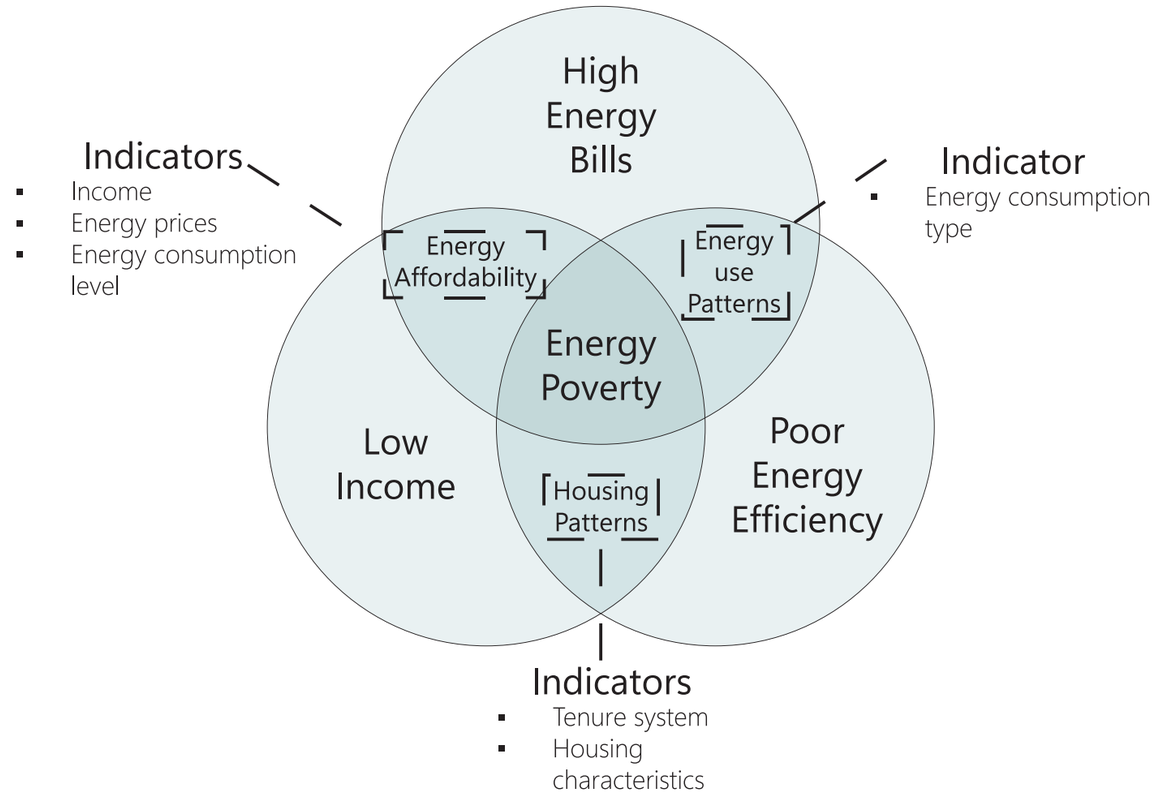


Figure 11: Energy Poverty diagram adapted from Broadman (1999).

ENERGY POVERTY

In South-Holland

Bouwlust
Laakkwartier en Spoorwijk
Rustenburg en Oostbroek
Moerwijk
Morgenstond

Buitenhof
Voorhof

Kethel
Groenoord
Spaland en Sveaparken
Woudhoek

Feijenoord
Charlois
IJsselmonde

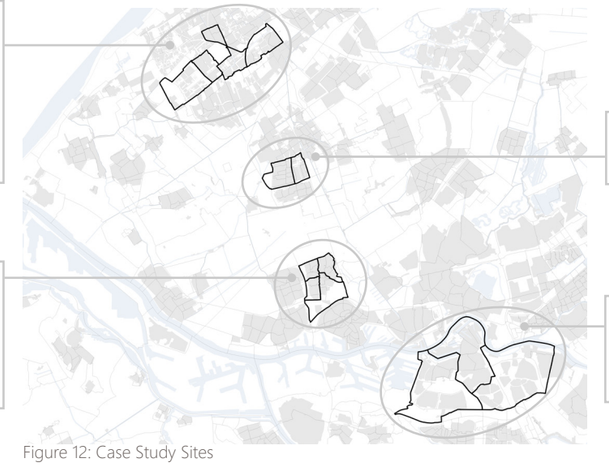
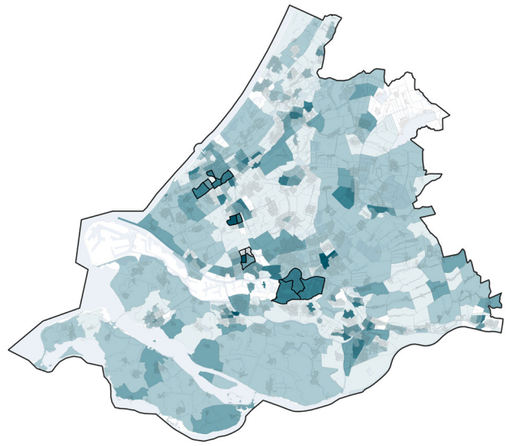


Figure 12: Case Study Sites

Energy poverty is a national challenge in the Netherlands, in the context of Zuid-Holland, it is mostly prevalent in urbanized areas, making it a complex issue. These highly dense areas are defined by diverse demographics and multi-layered stakeholders. The Den Haag – Rotterdam metropolitan region presents a prime example of this complexity. According to TNO (2021), energy poverty rates in the province of Zuid-Holland are in several districts and neighborhoods above average. Effectively reducing energy poverty in Zuid-Holland requires precise measurements and policies which defies simple indicators, as mentioned before.

To target interventions effectively, the project focuses on Low Income and Low Energetic Quality (LILEQ) housing areas where households with a relatively low income live poor quality housing. This measure, as defined by TNO (2021), understands energy poverty not as a measure regarding the expenditure on energy bills, but as a measure related to housing quality. In a study conducted by TNO about energy poverty in Zuid-Holland, 8% of the households in the province are indicated as LILEQ, corresponding to 133.054 households (TNO, 2021). In the selected neighborhoods, energy poverty is more than a financial burden. It is linked to a deteriorating housing stock, socio-economic vulnerability, and a lack of agency for residents. By focusing on LILEQ areas, it can be recognized that poor building performance and systemic disadvantage overlap, leaving the communities uniquely exposed to the risks of an unjust energy transition.



Building Quality

Low income + Low Energetic Quality housing

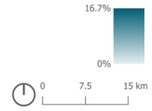
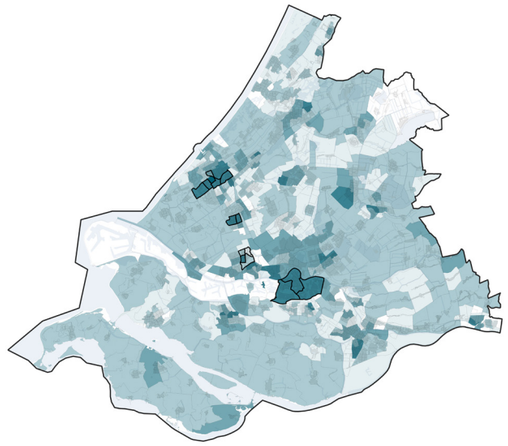


Figure 13: LILEQ indicator. Source: TNO (2024)



Affordability

Low Income + High Energy cost

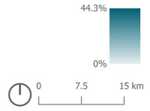
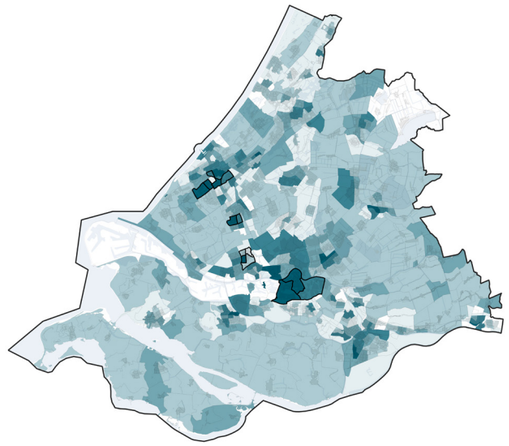


Figure 15: LIHE indicator. Source: TNO (2024)



Combination

Low income and Low Energetic Quality Housing and/or Low Income and High Energy Cost

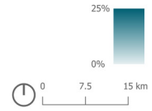
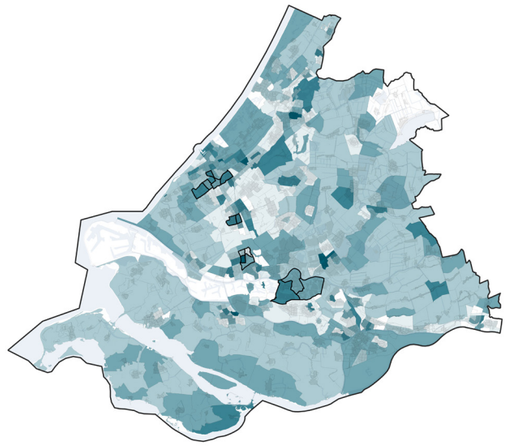


Figure 14: LIHE and/or LILEQ indicator. Source: TNO (2024)



Financial Possibilities

Low Energy label + Few Investment Options

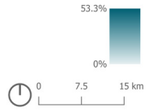
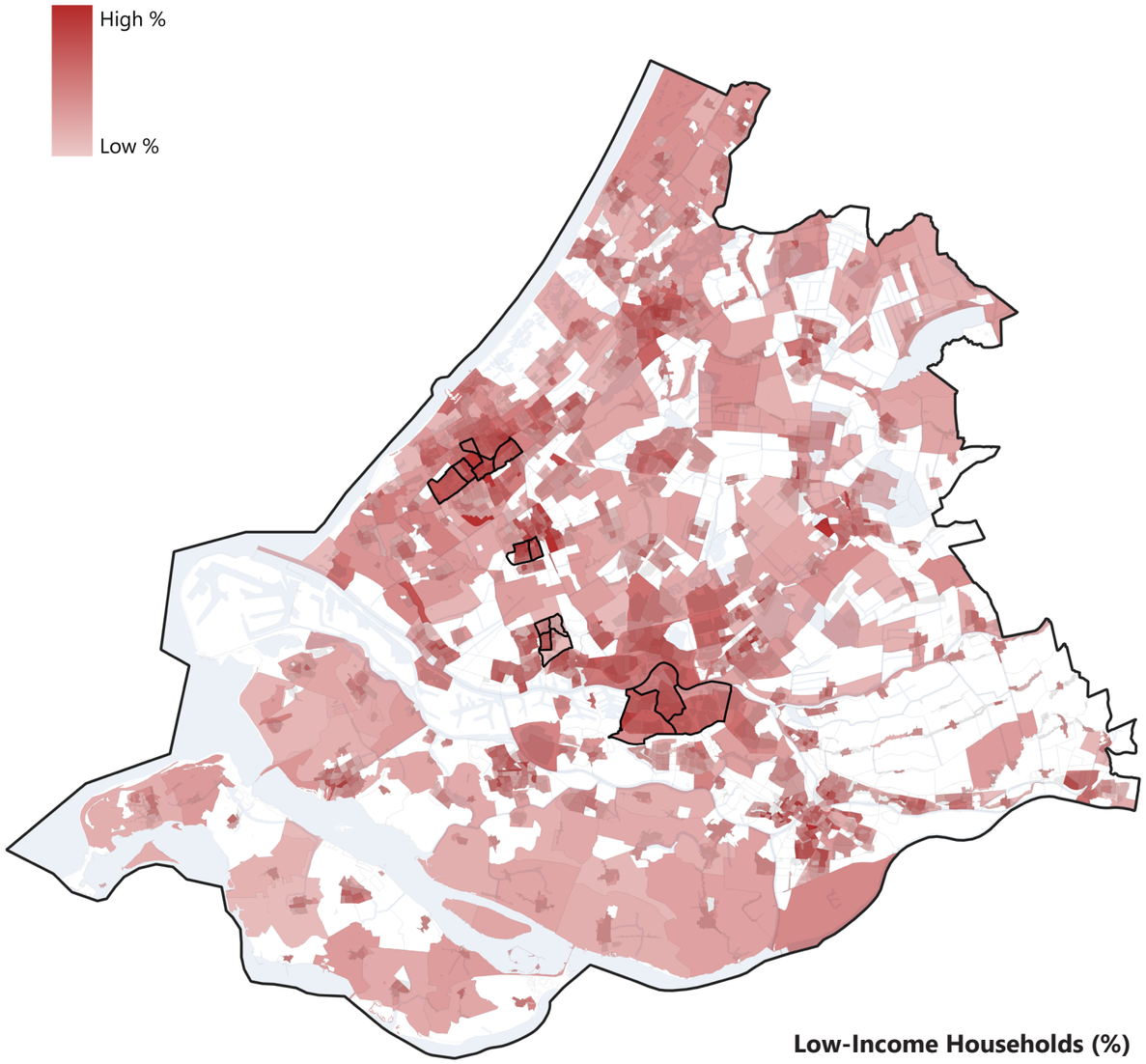


Figure 16: LEQFIO indicator. Source: TNO (2024)

ENERGY POVERTY

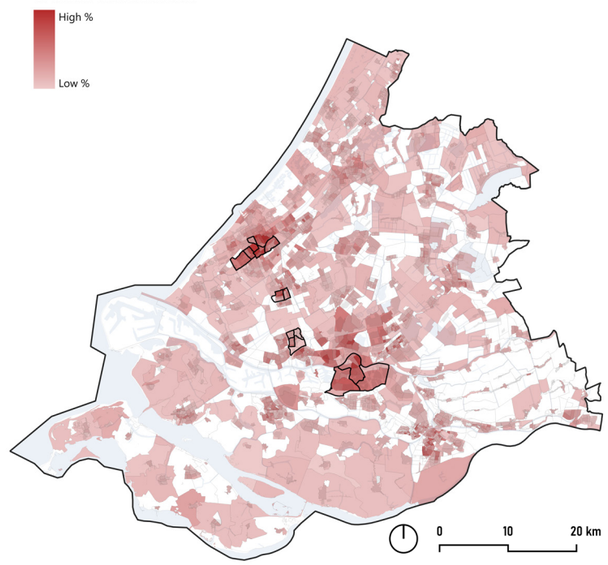
Socio-Economic Analysis



Low-Income Households (%)

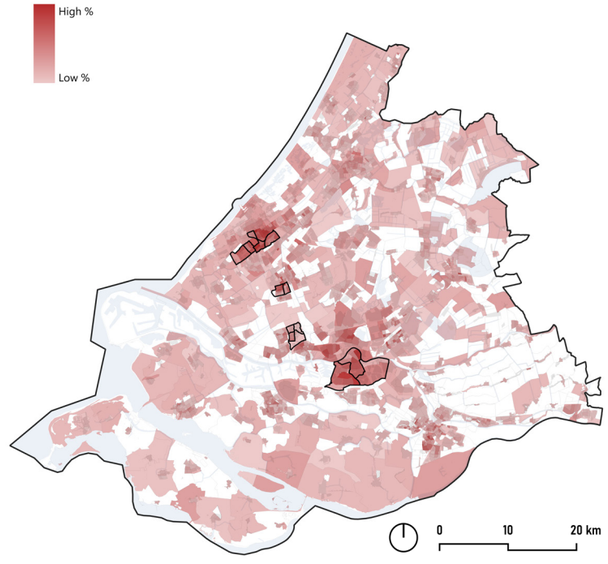
As shown in the map in Figure 17, the neighbourhoods contain relatively high shares of low-income households. In this way, households struggle to adapt, invest, or absorb short-term disruptions. Residents in LILEQ areas have little financial room to respond to rising bills, and possess limited power to shape housing improvements or take on the burden of the energy transition independently.

Figure 17: Income. Source: CBS (2022)



Households Equal or Under Social Minimum (%)

Figure 18: Households Equal or Under Social Minimum. Source: Open Data Zuid-Holland (2026)

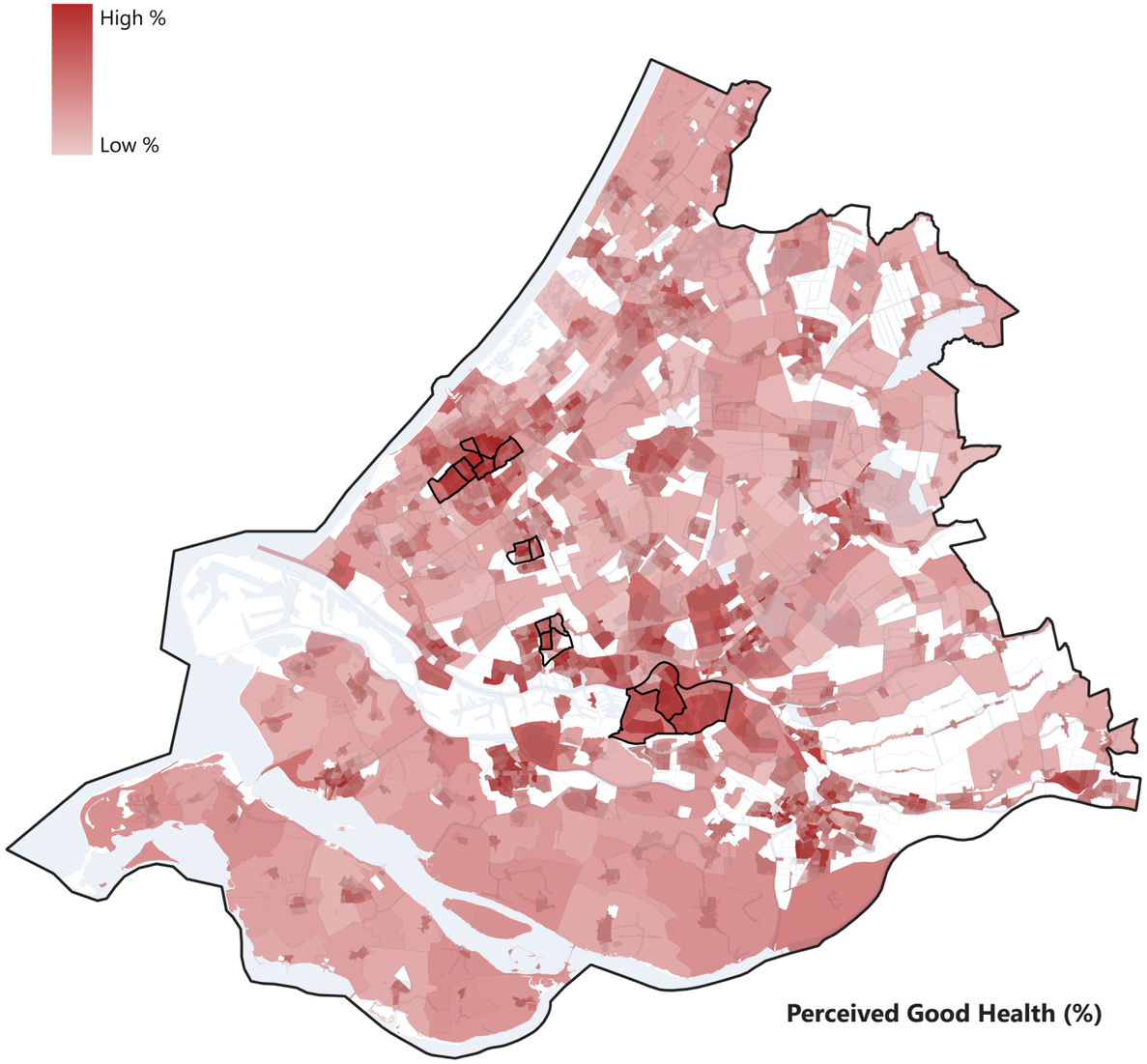


Households with Low Purchasing Power (%)

Figure 19: Low purchasing power households. Source: Open Data Zuid-Holland (2026)

ENERGY POVERTY

Socio-Economic Analysis

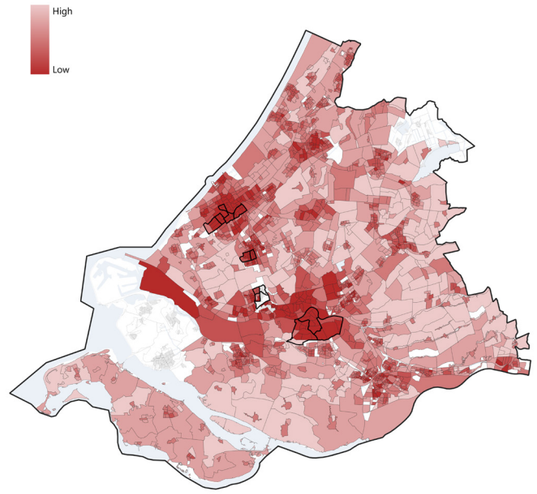


Perceived Good Health (%)

The selected neighbourhoods show significantly worse health and wellbeing indicators than many other parts of the province. According to the mapped data, they are associated with lower perceived health, lower socio-economic status, lower happiness levels, greater loneliness, higher risks of anxiety and depression, and lower healthy life expectancy.

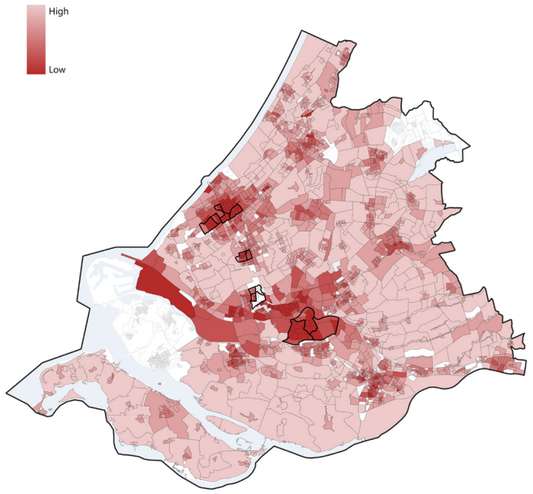
These conditions are reinforced by poor housing conditions and financial insecurity that make it harder to cope with inadequate homes. In this sense, energy poverty is part of a broader landscape of cumulative disadvantages.

Figure 20: Indicator of self perceived good health. Source: Open Data Zuid-Holland (2026)



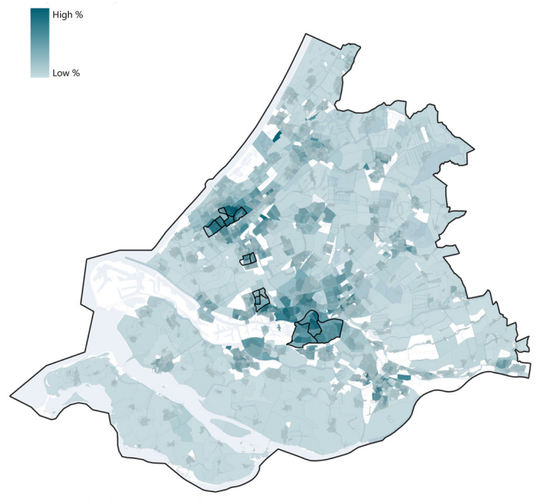
Social Cohesion

Figure 21: Indicator for social cohesion in neighborhoods. Source: Open Data Zuid-Holland (2026)



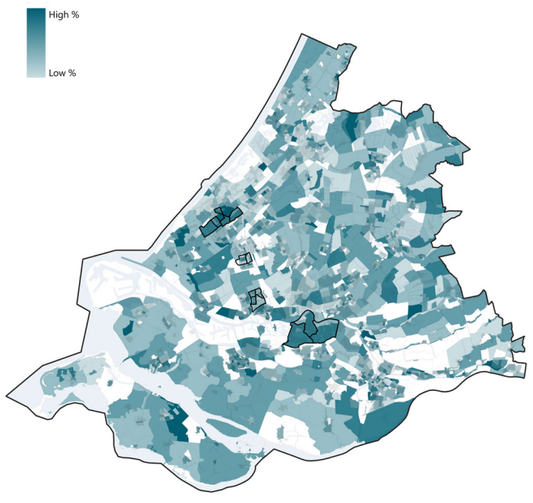
Safety

Figure 23: Indicator of feeling safe in the neighborhood. Source: Open Data Zuid-Holland (2026)



Non-Western Migration Background (%)

Figure 22: Percentage of total population in neighborhood of nonwestern migration background. Source: CBS (2022)

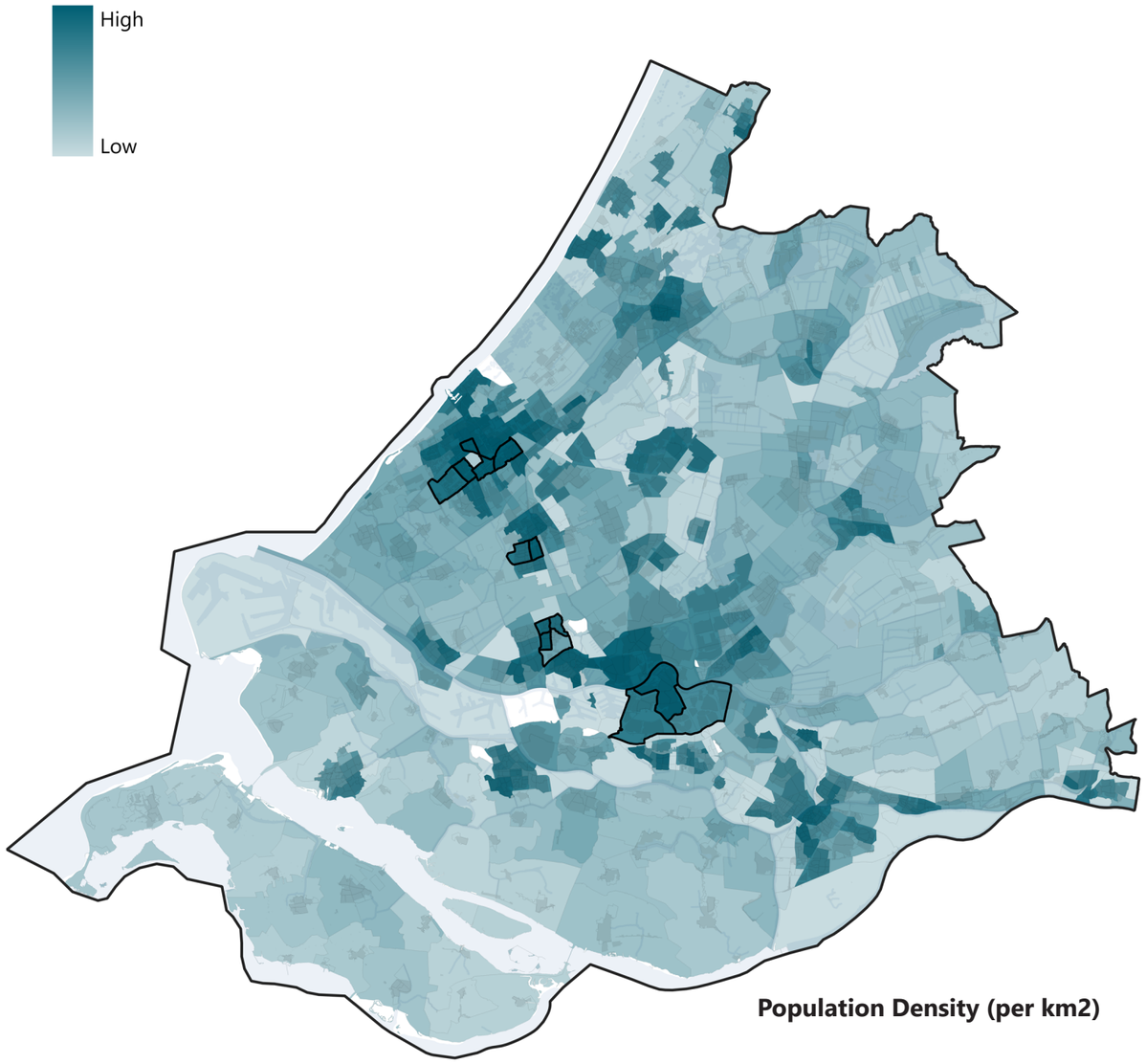


Low-Level Education (%)

Figure 24: Percentage of total population in neighborhood being low-educated. Source: CBS (2022)

ENERGY POVERTY

Socio-Economic Analysis



Population Density (per km2)

As these areas are part of largely urbanized areas, they are relatively densely populated. This is an important aspect to consider for the development of spatial and procedural strategies.

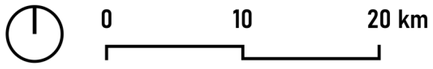
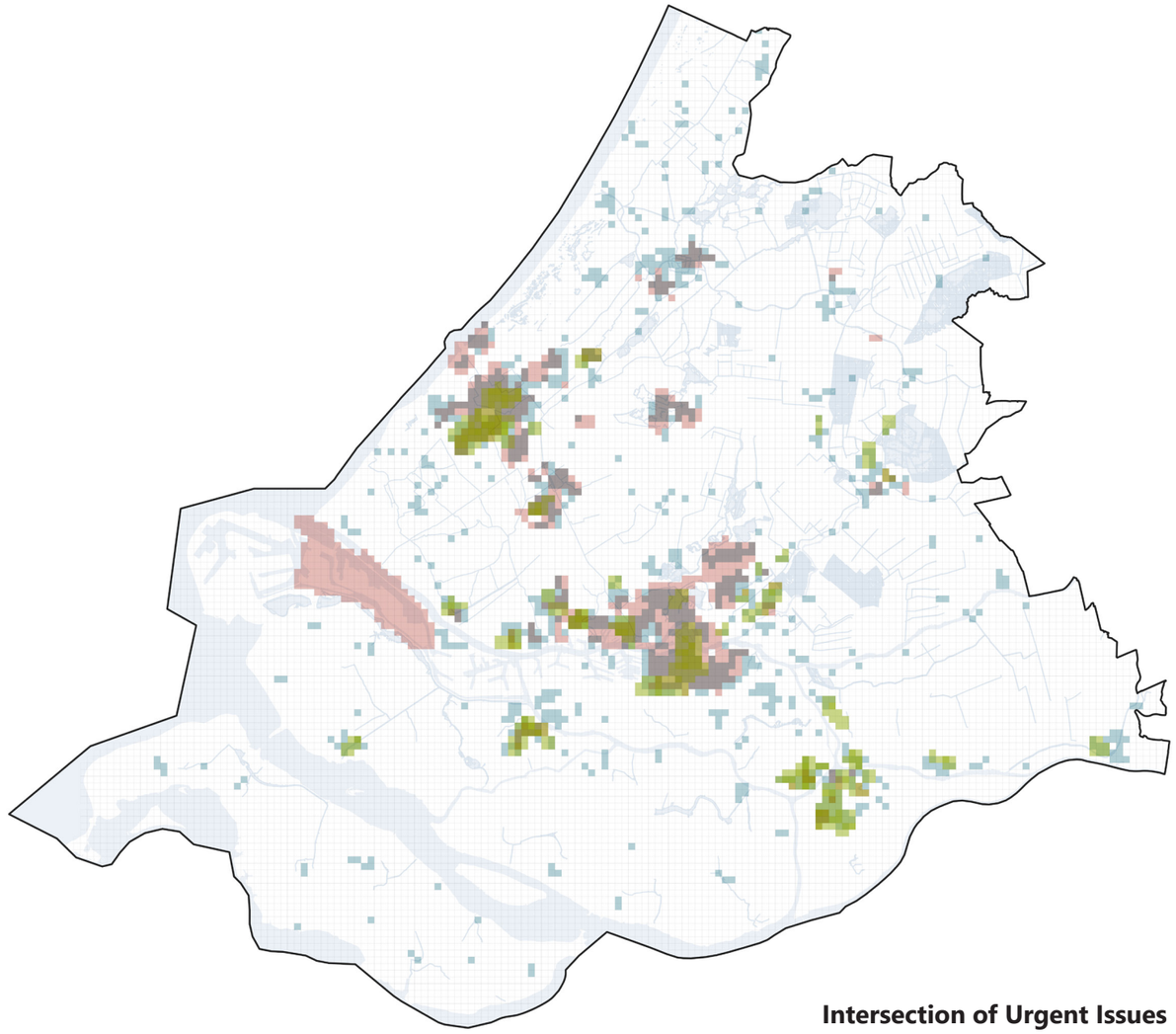
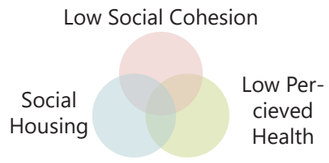


Figure 25: Population Density per km2. Source: CBS (2022)



Intersection of Urgent Issues

As a conclusion map for later reference in the development of the vision and strategy, the most urgent community experiences were mapped using grid construction. The grid was used to create typologies and facilitate the distinction and prioritization among the diverse neighborhoods.



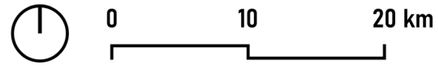


Figure 26: Conclusion Map for Urgent Social Issues within the Communities

ENERGY POVERTY

Community Experience

During the excursion, three people were interviewed: two social workers in Moerwijk and one middle-aged migrant resident who joined the conversation in the Buurt Kamer.

Although the interviews were limited, the conversations were revealing. Upon asking about the energy transition, both social workers stressed that for many residents the issue feels rather distant. They are more focused on immediate concerns, focusing on living day-by-day. The resident confirmed that most know little about the transition, and do not concern themselves about it, they would only care if it materialized and entailed better living conditions for the community.

The resident lived in a recently renovated social housing unit. He described how he was relocated for a few weeks to a nearby flat and how, upon returning, the house had become smaller and was still reliant on gas. Additionally, the bathroom had some draining and ventilation issues. Luckily, his monthly energy bill had become approximately twenty euros cheaper. Although, the interventions seemed to have limited changes on living conditions.



Figure 27: Community Centre in Moerwijk.



Figure 28: Neighbourhood Room In Moerwijk.

Interviews

"The energy transition is not talked about much here, I think people just want a warmer house and a cheaper bill."



Social Worker at Wijkcentrum Moerwijk

"People just care to survive; they don't have the energy to care for the energy transition"



Social Worker at the Buurt Kamer Moerwijk

"I live in one of the renovated homes, it is €20 cheaper a month."



"However, the apartment is smaller than normal and the bathroom has ventilation issues."

Resident at the Buurt Kamer Moerwijk

Figure 29: Indicative Silhouettes of Interviewed Locals.

ENERGY POVERTY

Community Needs & Values

In order to understand better how these neighbourhoods are perceived from within, a media analysis of recent newspaper articles discussing LILEQ communities was carried out. This helped identify both the values and the concerns that residents associated to the neighbourhood.

Key Values:

Community
Many residents believe that there is a strong sense of community. That there is a deep connection between neighbors despite many of the challenges they face. Residents spoke highly of local initiatives which focus on community engagement which help with fostering a sense of belonging. Initiatives included projects such as growing community gardens, which also aimed at enhancing the local living environment.

Culture
Residents highlighted that they appreciate the diversity of culture, which they feel enriches the area. They mention that these cultures are often celebrated within the community through local events. Contributing to a vibrant atmosphere that celebrates the various backgrounds present in these communities.

Environment
Accessibility to local amenities such as community centers, "insert name of those community living rooms", green space, and local businesses enhances the living experience, according to the residents. They discuss how these features create a pleasant environment, provide opportunities for connection with others, and recreational activities. Residents mention that the walkability of neighborhoods plays a key role in allowing access to locals, helping keep people less isolated and more integrated into the community.

Key Concerns:

Safety
Many of the residents discussed concerns over the safety of their neighborhoods, specifically around noise, crime, and disturbances. These safety concerns overshadowed many of the positive emotions associated with the community. Instilling anger, and frustrated feelings which alter how many of the residents perceive the neighborhood.

Better Living Conditions
Residents expressed a general sense of dissatisfaction towards the living conditions of the housing, many mentioning a lack of general maintenance, inadequate heating, and some persistent structural issues. Several also highlighted the slow response of housing authorities to complaints, contributing to a feeling of neglect and frustration within the community.

Community Engagement
There are several calls for the community to be more involved in the decision-making process regarding neighborhood changes, with many residents' expressing frustration that their voices are often overlooked and that decisions are made without meaningful consultation. They feel disconnected from the planning and development that directly affects their daily lives, leading to a sense of disempowerment and marginalization within their own neighborhoods.

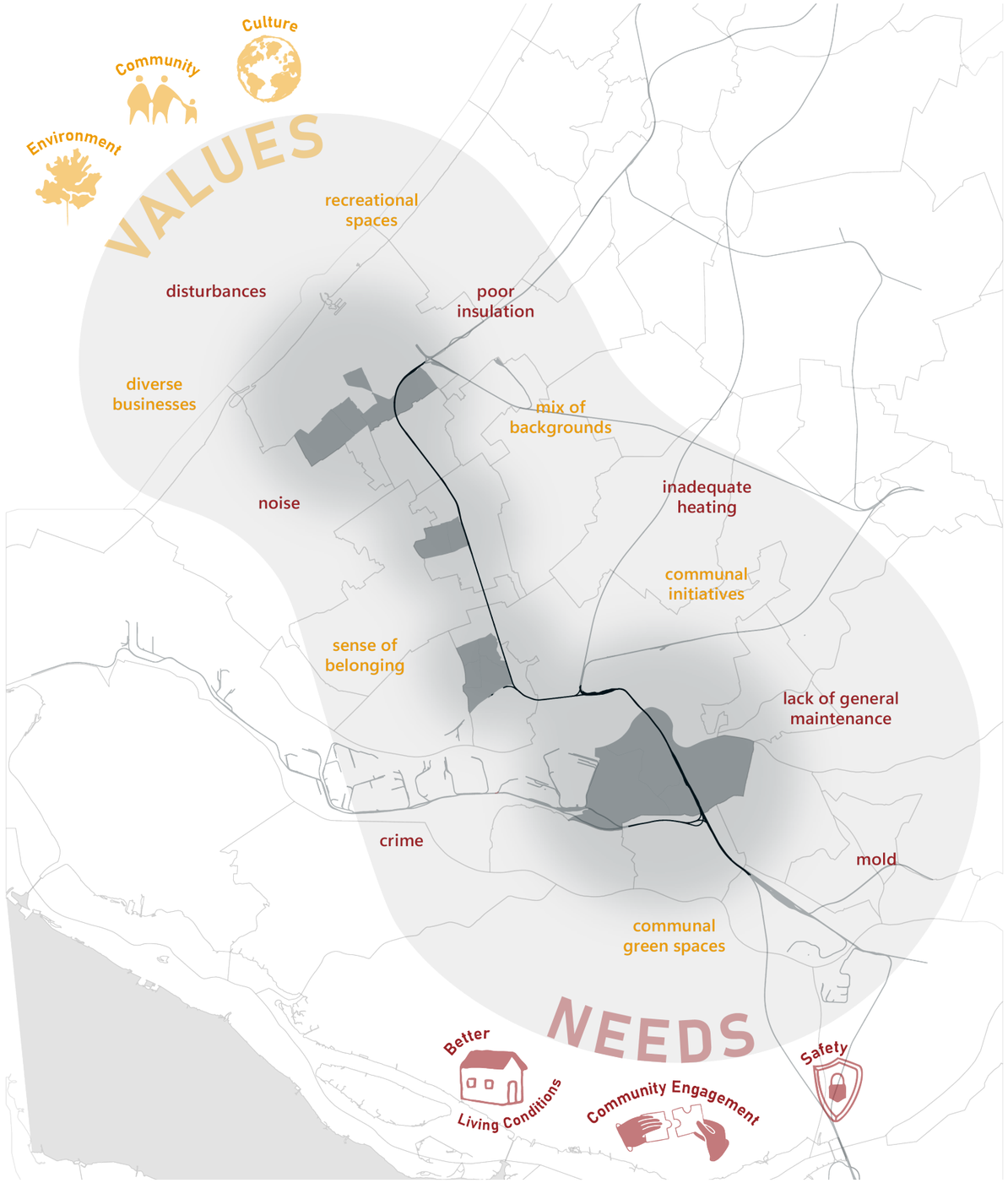


Figure 30: Values and Needs Map of LILELQ Communities.

ENERGY POVERTY

Housing Circumstances

Several studies have shown that energy poor households generally live in energy inefficient apartments and houses primarily due to poor insulation and the lack of a proper heating system (Mulder et al., 2023 and Van Ooij et al., 2023). Furthermore, energy poor households usually use inefficient electrical appliances since these are cheaper to buy, however, these consume more energy and thus less cost-effective in the long run (Van Ooij et al., 2023). However, most are still heavily reliant on gas which has become an expensive resource due to heightened tax.



Figure 31: Housing in Moerwijk.



Figure 32: Energy House in Schiedam.



Figure 33: Housing in Moerwijk.



Figure 34: Housing in Moerwijk.



Figure 35: Community garden in Moerwijk.



Figure 36: Housing in Schiedam.

ENERGY POVERTY

Energy Pamphlets at the Buitenhof Energiehuis

Free help with energy saving

Advice to save energy and lower energy bill!

24 small tips with a big effect!

Changing habits to save energy

Met de tips op de achterkant kun je een heleboel energie besparen, de meeste tips gaan over het aanpassen van gewoonten en kosten helemaal niets.

WIL JE MEER DOEN?

Scan de QR- code of kijk op 015Duurzaam.nl voor meer informatie en het maken van een afspraak met een energiecoach.



015 DUURZAAM?

015 Duurzaam is een initiatief van Delftenaren gericht op duurzaamheid. Samen met Deelstroom Delft ontwikkelen ze projecten voor lokale duurzame energie en ondersteunen ze bewoners en bedrijven bij duurzame keuzes.

Gratis hulp bij energie besparen

Maak nu een afspraak met de Energiehulp!

Heeft u moeite om uw energierekening te betalen? De Energiehulp van 015 Duurzaam adviseert hoe u uw energieverbruik kunt verlagen. Deze hulp is gratis.

U kunt zelf een afspraak maken met de Energiehulp. De energiehulp helpt u graag om energiezuiniger te wonen. Met tips en energiebesparende materialen. De energiehulp komt bij u thuis en brengt gelijk de tochtstrips, ledlampen en radiatorfolie voor u aan. Hierdoor bespaart u meteen energie. Meedoen kost u niets.

Wanneer komt u in aanmerking? This assistance is free if you have received an energy allowance or a letter from the municipality.
Deze hulp is gratis als u energietoeslag heeft gekregen of een brief van de gemeente.

Meer informatie
Op **www.delft.nl/energiehulp** vindt u meer informatie over onze Energiehulpen.

Scan de QR code voor een afspraak



24 KLEINE TIPS MET EEN GROOT EFFECT

De goedkoopste energie is die je niet gebruikt, deze tips gaan bijna allemaal over het aanpassen van gewoonten en kosten helemaal niets!
Wil je meer doen, meer informatie ? Kijk op onze website 015Duurzaam.nl en maak een afspraak met een van onze energiecoaches.

1 tot €250,- pj/jaar **Plaats deurdrangers** Als je alle tussendeuren in huis sluit en in kamers waar je niet best de radiator uitzet, bespaar je tot €250,- per jaar aan gas.	2 tot €225,- pj/jaar **Douche niet langer dan 5 minuten** Iedere dag 20 minuten douchen kost €300,- p/jaar en 5 minuten kost €75,- p/jaar. (per persoon) Tip: plaats een (leuke) douchetimer in de douche.	3 ca. €170,- pj/jaar **Verwarm minder kamers in huis** Verwarm alleen de kamers waarin je zit of werkt en sluit alle deuren in huis.	4 tot €170,- pj/jaar **Gebruik een radiator ventilator** Met radiator ventilatoren kan de ketteltemperatuur omlaag tot 60°C en wordt woonkamer toch snel lekker warm.	5 tot €85,- pj/jaar **Zet de thermostaat een graadje lager** Zet de thermostaat 1°C lager. Tips: doe een warme trui aan, gebruik een deken op de bank en zet 1 uur voordat je gaat slapen de thermostaat op nachtstand.	6 tot €80,- pj/jaar **Doe 2e koelkast weg** Een 2e koelkast is vaak oud en verbruikt veel stroom. Doe hem weg of gebruik hem alleen tijdens een feestje.	7 tot €75,- pj/jaar **Zet apparaten uit en niet op stand-by** Laat elektrische apparaten niet op stand-by staan, maar zet ze helemaal uit. Tip: gebruik hiervoor een stekkerdoos met schakelaar.	8 tot €60,- pj/jaar **Gebruik de ventilator in plaats van de airco** Een airco verbruikt veel stroom als hij aan staat. Een ventilator is energiezuiniger en dus milieuvriendelijker dan een airco.
9 tot €70,- pj/jaar **Hang je was aan de lijn** (i.p.v. in de droger) Hang je was aan de lijn. Heb je daar weinig ruimte voor, probeer dan de helft van je was op te hangen, dat bespaart toch ook al zo'n €30,-.	10 tot €55,- pj/jaar **Plaats een douchespaarkop** Monteer een waterbesparende douchekop. Dat bespaart tot pp €40,- per jaar en bij het vervangen van een regendouche wel €55,- pp per jaar.	11 tot €50,- pj/jaar **Plaats tochtstrips** Plaats tochtstrips in deuren en ramen (en een tochtborstel voor de brievenbus). Tip: isoleer ook het luik van je kruipruimte!	12 tot €30,- pj/jaar **Plaats radiatorfolie achter je radiatoren** Plaats radiatorfolie bij radiatoren tegen een niet geïsoleerde buitenmuur.	13 tot €20,- pj/jaar **Houd radiatoren vrij** Hang geen gordijnen voor de radiator en zorg dat er (vooral in de winter) geen meubels voor de radiator staan.	14 tot €20,- pj/jaar **Was op max. 40 graden** Was niet warmer dan op 40 graden. Tip: het is voor hygiëne niet altijd nodig heter te wassen dan 40°C. (behalve bv. vaatdoekjes)	15 tot €15,- pj/jaar **Zet de vaatwasser op ECO stand** Gebruik je toch een vaatwasser, zet hem dan op ECO stand. Dit wast doorgaans goed schoon en is veel zuiniger. Je bespaart zo'n €15,-.	16 tot €5,- pj/jaar **Gebruik LED-lampen** Vervang gloei- en halogeenlampen door LED-lampen. Besparing per lamp is € 4,50 per jaar.
17 TIP **Zet je vriezer op max. -18°C** Bedenk goed of je echt een vriezer nodig hebt. Als je hem toch gebruikt, zet hem dan maximaal op -18°C.	18 TIP **Zet vaatwasser pas aan als deze vol is** Geen vaatwasser gebruiken bespaart het meest. Gebruik je deze toch, zet hem dan pas aan als deze helemaal vol is.	19 TIP **Kies de juiste vlam, en doe deksel op de pan** Zorg dat de gasvlam onder de pan blijft. Doe ook altijd de deksel op de pan. Eten kookt dan eerder, en wordt sneller gaar, dit spaart gas.	20 TIP **Koel zuinig en ontdooi regelmatig de koelkast** Laat spullen uit de diepvries in je koelkast ontdooien. Ontdooi ook koelkast & vriezer regelmatig. Tip: Zet beide kasten 10 cm van de muur af.	21 TIP **Gebruik de waterkoker zuinig** Zuinig omgaan met de waterkoker levert best wat op. Tip: verwarm niet meer water dan nodig. Maak water ook niet heter dan nodig.	22 TIP **Ontlucht radiatoren regelmatig** Als er tevel lucht in de leidingen zit werkt de verwarming niet optimaal. Dit kost extra energie. Tip: vul ook de CV-ketel bij.	23 TIP **Laat je CV-ketel afstellen** Laat de temperatuur van de ketel afhangen van de buitentemperatuur (ketels staan vaak op 90 graden, terwijl 60°C al prima is).	24 TIP **Zorg voor goede luchtcirculatie** Schone lucht in huis is noodzakelijk voor jouw gezondheid. Tip: open even 's ochtends de ramen/deuren om verse lucht binnen te laten.

De gegevens zijn afkomstig van o.a. Milieucentraal (www.milieucentraal.nl), uit de Klimaatgids van de stichting Natuur en Milieu (www.natuurenmilieu.nl), het Rotterdams Milieucentrum (www.opzuinig.nl), de Nederlandse Woonbond (www.bespaarenergiemetdewoonbond.nl) het Nibud (www.nibud.nl). © concept & ontwerp: www.diepzicht.nl
Hoeveel je met de maatregelen bespaard hangt af van je verbruik en je energietarief, de mogelijke besparing is berekend op basis van een gemiddelde verbruik en tarief van 2021.

Figure 37: Community Centre Pamphlets Collected on Site Visits.

24 ZOMERTIPS voor een koel huis en groene buurt

In Delft gaan we voor een fijne en leefbare stad, nu en in de toekomst.
Samen kunnen we dat voor elkaar krijgen.

Living in a cool and health home

1. **Houd de warmte buiten tegen met zonwering**
2. **Maak ramen zon- en warmtewerend**
3. **Isoleer je muren, dak en ramen**
4. **Bij warm weer overdag ramen en deuren dicht**
5. **Zet ramen en deuren pas open als het afkoelt**
6. **Goed ventileren voor gezonde lucht in huis**

Green you home, roof, garden

13. **Vervang je tegels in de tuin voor groen**
14. **Meer groen met een heg, struik of boom**
15. **Help insecten met inheemse planten**
16. **Maak je tuin vriendelijk voor kleine dieren**
17. **Een gevel- of daktuin voor verkoeling**
18. **Geen tuin? Vergroen je balkon**

Energy saving in the summer

7. **Geen airco maar ventilator**
8. **Was aan de lijn, niet in de droger**
9. **Maak een afspraak met een energiecoach**

Living outside in green

19. **Vergroen zelf je straat met de buurt**
20. **Onderhoud samen een moes- of buurtuin**
21. **Ontmoet de klimaatmaatjes**

Save (rain)water

10. **Plaats een douchekop die water bespaart**
11. **Sluit de regenpijp aan op een regenton**
12. **Hergebruik je (regen)water**

Working together on a clean neighborhood

22. **Samen zorgen voor een schone buurt**
23. **Ruilen, delen, repareren, (uit)lenen of weggeven**
24. **Laat je auto staan of rij met een deelauto**

Overleg met verhuurder · Subsidie mogelijk · Bespaart geld

Kijk op de websites voor meer informatie. Aanpakplan een deskundige voor grotere energiebesparingen in 11 modules per huis. De tips in dit artikel zijn op alleen te zien op: www.gaanmeedoen.nl

015 DUURZAAM · delft doet duurzaam · DE KLIMAAT MAAT

24 Summertips for a cool house and green neighborhood!

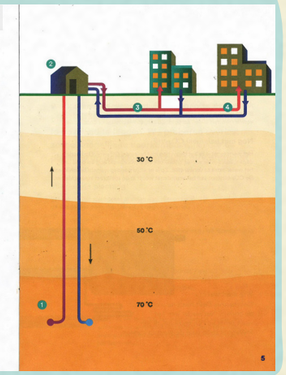
Heating network in the neighborhood

How does it work?

Hoe werkt het warmtenet?

Een warmtenet is een systeem van buizen in de grond waar warm water doorheen stroomt. Met het water in het warmtenet kunnen we woningen in Voorhof, Buitenhof en op de TU Delft Campus verwarmen. De warmte komt diep uit de bodem. Dit noemen we aardwarmte of geothermie.

1. Op ruim twee kilometer diepte zit warm water in de bodem. Dit water heeft een temperatuur van ongeveer 75 graden.
2. We pompen dit warme water omhoog bij de aardwarmteboren op de TU Delft Campus. We gebruiken de warmte om het water in de buizen van het warmtenet op te warmen.
3. Het warme water stroomt via het warmtenet naar de woongebouwen.
4. Het water gaat de woningen in, verwarmt de kamers en in sommige gevallen het kraanwater en douchewater.



Energy coaches!

WIL JIJ BESPAREN OP JE ENERGIEREKENING EN JE HUIS VERDUURZAMEN?

De energiecoaches van 015Duurzaam staan voor je klaar!

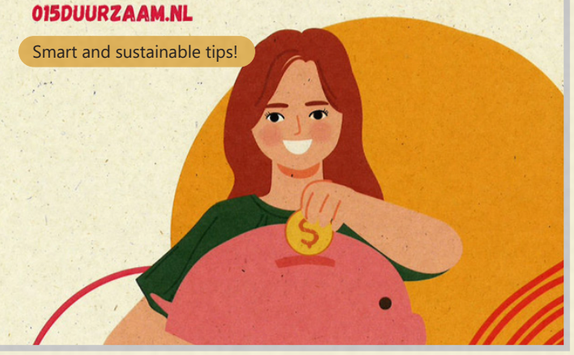
Advice to save energy and making your house more sustainable!

- Gratis en vrijblijvend hulp
- Direct besparen met simpele aanpassingen
- Slimme en duurzame tips die bij jou passen
- Hulp bij isoleren en van het gas af gaan

BOEK EENVOUDIG EEN GRATIS GESPREK VIA:

015DUURZAAM.NL

Smart and sustainable tips!



Energy cooperation for everyone

energie samen

Jouw energiecoöperatie is er voor iedereéén

Energie Samen Academie
Opwekprojecten voor iedereen

Tips to include youth, woman, peopel with nonwestern migration background

- **Praktische tips** om mensen met een niet-westerse migratieachtergrond, jongeren en vrouwen te betrekken bij je energiecoöperatie.
- **3 financiële principes** om mensen met een krappe beurs ook te laten profiteren van duurzame, coöperatieve energie.
- **Een overzicht** van bestaande projecten waarvan je kunt leren.

Bonus
Handreikingen, cijfervoorbeelden, financieringsplannen, advies voor communicatie



Figure 38: Community Centre Pamphlets Collected on Site Visits.

ENERGY POVERTY

Building Characteristics

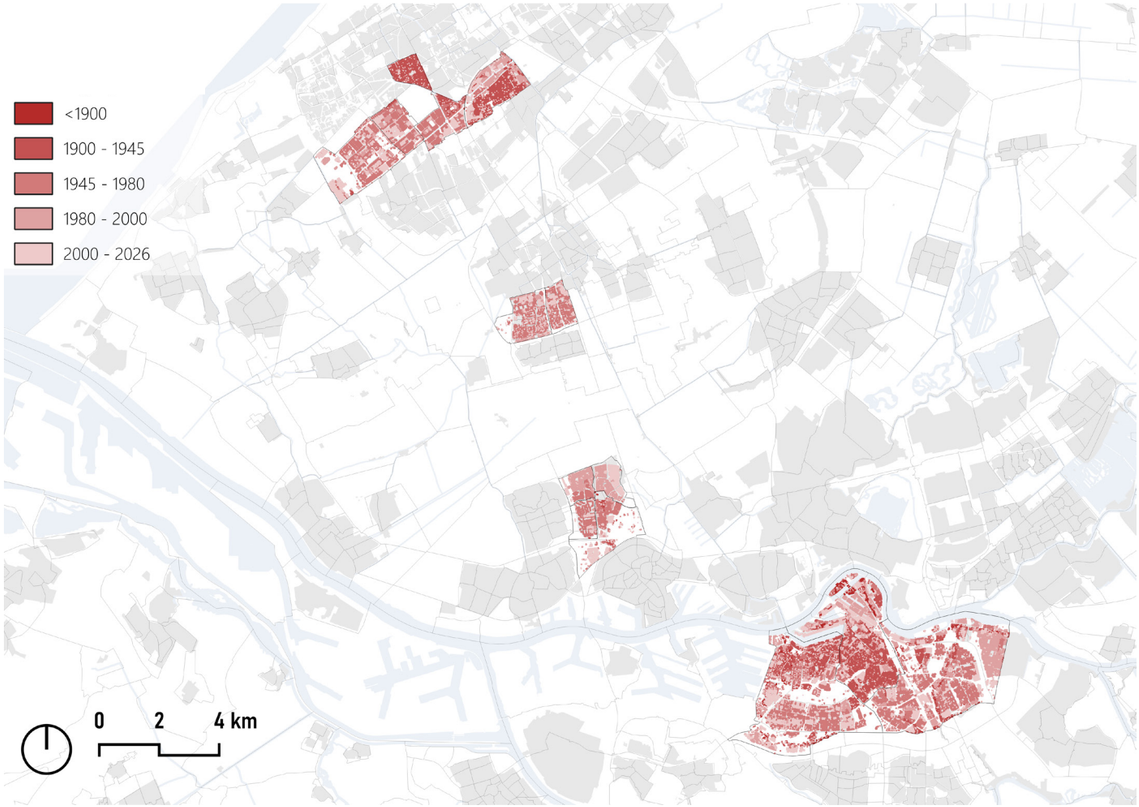


Figure 39: Neighborhood typology of case-study neighborhoods. Source: BAG (2026).

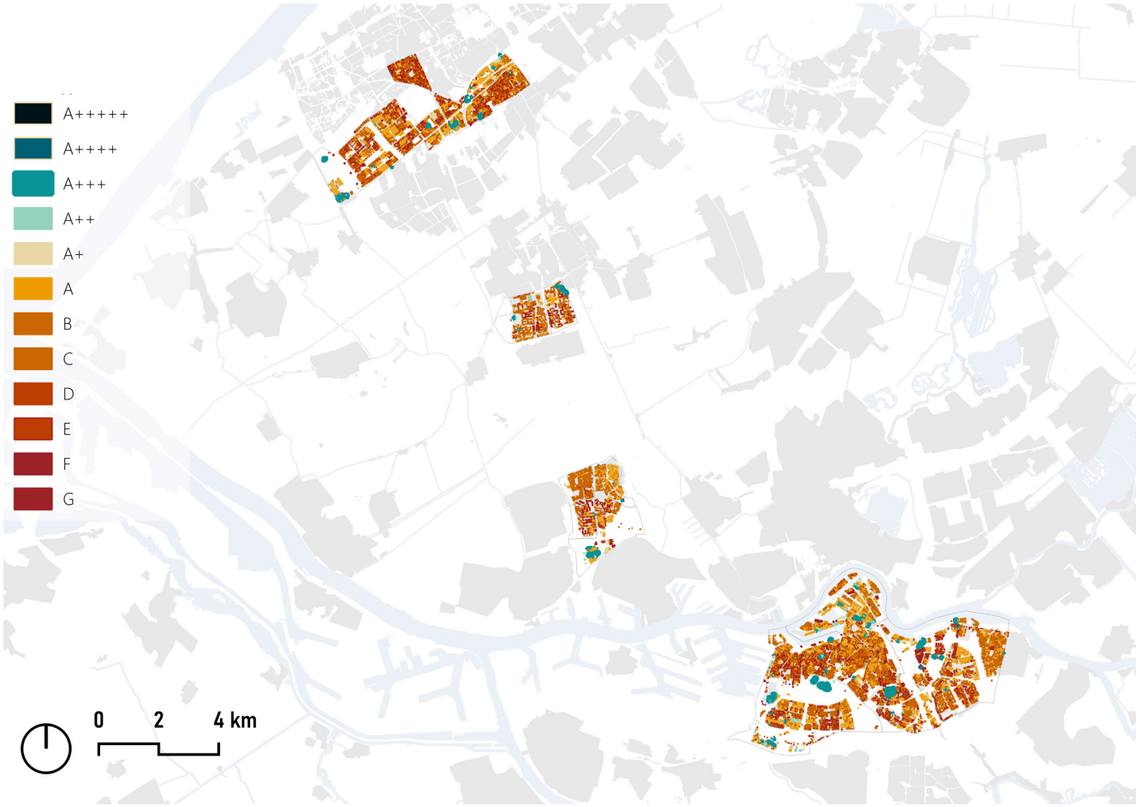


Figure 40: Energy labels of case-study buildings. Source: AR2U086 (2026).

Building Age

Most housing units were constructed throughout the 20th century, a dominant number of housing units were built right after the Second World War and after the 1980's. A significant number of houses were also built before the war. There is a small number of buildings built before the 20th century or recently in the 21st century.

Energy Labels

Several studies have shown that energy poor households generally live in energy inefficient apartments and houses that are poorly insulated, and lack a proper heating system (Mulder et al., 2023 and Van Ooij et al., 2023). Figure 40 supports this notion, showing the energy labels of the buildings in the case study neighborhoods.

Poor insulation, single-glazed windows, and outdated construction methods continue to shape the energy performance of these homes. For residents with limited financial means, this translates into higher heating costs and/or lower thermal comfort, and less resilience when energy prices increase.

ENERGY POVERTY

Building Characteristics

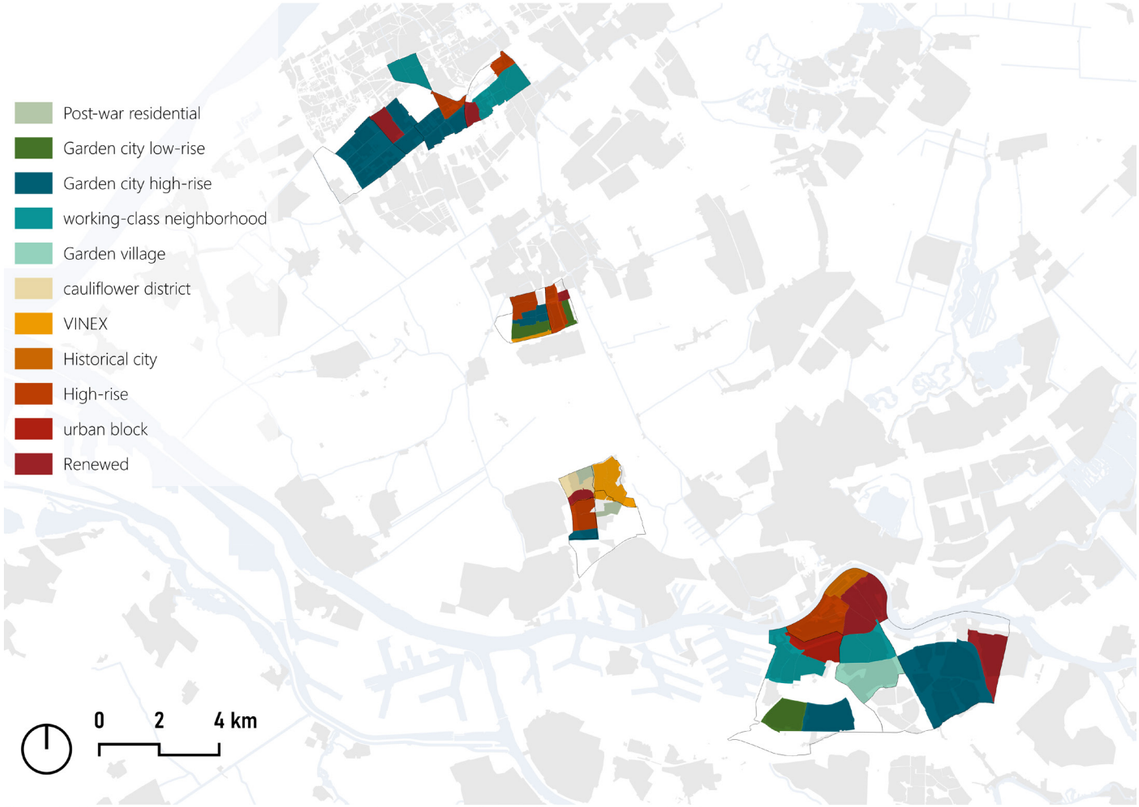


Figure 41: Neighborhood typology of case-study neighborhoods. Source: Klimaateffectatlas (2026)

Neighborhood & Building Typologies

The dominant housing typology in the selected LILEQ neighborhoods are composed of post-war housings. Particularly the garden city high- and low-rise typology. Although, there is some variety in secondary typologies present in the neighborhoods. The typologies share one important characteristic; they were built with different housing standards, standards which do not align to the current day.

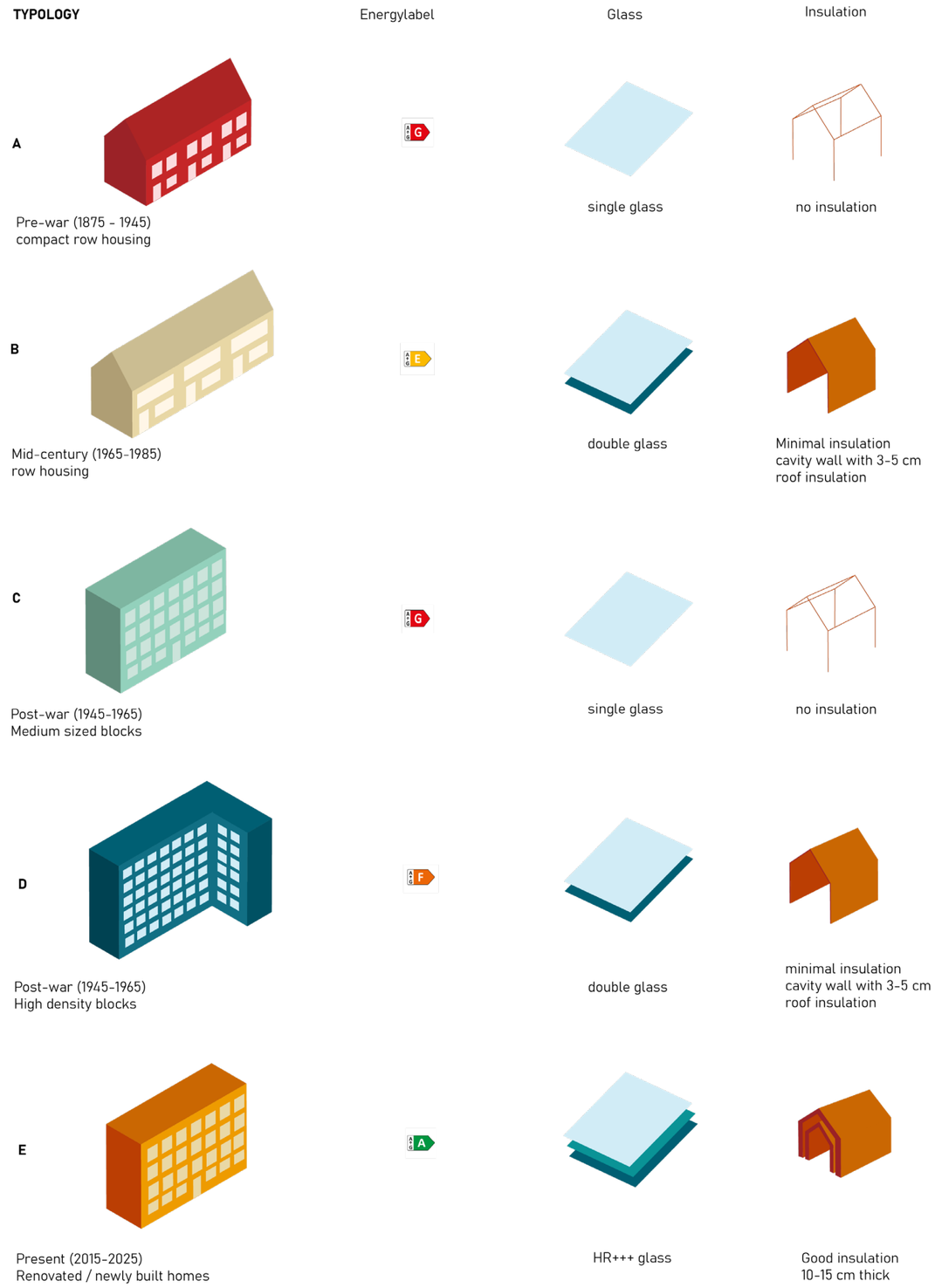


Figure 42: Building Typologies with Most Common Build-up

ENERGY POVERTY

Ownership



Figure 43: Percentage of Housing Owned by Housing Corporations. Data: CBS (2022).

Housing Corporation Ownership

Furthermore, energy poor households mostly live in rental housing. In the Netherlands, around 75% of the energy poor households live in dwellings owned by social housing corporations (Mulder et al., 2023). These households, even still being able to pay their energy bills, lack the authority or means to invest in sustainable alternatives. Residents are dependant on housing corporations for a change in circumstance.

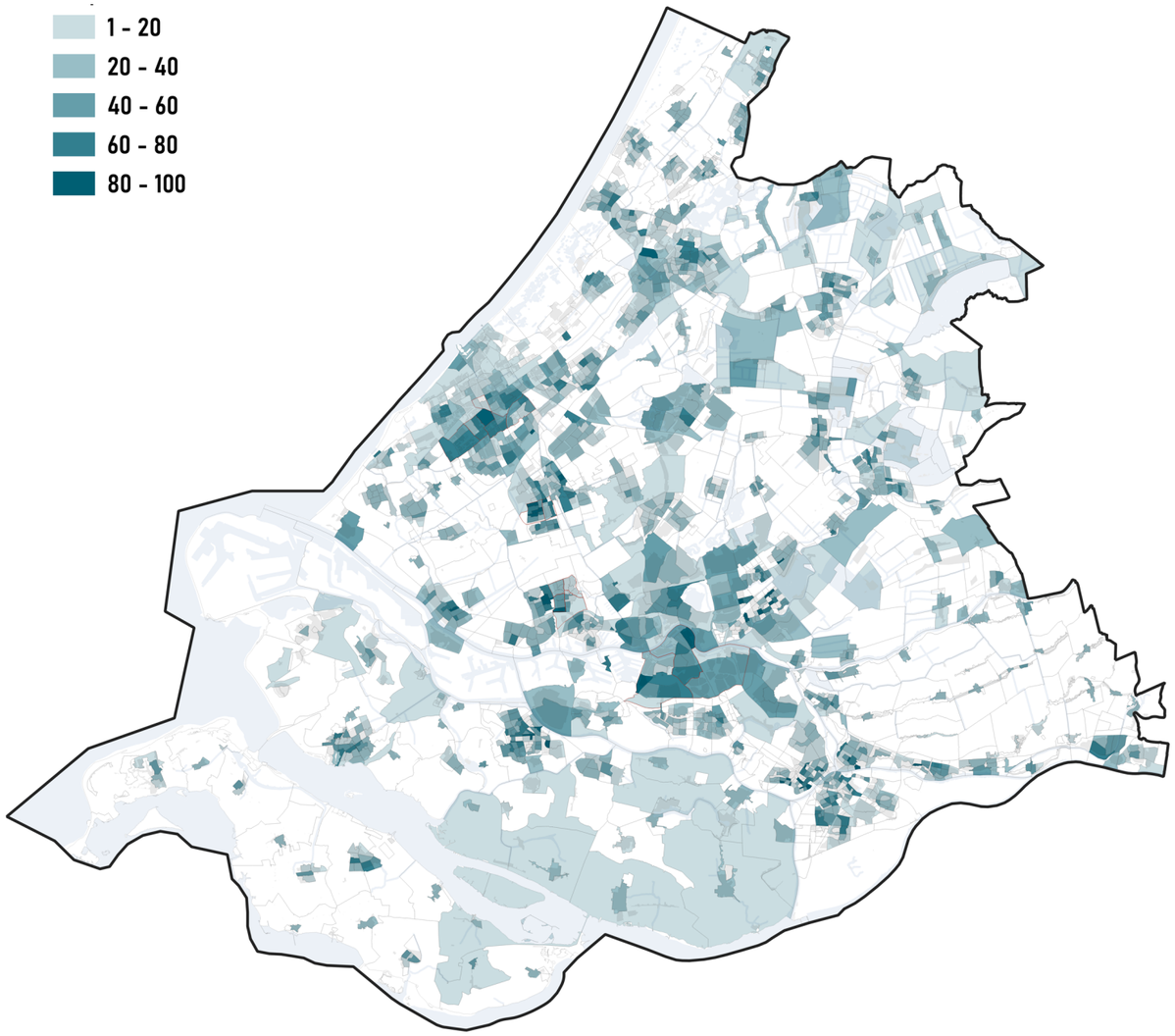


Figure 44: Percentage of Housing Owned by Housing Corporations. Data: CBS (2022).

BALANCE OF POWER

Stakeholder Analysis

The stakeholder analysis highlights a clear imbalance between the most affected by energy poverty and those with the greatest capacity to shape outcomes. As shown in the Power/Interest matrix (Figure 45), ministries and housing corporations occupy the higher-power end of the spectrum, while residents, social workers and small local actors tend to cluster in positions with lower formal power despite having high direct interest in the issue. Significant structural power is held also by energy and gas companies, even if their direct interest in neighborhood-level justice may be limited.

This reveals the basic tension of the project: the ones who experience the problem are not the ones in power to solve it. Housing corporations hold the most influential position, linking national policy, local housing conditions and the practical implementation of the transition. They represent central actors in technical delivery, but also in terms of fairness, timing, and residents' agency.

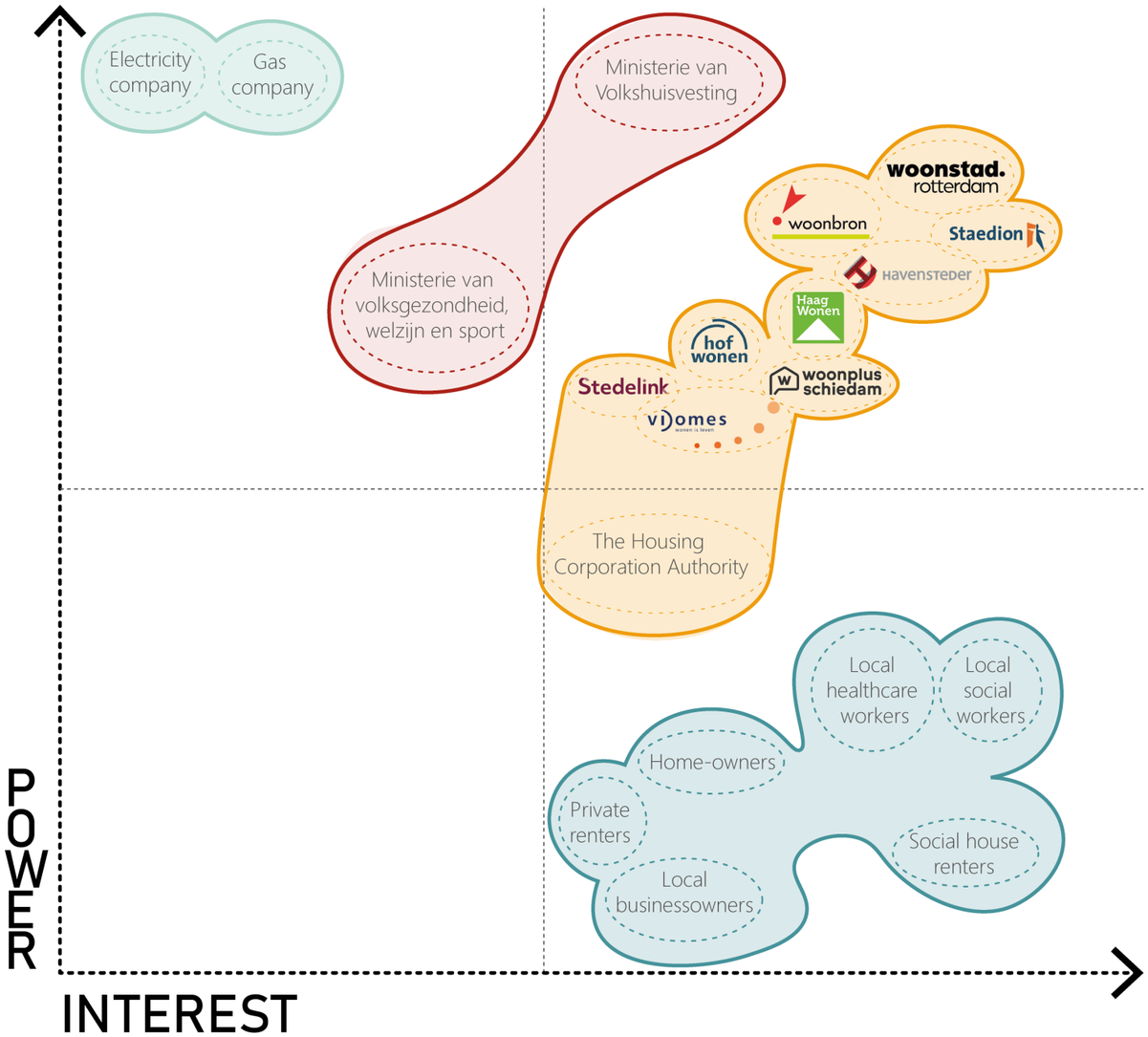


Figure 45: Power Interest Matrix.

BALANCE OF POWER

Housing Coporations

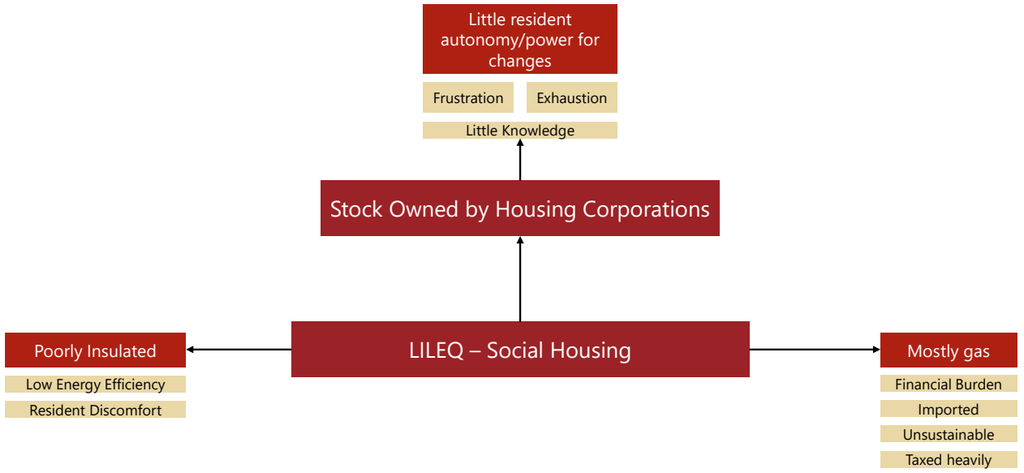


Figure 46 Diagram of Housing Corporation Influence and Consequence on Residents

The chosen neighborhoods are primarily composed of social housing. In the Netherlands, social housing is managed by housing corporations (woningcorporaties). To better understand the quality of housing and the underlying power relations that affect living conditions, housing corporations were analyzed. Actions done by these entities structure financial and spatial decisions, limiting the agency tenants' ability to lower costs and improve their personal thermal comfort.

Housing corporations are non-profit, independent organizations. They provide and manage housing primarily for low-income households, vulnerable citizens, and people with limited access to the market. They are private entities but fulfill a public mission and are significantly supervised by Authority for Housing Corporations, especially after various corruption scandals in the past (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2024). They own and manage a notable percentage of the Dutch housing stock, 75% of the rental sector (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2021); however, the size of each housing corporation varies significantly.

Housing corporations in the Netherlands originated in the mid-19th century, beginning in 1852 to address growing housing shortages. Their role expanded with the Housing Act of 1901, which introduced government subsidies for affordable housing under strict conditions. Although initially kept private, corporations increasingly operated within a regulated framework focused on public housing provision.

After the Second World War, a severe housing crisis led the government to give corporations a central role in reconstruction, with strong state control over rents, construction, and management. Over time, reforms aimed to increase their independence, culminating in the 1990s "brutering" operation, which made corporations financially autonomous but also increased their risks and responsibilities.

In the early 2000s, their role expanded to include improving neighborhood quality and supporting the broader housing market. However, financial issues and political scrutiny led to stricter regulation, particularly with the 2015 Housing Act, which refocused their activities on core social housing tasks. The abolition of the landlord levy in 2023 reflects a renewed governmental role in guiding housing corporations to address housing shortages and improve sustainability.

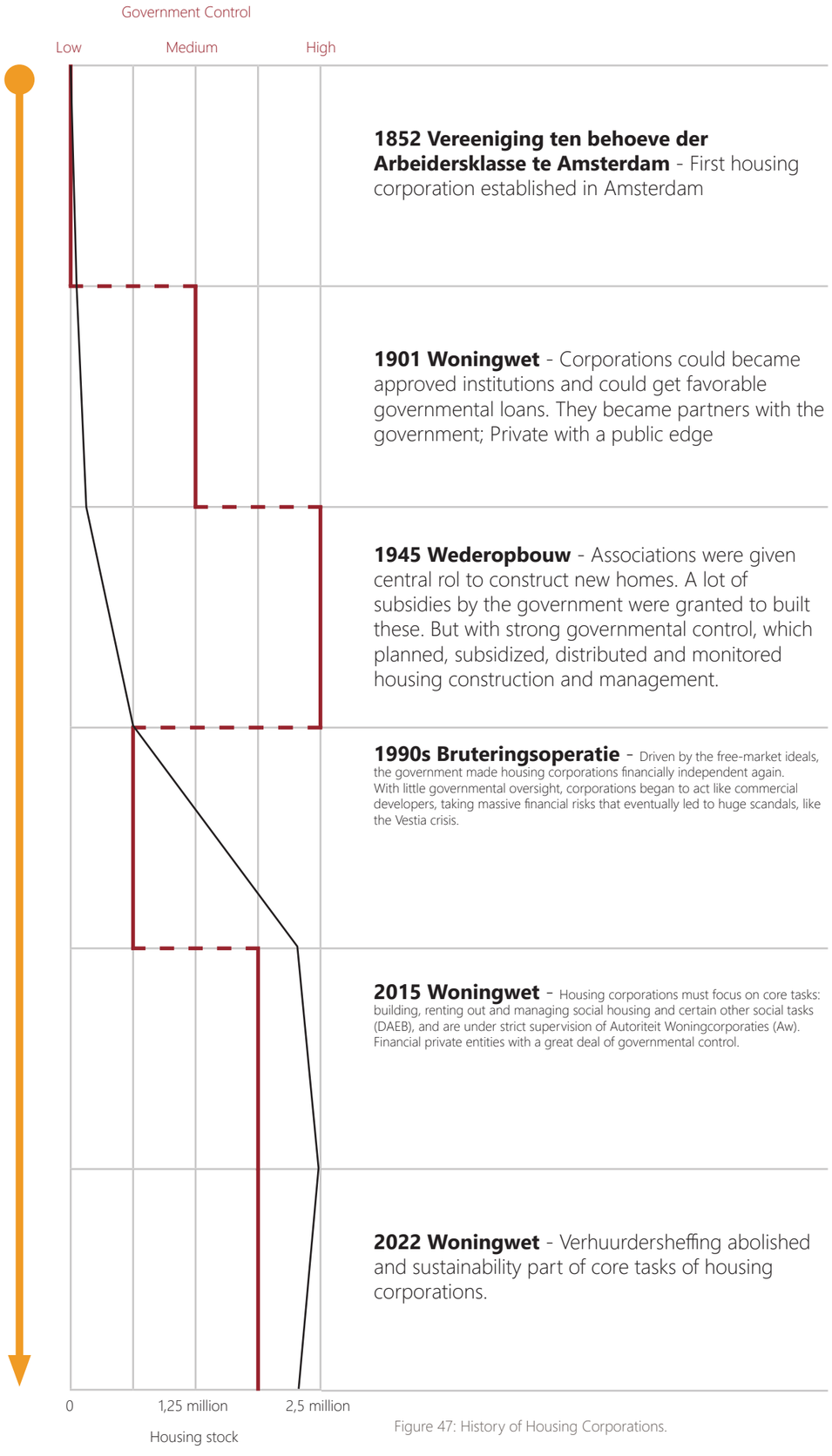
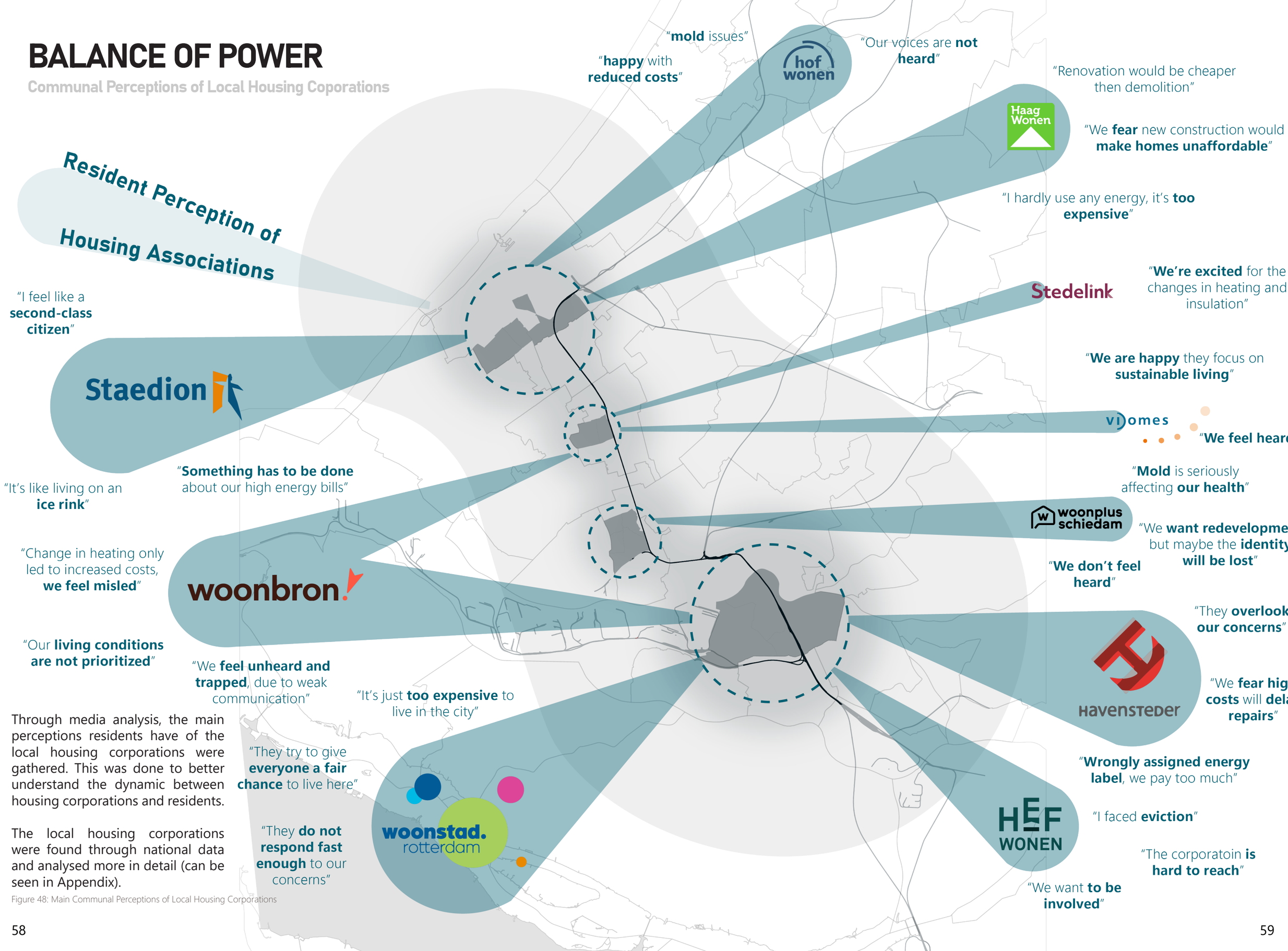


Figure 47: History of Housing Corporations.

BALANCE OF POWER

Communal Perceptions of Local Housing Coporations



Through media analysis, the main perceptions residents have of the local housing corporations were gathered. This was done to better understand the dynamic between housing corporations and residents.

The local housing corporations were found through national data and analysed more in detail (can be seen in Appendix).

Figure 48: Main Communal Perceptions of Local Housing Corporations

ENERGY TRANSITION

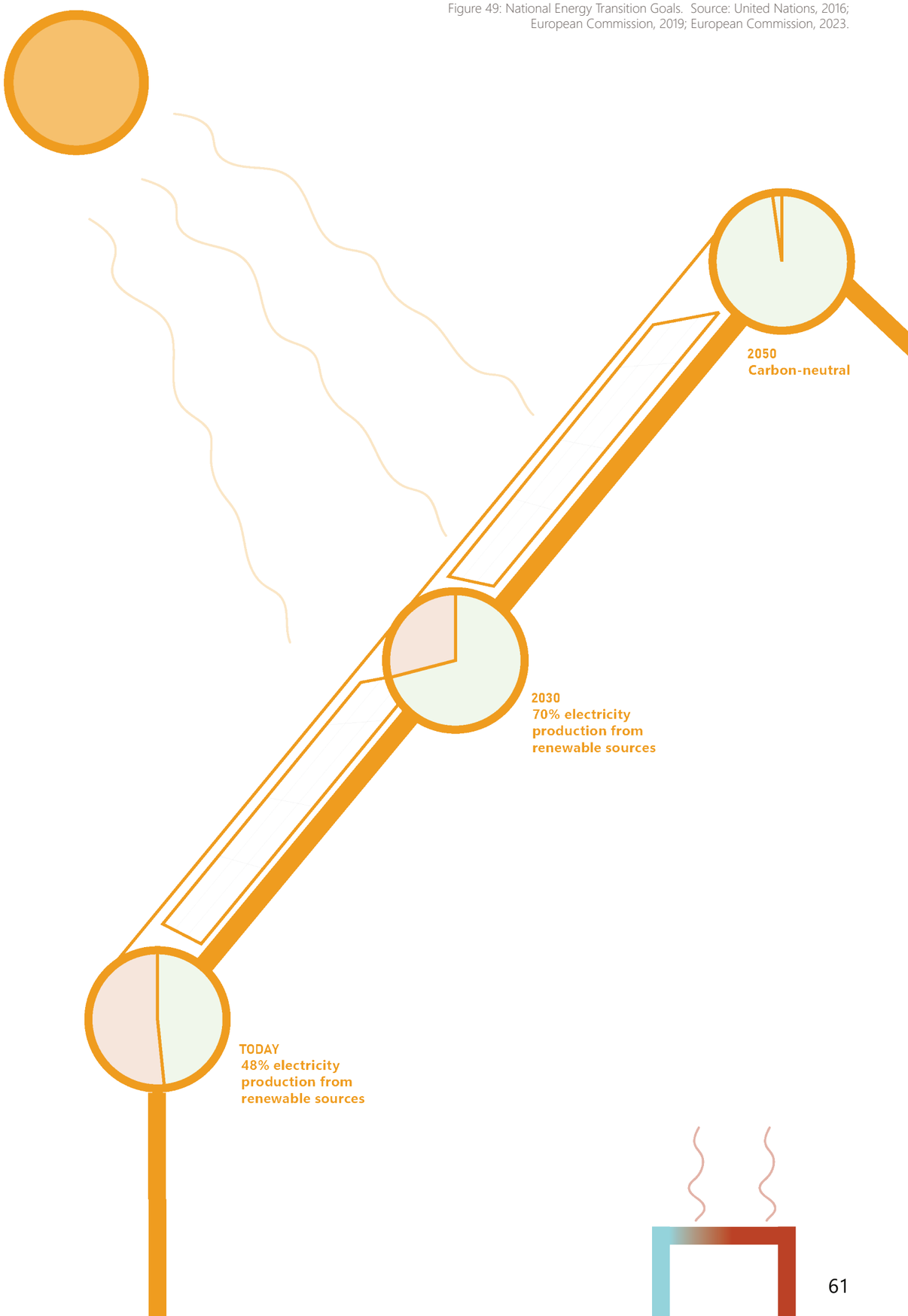
The Netherlands has enjoyed the access to energy-dense fossil fuels, becoming heavily reliant on it. However, it has become apparent, for a while now, that this has had catastrophic consequences on the climate of our planet, accelerating the natural occurring climate change to an unnatural rate.

To battle accelerated climate change international such as the Paris Agreement, European Green Deal, to make goals and the European Climate Law, to make the goals binding, have been made (United Nations, 2016; European Commission, 2019; European Commission, 2023). These European goals have led to the Dutch Climate Act, Klimaatwet (2019), which translate the international goals to national goals. The goals set are clear; by 2030 50% less emissions compared to 1990 levels, and full carbon neutrality by 2050. This, however, means transitioning away from the fossil fuels we have become so dependent on.

While the energy transition is fundamentally defined as a shift from fossil fuels to sustainable energy sources, such as wind and sun, the reality is far from simple. Achieving these national and international goals means a drastically change in the Netherlands' current energy system.

Furthermore, The success of the energy transition depends on public support. It is, therefore, not only a technological, but also a social change. How high will the bill be? Who is going to pay it? And who decides? Energy justice has several sides. It is about citizens and whether they can afford the additional costs. But there is also a new division of roles among companies. In addition to the traditional energy companies, local cooperatives or new market players can produce and sell energy. And this is only possible if the legislator provides room for these activities.

Figure 49: National Energy Transition Goals. Source: United Nations, 2016; European Commission, 2019; European Commission, 2023.



ENERGY TRANSITION

Climate-Related Challenges

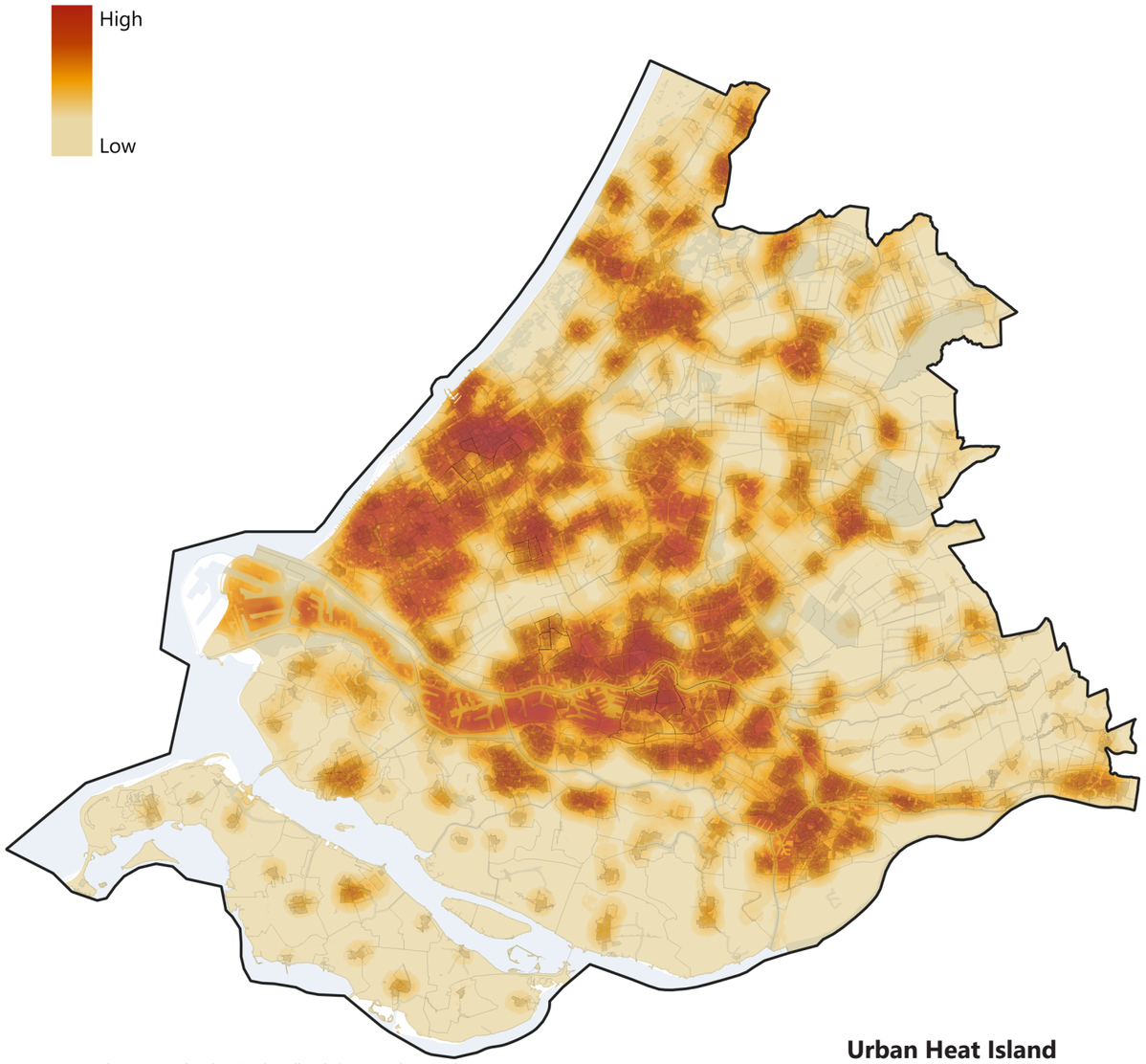


Figure 50: Urban Heat Island in Zuid-Holland. Source: Klimaatatlas (2026)

Urban Heat Island

As cities have expanded, dense built-up areas have increasingly retained more heat than their surrounding rural landscapes. This phenomenon, known as the Urban Heat Island (UHI) effect, occurs when human activity, paved surfaces, and densely built areas absorb and re-emit heat more intensely than surrounding natural environments (Yang et al., 2016). In vulnerable neighborhoods this effect can worsen indoor discomfort, increase heat stress, and place additional pressure on residents who already live in poor housing conditions

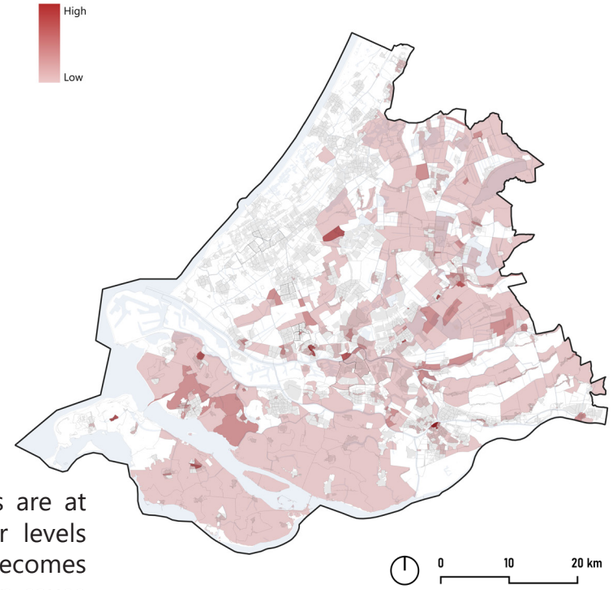


Figure 51: Pole Rot Risk in Zuid-Holland. Source: Klimaatatlas (2026).

Pole Rot Risk

Homes with wooden pole foundations are at risk of rotting when the groundwater levels drop. The top of the foundation pole becomes exposed to air and thus will rot. This can cause structural damage to the building or worsen and accelerate existing issues.

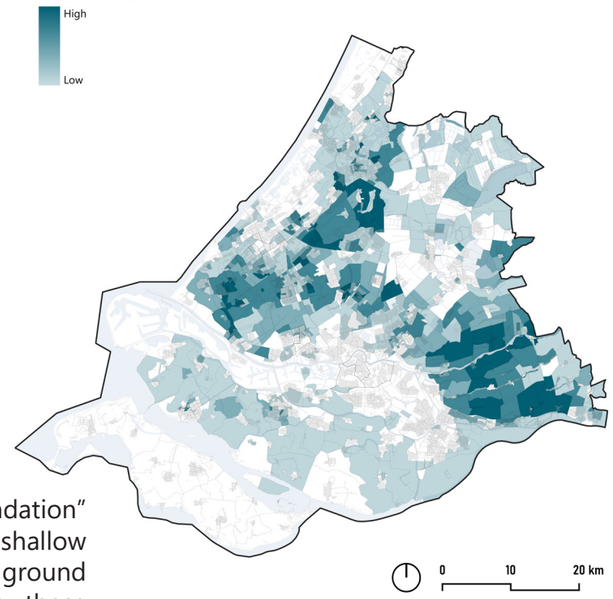


Figure 52: Tilting Risk in Zuid-Holland. Source: Klimaatatlas (2026).

Tilting Risk

Houses built with “shallow foundation” (fundering op staal) are built on a shallow foundations of concrete or bricks. If the ground subsides rapidly because of droughts, these homes will experience “differential settlement.”, causing damage in buildings affected. The risk of this is highest in areas with clay and peat soil.

ENERGY TRANSITION

Current consumption

Electricity use

High

Low

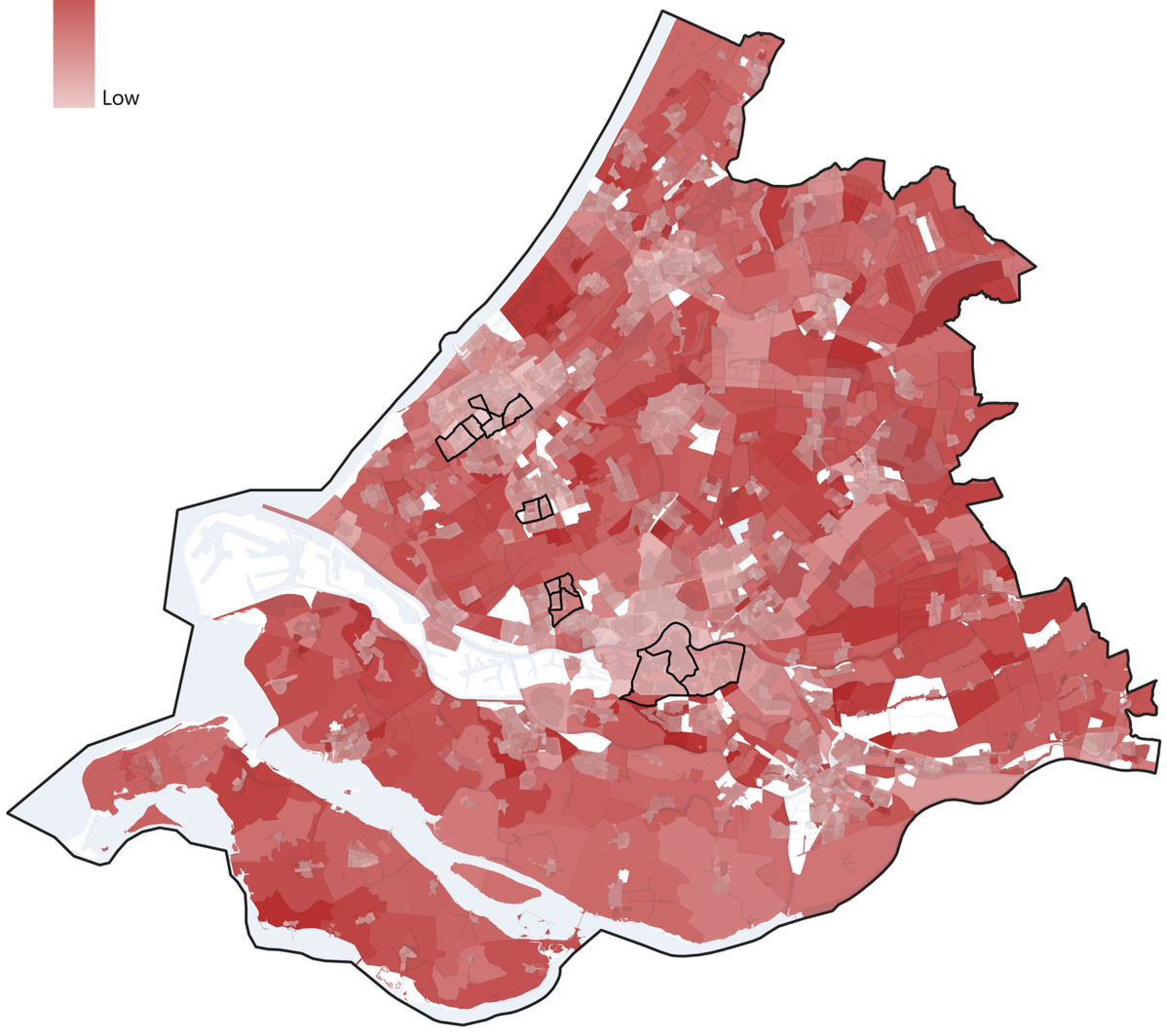


Figure 53: Mean total electricity use (kWh). Source: CBS (2022)

As illustrated in Figures 53 and 54, energy consumption in the selected LILEQ neighborhoods is noticeably lower. While the relatively low electricity use is expected given the continued reliance on gas, gas consumption is also significantly lower than average.

Gas consumption (m3)

High

Low

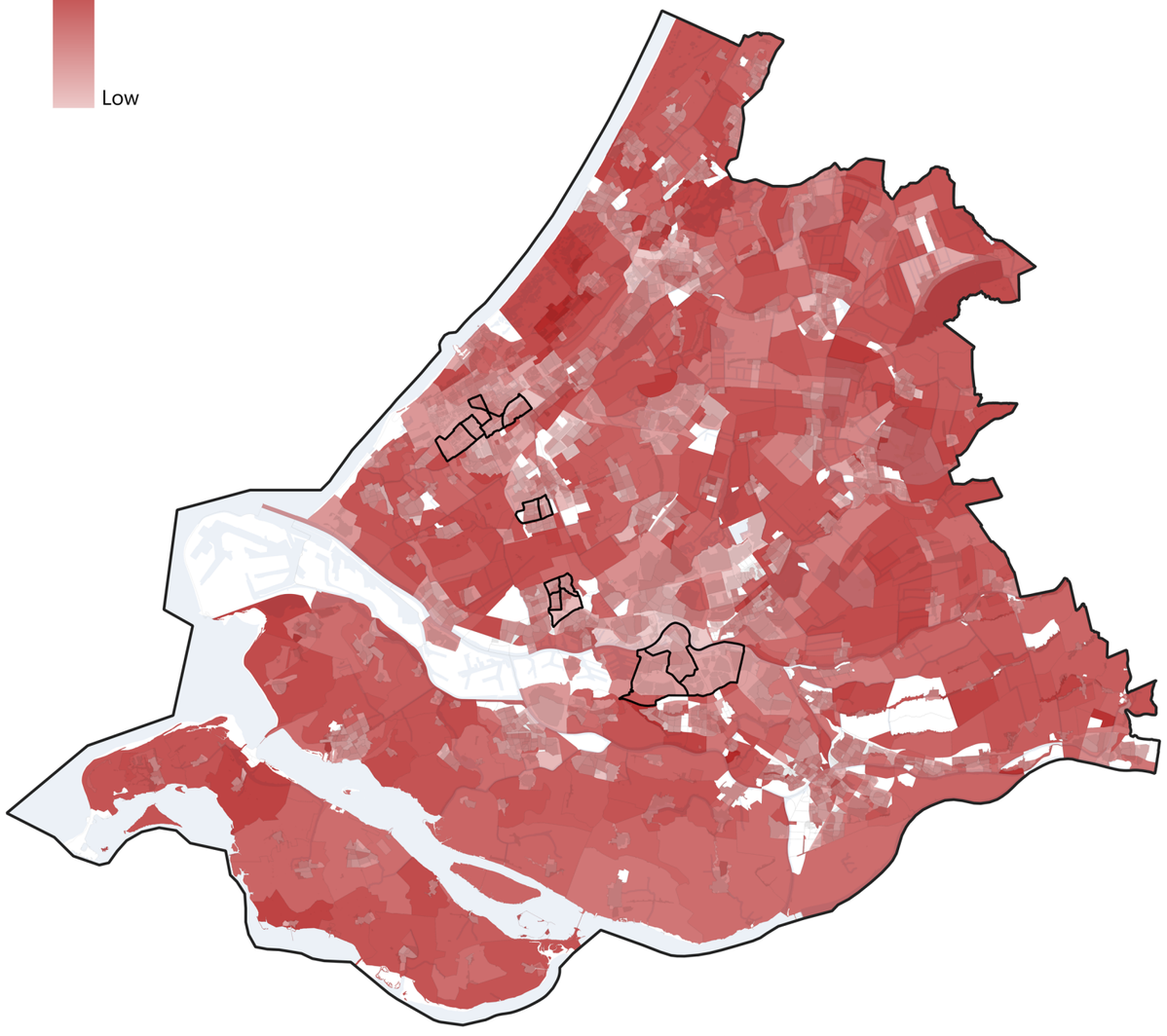


Figure 54: Mean total gas use (m3). Source: CBS (2022)

Considering the poor energetic quality of these homes, this suggests that households are not consuming less due to efficiency, but rather have adapted their behavior to limit energy use in order to reduce costs. This indicates a form of constrained consumption, where residents under-heat or under-utilize energy services, potentially at the expense of comfort and wellbeing.

ENERGY TRANSITION

Current consumption

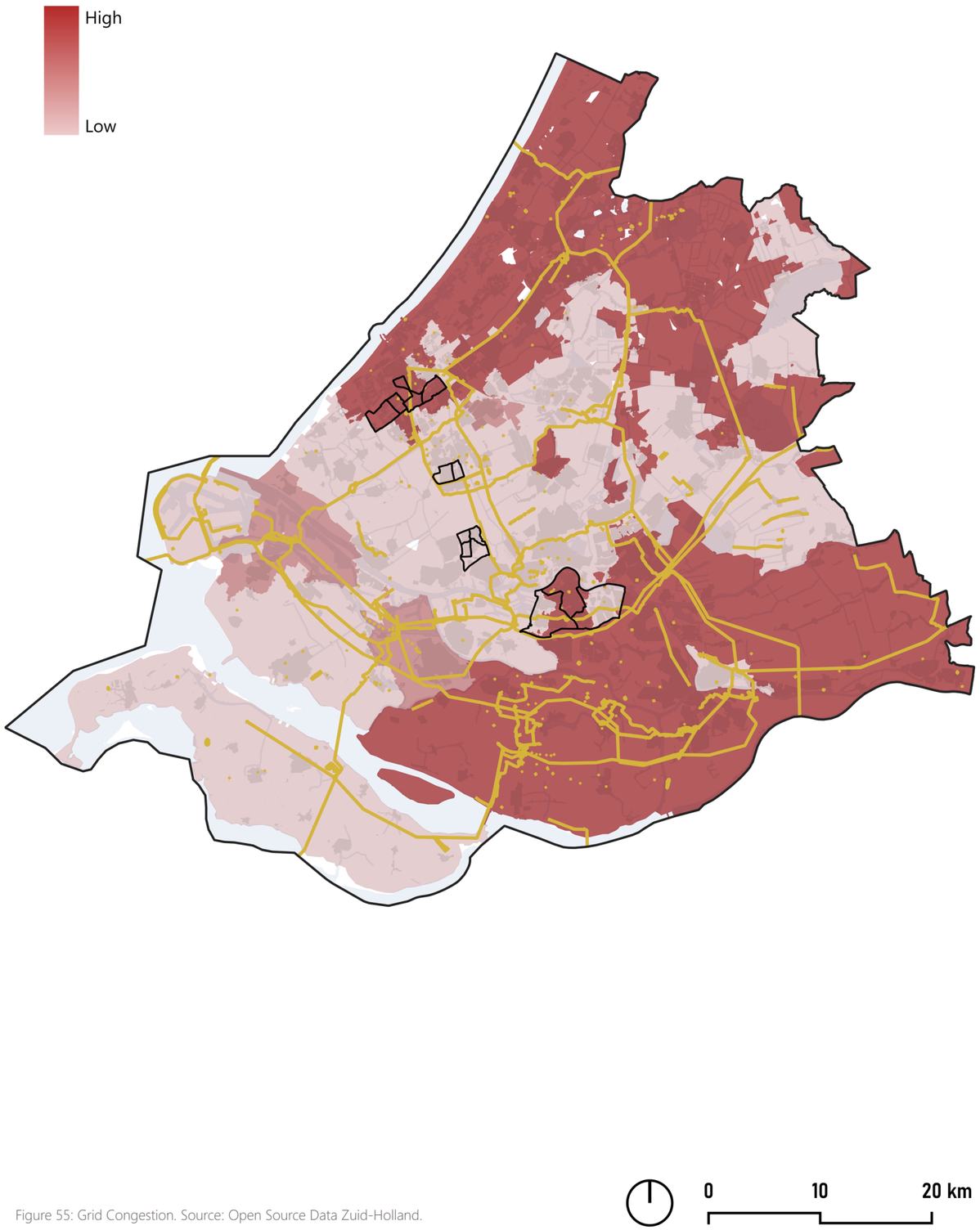


Figure 55: Grid Congestion. Source: Open Source Data Zuid-Holland.

In large parts of the Netherlands the electrical grid is congested. This is because there is an growing demand for electricity from households, businesses and the mobility sector, and a growing supply of electricity from renewable energy sources (e.g. wind and solar) (Rijksoverheid, 2026). All the while we are going towards a gas free future. The dutch electrical grid is not designed at this moment for these huge amounts of extra electricity supply and demand to pass through it.

Supply and demand is often high during peak hours on the day, usually between 16:00 and 21:00. These peak hours arise mostly from businesses and households. Households use for example heat pumps, induction cooking or charge their electrical cars. While businesses want to transition from fossil fuels to renewable electricity sources. During these peak hours there is not enough capacity to transfer all the demand and supply electricity through the grid. The grid cannot transfer all the electricity at the same time and gets overloaded. This causes a sort of traffic jam on the grid.

During these peak hours the grid has not enough room to transfer all the electricity through the grid. There is too much demand and supply. This causes a sort of traffic jam on the grid. The electricity grid consists of three levels: high, medium, and low voltage. These work together, just like highways, provincial roads, and local streets. If traffic grinds to a halt on one road, the other roads will feel the impact as well. Although housing is connected to the low voltage net, it means they can still feel this congestion on the higher levels. With electricity, such a congestion does not lead to a traffic jam, but to overloading. This can cause power outages or damages.

There are two kinds of net congestions:

Demand congestion
Usually net congestion is about situations where there is insufficient capacity for the withdrawal of electricity. This occurs during peak hours when demand for electricity is higher than the grid can handle. For example, when many devices are switched on simultaneously or when multiple companies use a lot of electricity at the same time. Due to this congestion, new or existing users are placed on waiting lists to get to use electricity. Examples include big companies that want to transition to renewables, users of charging infrastructures, or new residential areas that require extra electricity (RVO, 2026).

Generation or feed-in congestion
This form of congestion happens when the generation of electricity is more than the grid can handle on that moment. This mostly happens in areas where there are a lot of wind- and solar-parks on a sunny or windy day. Due to generation congestion, new solar energy installations or wind turbines have to wait longer for a connection to the electricity grid in order to ‘feed’ the generated electricity into the grid. And existing installations may be able to feed back less generated electricity to the grid (RVO, 2026).

ENERGY TRANSITION

Energy Potentials - Solar Energy

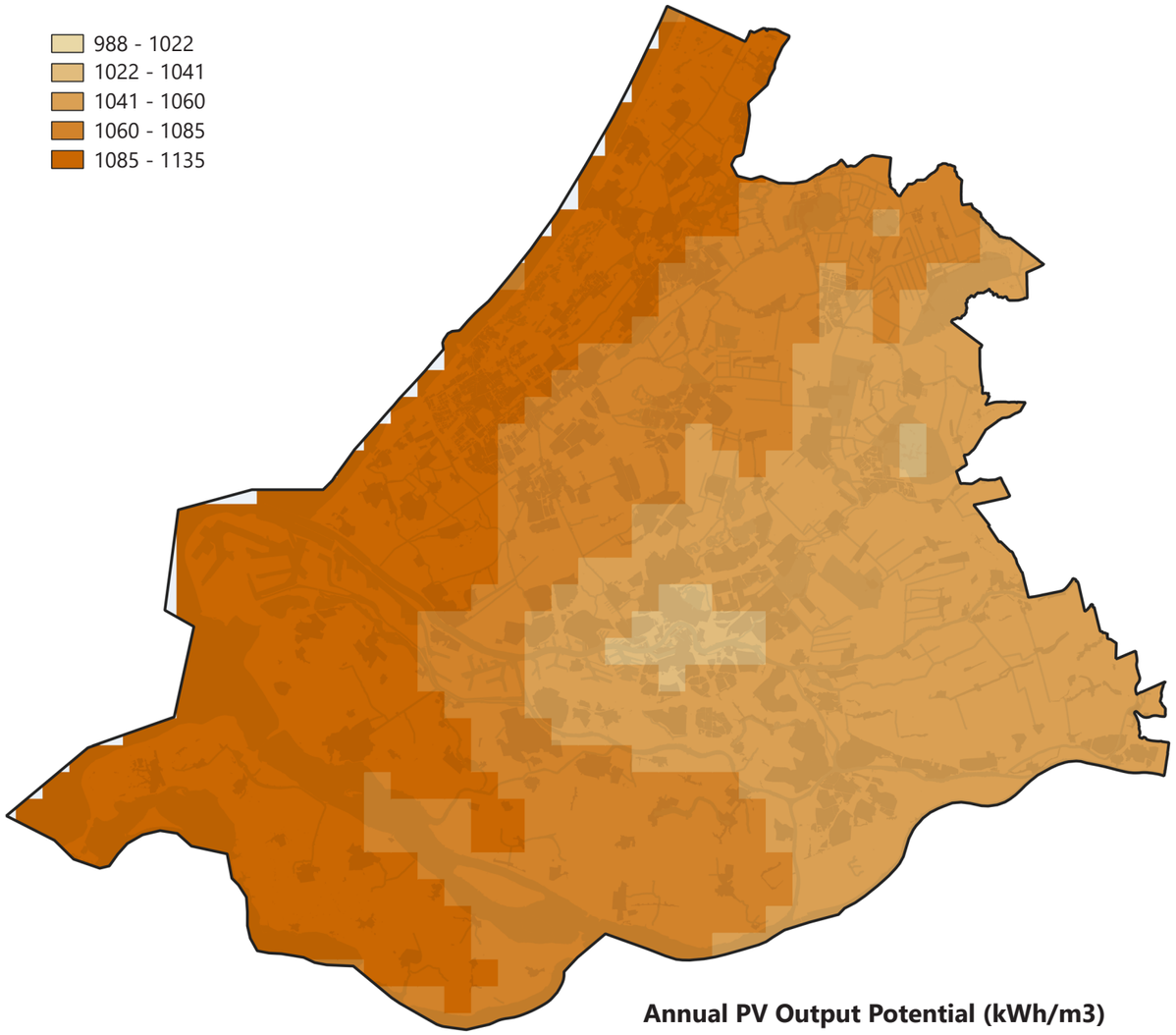


Figure 56: Annual PV Output Potential in Zuid-Holland. Data: AR2U086 (2026)

Solar energy is uniquely suited for the built environment as it allows for decentralized production, generating power where it is consumed. Its use is identified by the Dutch government as one of the most important clean energy sources needed to be carbon neutral by 2050 (Rijksoverheid, 2026). By utilizing unused rooftops, urban areas can expand renewable energy capacity without depending on available open land. However, since solar power is inherently volatile, its production depends on the sun, its effectiveness depends on how it is integrated into the broader energy structure.

Solar energy has a larger potential throughout the coast, since Zuid-Holland is a coastal province, the potential is relatively higher.

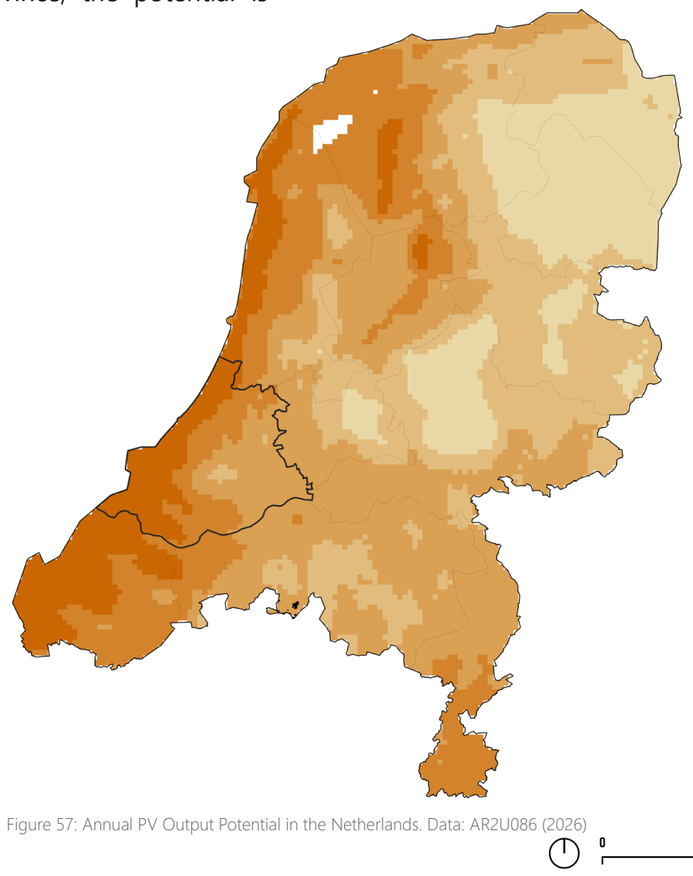


Figure 57: Annual PV Output Potential in the Netherlands. Data: AR2U086 (2026)

Over the past decades, solar panels have undergone a great transformation; a dramatic drop in price accompanied by a steady increase in efficiency and production rates. Because of this, PV systems have become available to the middle class of the Netherlands. This has made solar panels a common sight in both urban and rural areas.

However, as stated, solar energy is volatile and its production is uneven throughout the day and seasons, thus distribution and storage are essential. Batteries can help store surplus energy for later use, while connection to the grid remains necessary to balance periods of shortage and excess. This is important in the Netherlands, where grid congestion has already become a significant obstacle to the expansion of renewable energy. Solar energy cannot be treated as a stand-alone solution: its success depends on storage, smart local use, and a grid that can absorb and redistribute power when needed.

The Dutch government gives out several subsidies for installing and using solar energy. There are individual subsidies, but also for local energy cooperations. An energy cooperative is eligible for the Cooperative Energy Generation Subsidy Subsidy (SCE). This subsidy is meant for energy cooperatives and homeowners' associations that wish to generate renewable electricity via solar, wind, or hydropower. However, this must take place within their own living environment, which is defined by a postcode area (Rijksoverheid, 2025).

ENERGY TRANSITION

Energy Potentials - Geothermal Energy

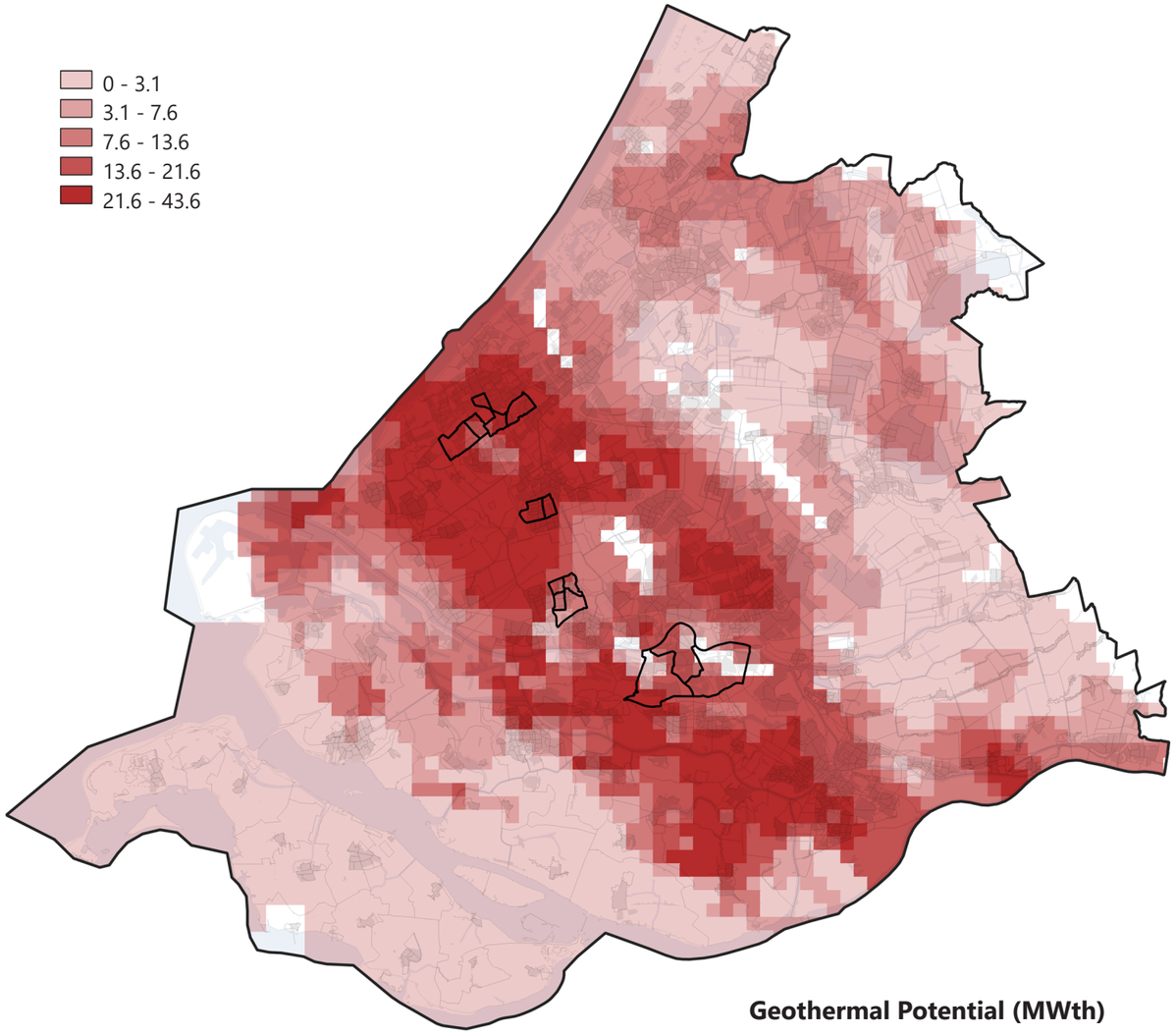


Figure 58: Geothermal potential in MWth. Source: AR2U086 (2026)

Geothermal energy is a sustainable way of extracting heat from the subsoils of the earth's crust. By drilling wells, this underground heat can be pumped to the surface and used for various purposes, such as electricity production, water heating, district heating and industrial processes (Geothermie Delft, 2026). Depending on the depth of these wells, hot water at different temperatures can be pumped up. A key advantage of geothermal energy is its independence from weather conditions, making it a reliable and consistent source of heat.

Along the Rotterdam-Hague Metropolitan Region there is a significant potential for geothermal energy which should be taken advantage of.

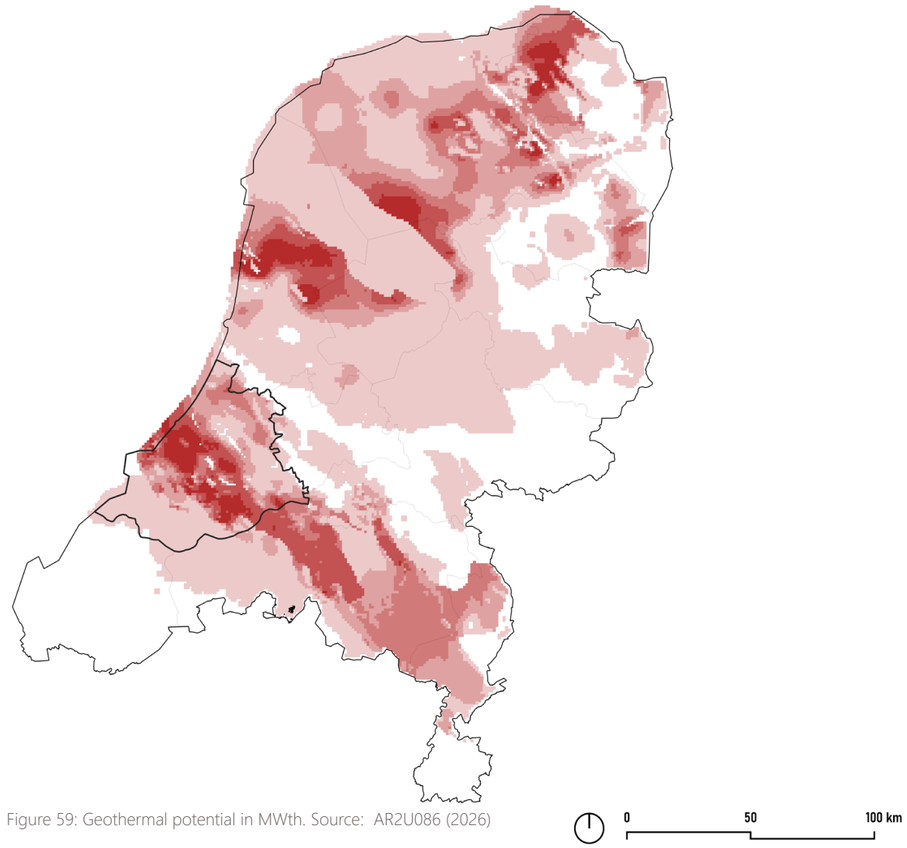


Figure 59: Geothermal potential in MWth. Source: AR2U086 (2026)

Heat is being transferred via heat exchangers to local tap water of to a heating network, which distributes the heat locally to buildings.

Soil energy (0-500 m)
With soil energy, heat (of max 20°C) and cold is extracted from the soil or groundwater and stored locally. The water is extracted from a depth of approximately 300 meters and heated by a heat pump to around 55°C for indoor use. The pump can be individually connected to a well-insulated building.

Geothermal energy (<500 m)
Geothermal energy or (earth warmth) is being extracted at a depth of more than 500 meters and therefore falls under the mining act. A geothermal installation pumps this water up and distributes the heat via a heating network to the surrounding built environment. It is a heating solution for collective use with one extraction installation that takes up around 30m2.

ENERGY TRANSITION

Urban Mining

There is considerable discussion around the topic of urban mining in the Netherlands, especially the mining of valuable materials such as metals (Koutamanis et al., 2018). As a result, infrastructure exists around the recovery and repurposing of metals (specifically those used in electronics), but there is little to no infrastructure around repurposing of other building materials.

The feasibility of urban mining within the construction industry is plausible, especially among housing corporations which are expected to maintain detailed accounts of plans, refurbishment and new builds for their respective housing stock. This, in turn, would facilitate inventory development of repurposable material across most, if not all, the social housing stock in the Netherlands.

The primary concern would relate to the infrastructure required for urban mining, especially since building components are considerably larger than electronics. Infrastructure would include: administration and storage centers, a managing entity, vehicles for transportation, etc.

Urban mining has the potential to reduce CO2 emissions significantly, especially among an industry which accounts for 12% of the total annual GHG emissions (CBS, 2024). Overtime, studying the possibility of recovery for certain materials can lead to building more modularly and circularly, where components can easily be replaced and repurposed.

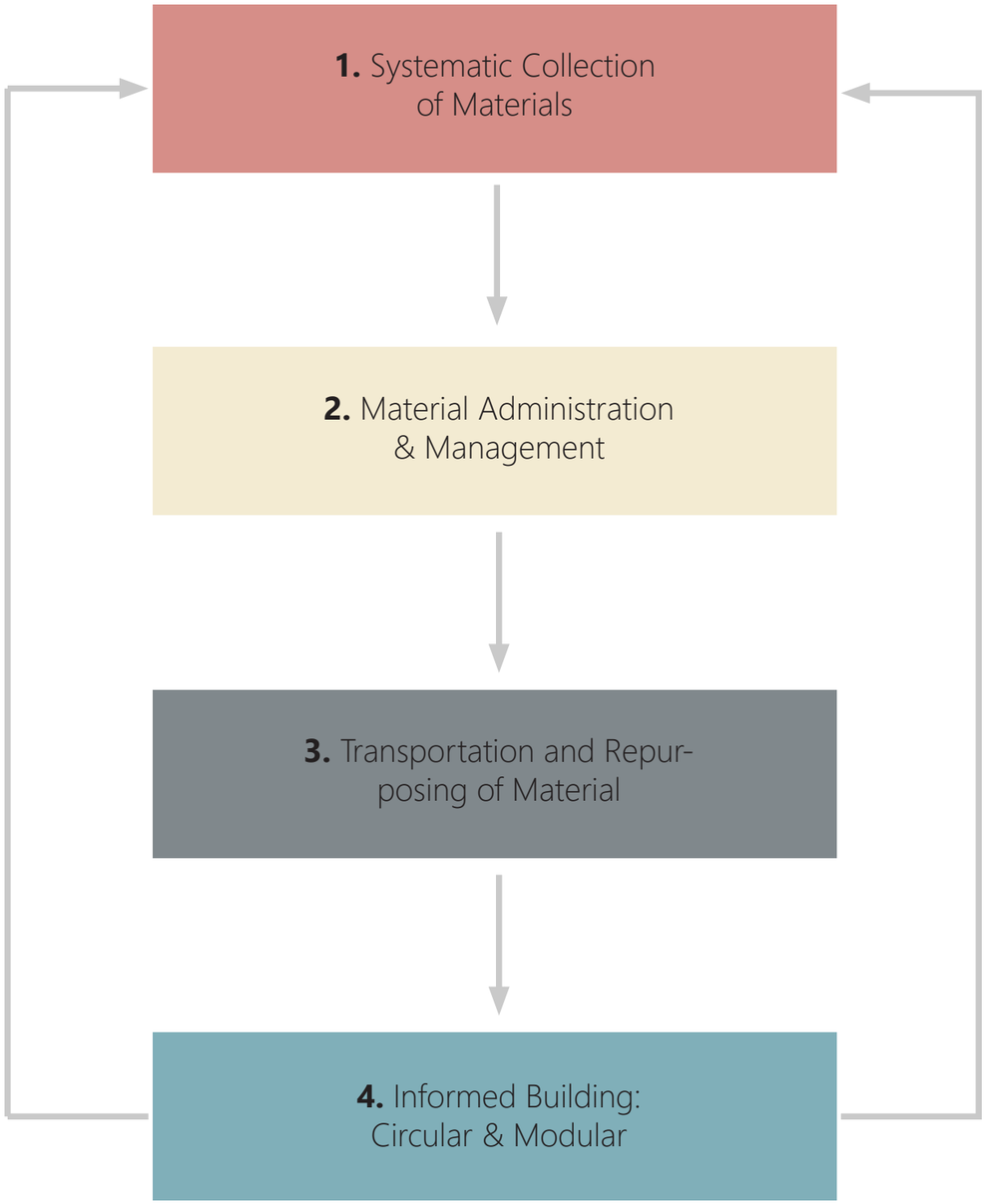


Figure 60: Urban Mining Cycle (adapted from: Mensah-Bonsu, 2023)

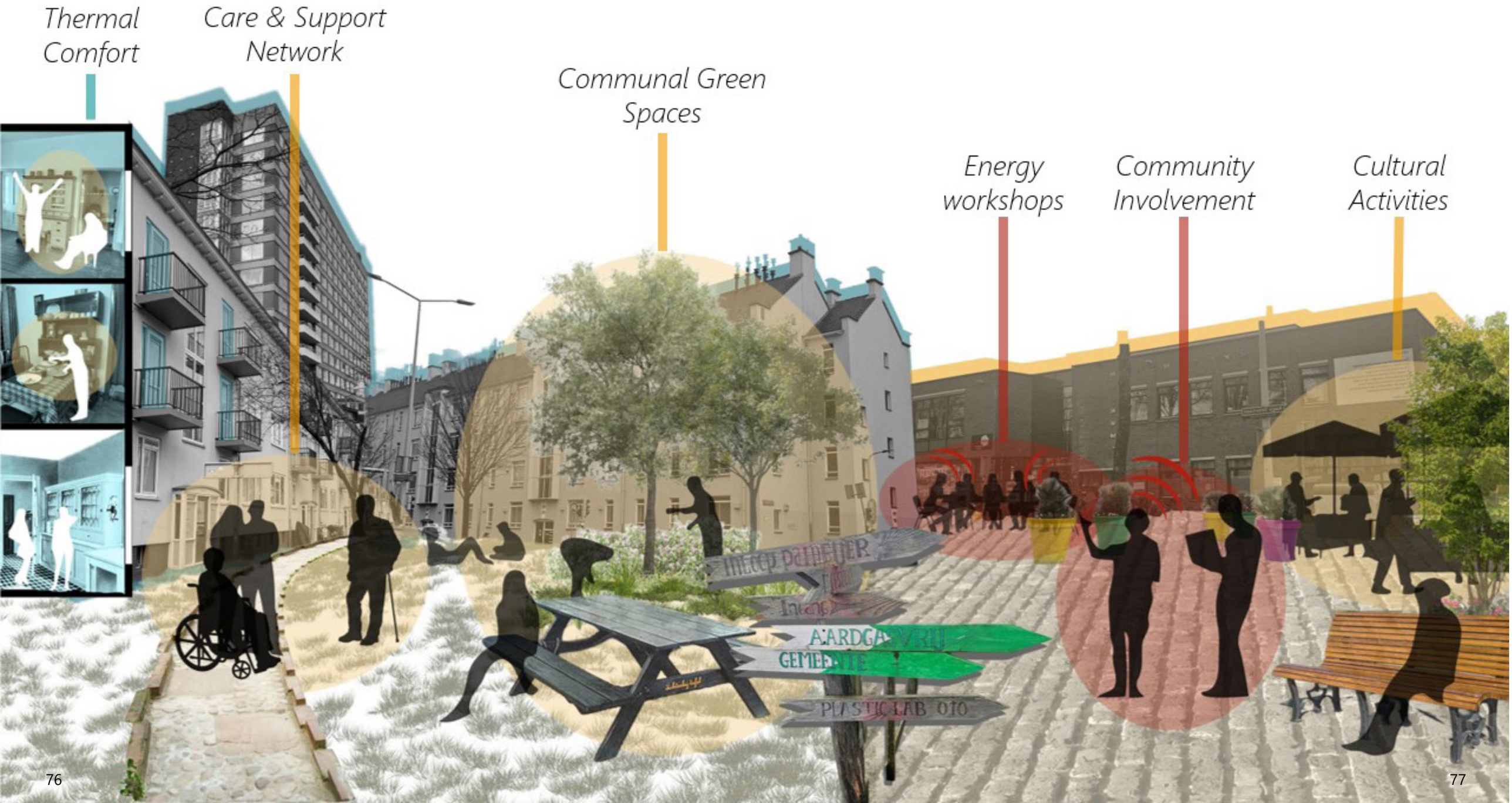
VISION

LAYING THE FOUNDATION FOR FUTURE ENERGY COMMUNITIES

COMMUNITY VISION

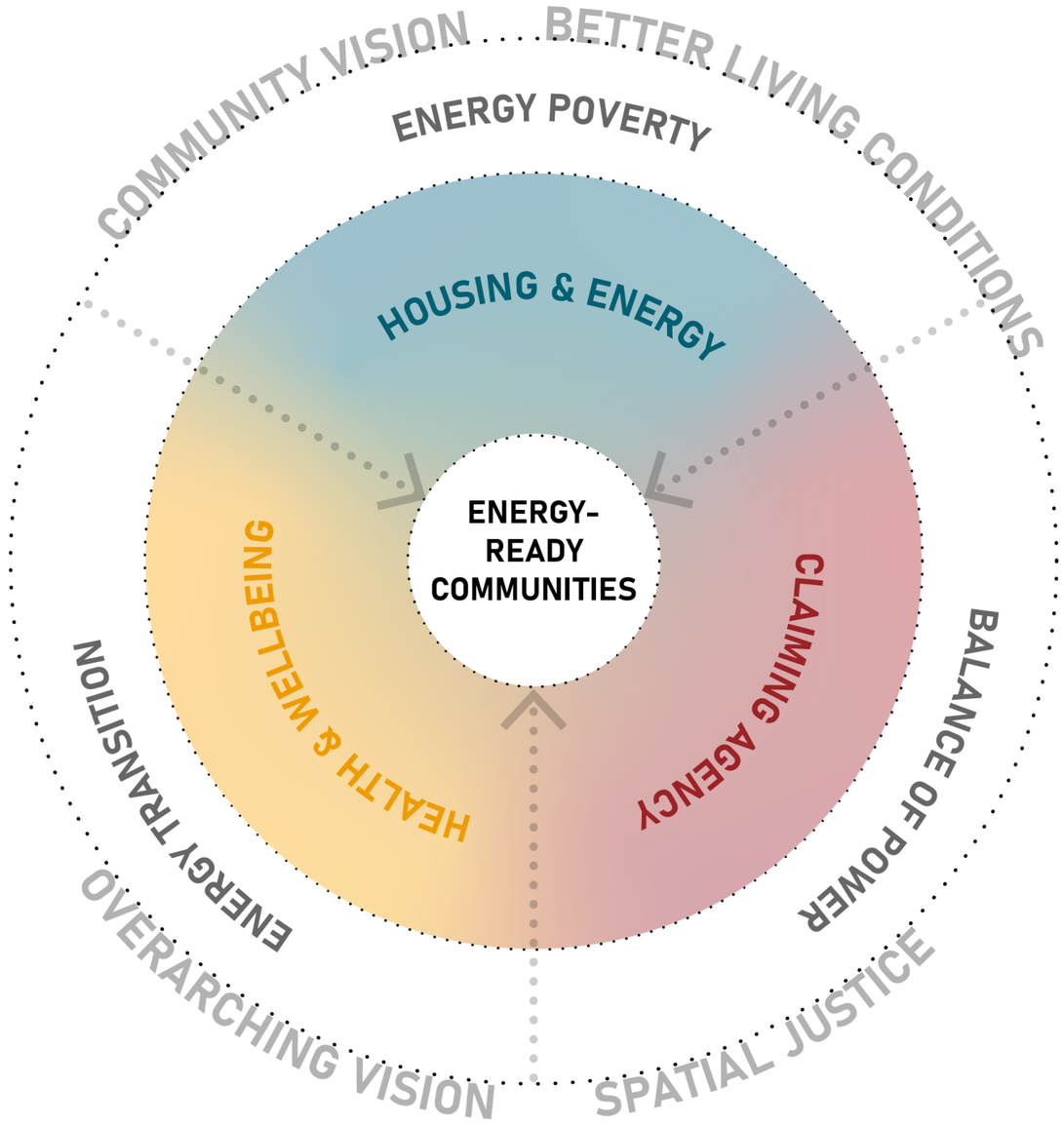
Through our analysis, we developed a community vision grounded in insights from the media analysis, which highlighted their key values and needs.

Figure 61: Community Vision.



PRINCIPLES

Figure 62: Principles Diagram.



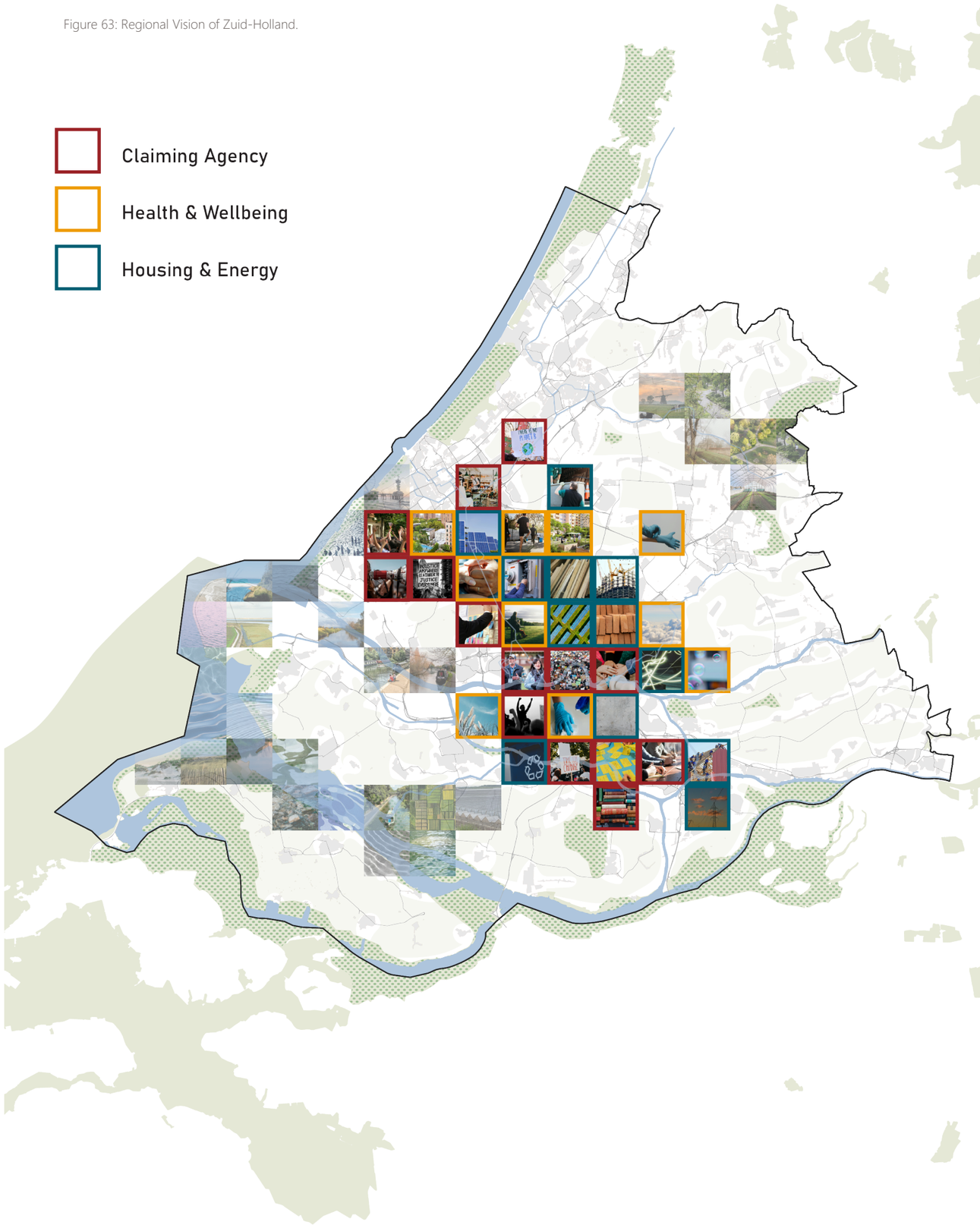
Our key principles that underpin our vision were shaped by our conceptual and theoretical frameworks (see Figure 62). Through our analysis, we developed a clearer understanding of the socioeconomic and spatial dynamics of the Hague–Rotterdam Metropolitan area, revealing structural inequalities in housing quality, financial disparities, and participation in decision-making.

The theoretical framework of the commons emphasizes rethinking collective forms of ownership and management. As our analysis revealed the current housing conditions do not foster equitable livelihoods for residents.
In parallel, spatial justice guides our focus on improving housing conditions in LILEQ areas, by addressing disparities and promoting more equitable living environments. Communication and participation are central to our vision, ensuring that residents are actively involved in decision-making processes at every stage to strengthening inclusivity, and local knowledge. Through the accumulative understanding of these key concepts we were able to frame a vision which prioritises providing equitable access to energy, improving housing conditions, and ultimately seeks to foster better livelihoods for residents in the Hague–Rotterdam Metropolitan area.

REGIONAL VISION

A regional vision for Zuid-Holland centers on visualising the key components of housing and energy, health and wellbeing, and claiming agency. Together, these dimensions intend to foster a more inclusive and adaptive region where residents are not only beneficiaries of change but key drivers of it.

Figure 63: Regional Vision of Zuid-Holland.



THE MAIN ACTORS

As established in the analysis there are many stakeholders which have varying power and interest on the topic of energy justice. These key stakeholders generally resolve around the government bodies, housing corporations, and the residents (see Figure 64). This creates a dynamic where the state indirectly steers living conditions through rules on rent control, energy costs, and housing allocation, while housing corporations will directly implement these policies on the ground. As a result, residents often experience housing corporations as the primary authority affecting their living situation, even though many of the underlying decisions originate from government frameworks.

Housing Corporations

Housing corporations play a central role in shaping residents' daily lives, as they manage a large share of affordable housing and influence access, quality, and neighborhood development. While these corporations operate as independent, non-profit entities, their priorities and actions are deeply guided by national housing policies, regulations, and funding structures set by the government.



Figure 64: The Main Actors Diagram.

THE MAIN ACTORS

After identifying housing corporations as a main actor, we isolated the most diverse arena in the Zuid-Holland area. We categorised them based off findings from the media analysis which revealed their main characteristics (refer to the Appendix). This enabled us to formulate a vision that accounts for the potential impacts and conflicts, particularly within the relationship between housing corporations and residents.



Figure 65: Havensteder Logo. Source: Havensteder. (n.d.).

Havensteder, with around 29,000 social housing units, represents another large-scale category. In this case, the issue is the perception that investment and communication can be limited. This makes the corporation highly influential, but also difficult for residents to relate to or trust.



Figure 66: Haag Wonen Logo. Source: Haag Wonen. (n.d.).

Haag Wonen, managing around 20,000 units, represents a more intermediate position. Its approach appears more focused on practical housing conditions, especially issues such as mold and thermal comfort, and in some cases it includes resident input in renovation processes.



Figure 67: Staedion Logo. Source: Staedion. (n.d.).

Staedion represents one of the large-scale housing corporations with more than 32,000 social housing units. This category is characterised by a top-down approach, where large-scale redevelopment takes priority through demolition and rebuilding rather than renovation. This makes Staedion more distant from residents' everyday concerns.



Figure 68: Vidomes Logo. Source:. Vidomes. (n.d.).

Vidomes, with just over 4,000 units, represents the category that is most oriented towards bottom-up initiatives and community engagement. Although smaller in size, it stands out for supporting participation and local involvement more directly.



Figure 69: Woonplus Logo. Source: Woonplus. (n.d.).

Woonplus, with around 11,000 homes, represents a category with a stronger focus on sustainability and resident feedback. It works on a sustainable heat network and use a more integrated approach, where environmental goals and social conditions are considered together.

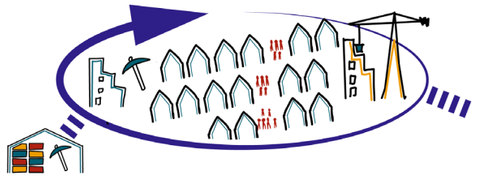
THE MAIN ACTORS

Figure 70: Housing Corporations Summary.

Housing Corporations	Should Be Doing	Are Doing	Key Conflicts
Staedion	• Improve the energy quality of social housing • Reduce residents' energy burden • Support remediation in vulnerable neighbourhoods • Upgrade ageing housing stock • Contribute to long-term neighbourhood resilience • Support the transition through realistic governance and investment	• Expanding housing supply through densification and new construction • Planning to add 5,000–6,000 homes • Increasing differentiation, including middle-rent housing • Working on stronger and more liveable neighbourhoods • Aiming for no E/F/G labels by 2028 • Targeting a CO_2-neutral stock by 2050 • Combining immediate support with large-scale redevelopment	• Bottom-up participation is not seen as the main driver • Community ambition alone is seen as insufficient • Phase I is supported, but considered not enough • Phase II is treated as the crucial phase • Demolition and rebuilding are seen as legitimate tools • Housing corporations cannot carry the transition alone
Havensteder	• Improving transparency and communication with residents about any changes to their housing • Investing in the energy transition	• Constructing new housing • Making improvements to their existing stock	• Abdoning plans to contribute to the energy transition which detach from broader national goals • Distrust between the housing corporation and its residents due to poor communication
Haag Wonen	• Incorporating more sustainable alternatives for energy production and consumption • Manage financial burdens on tenants better	• Projects related to bettering health and social aspects • Plans towards the energy transition • Significant consideration for community • Internal small-scale circular scheme	• Capital being a large obstacle to invest in transforming homes radically towards the energy transition • More collaboration with governing bodies
woonplus schiedam	• Invest more in sustainability	• Transparency • Relocating residents • Transforming and retrofitting housing to meet min energy label C • Using heat network for heating homes • In collaboration with local government • Local community support • Extra support for vulnerable residents • Creating diverse and inclusive neighborhoods	• Large part of current stock is old and therefore low energy labels which makes transforming the homes expensive and need to demolish in some cases. • More investment needed in sustainability • Creating diverse and inclusive neighborhoods while also creating more homes
vidomes wonen is leven	• Could be more transparent on their current projects (where they're renovating etc) • Involve tennants voices directly • In collaboration with government to remove barriers • Invest more in energy transition	• Transparancy • Working with bottom up initiatives • In collaboration with government to remove barriers • Income dependent rent • Involved in the connection to warmthnet	• Misses involvement with tennants through using representatives • More investment in the energy transition

STRATEGY

SPATIAL STRATEGIES



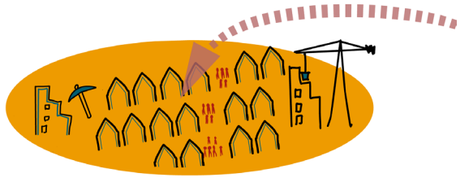
Urban Mining

Urban mining allows the buildings demolished as part of this strategy to be used as material reservoirs for the construction of new housing stock. Through the identification, collection, storage, transportation, and reintegration of these materials, a more localized supply chain can be established. Advancing broader sustainability goals by reducing waste and emission.



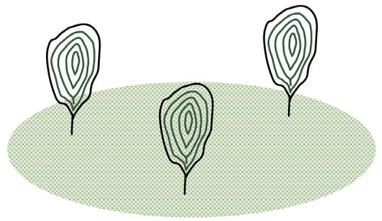
Autonomous Energy Production

Integrating decentralized renewable systems into communities across Zuid-Holland can reduce dependence on external energy sources. This can be achieved through the installation of rooftop solar panels, geothermal systems, and energy storage integrated into buildings and public spaces. By distributing energy locally, this approach supports a more equitable system while helping communities transition toward a



Transformation

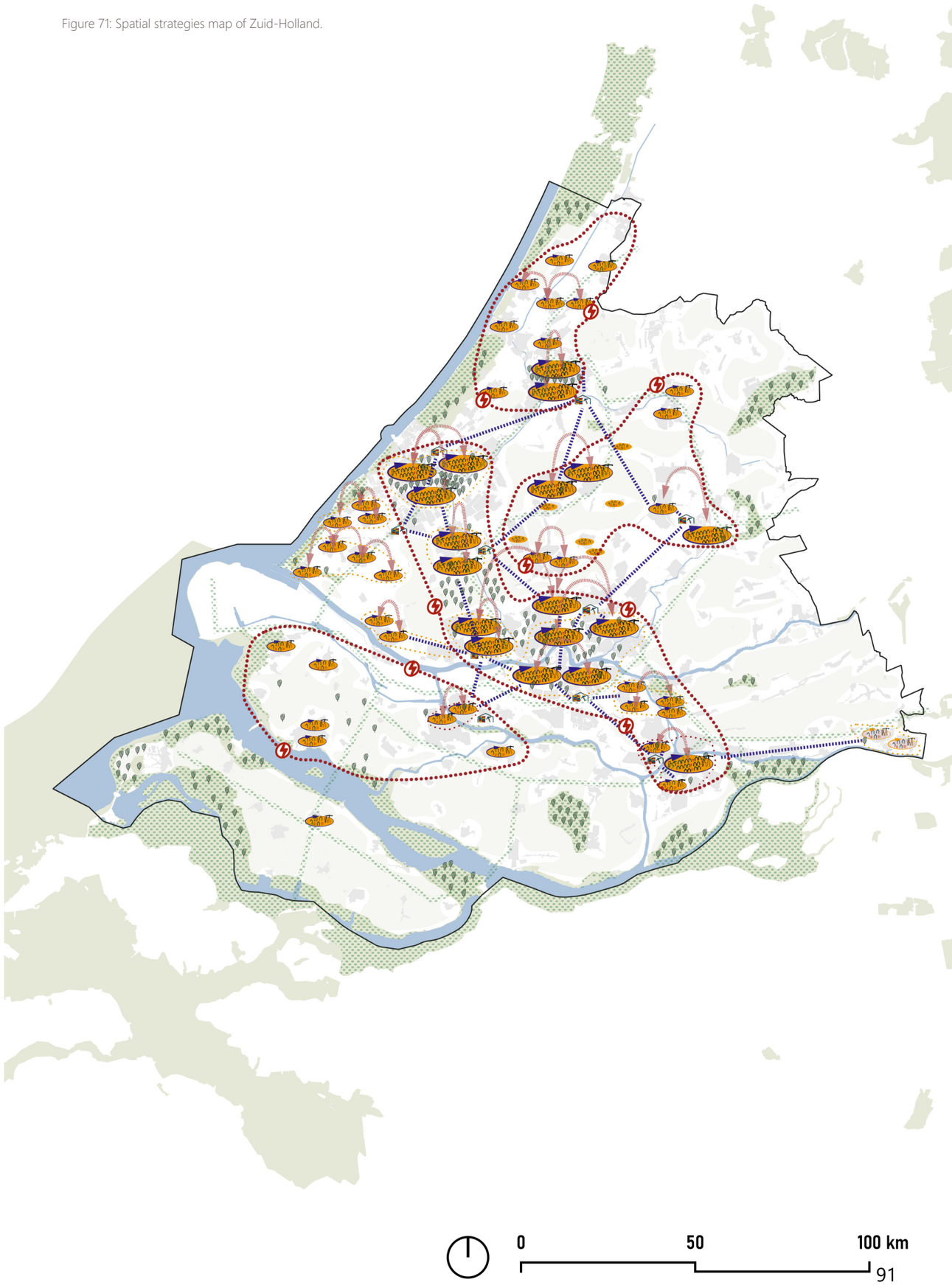
Demolishment, renovation, construction, and relocation together form a coordinated and transformative spatial strategy. This process can be used to address housing inequalities, particularly in energy-poor communities. Improving the quality and performance of the existing housing stock through targeted upgrades and redevelopment. Home will become more adaptive to the energy transition, reducing both the environmental impact and the financial and health burdens currently faced



Green Networks

This secondary spatial strategy enhances both ecological performance and community well-being. By establishing interconnected green networks, urban areas can mitigate heat, improve air quality, and provide more equitable access to public space. In turn, this fosters healthier lifestyles, encourages recreation, and strengthens social cohesion within communities.

Figure 71: Spatial strategies map of Zuid-Holland.



INTEGRAL STRATEGY

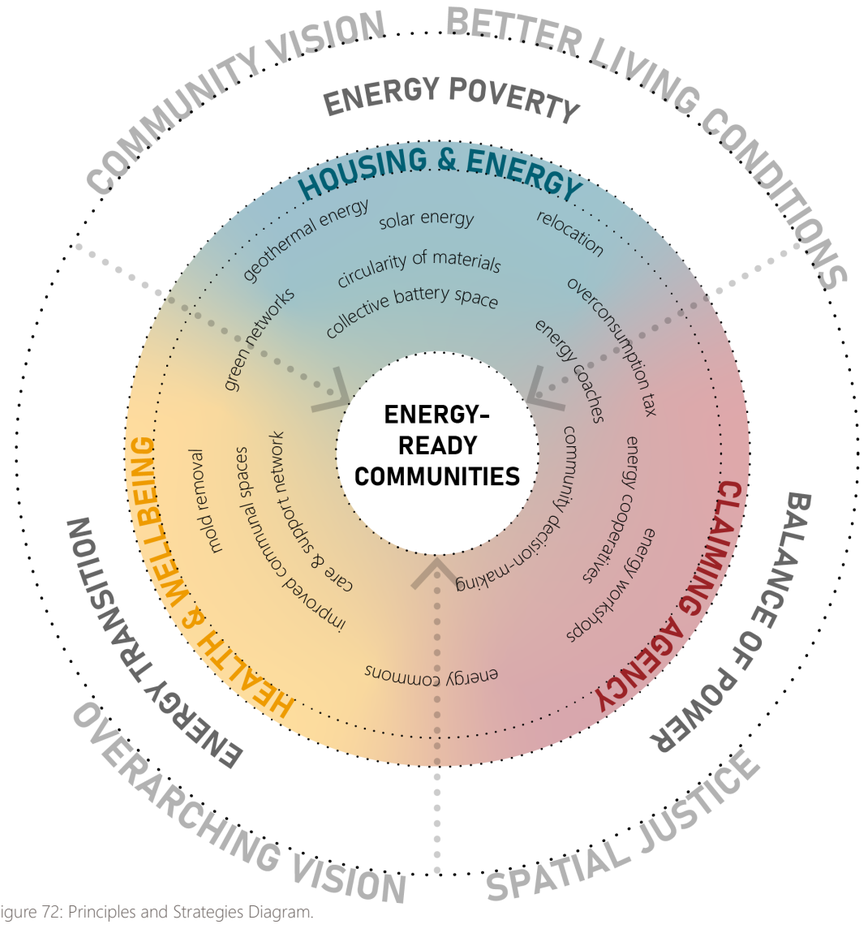


Figure 72: Principles and Strategies Diagram.

What is it?

An integral strategy is a comprehensive framework that combines spatial planning and policy interventions to guide long-term development. It aligns physical changes to the built environment, such as neighborhood redesign, retrofitting, and energy infrastructure with regulatory measures, financial incentives, and social objectives.

Within this framework, a rulebook for housing corporations serves as a practical guide, outlining standards, timelines, and preferred interventions to help transition their existing and future housing stock. This will help serve justice to the residents experiencing energy poverty and steer Zuid-Holland toward the national energy goals. By integrating spatial and policy dimensions, the strategy ensures that housing corporations not only upgrade buildings, but also contribute to broader objectives like climate adaptation, affordability, and livability, making the energy transition both coordinated and socially responsive.

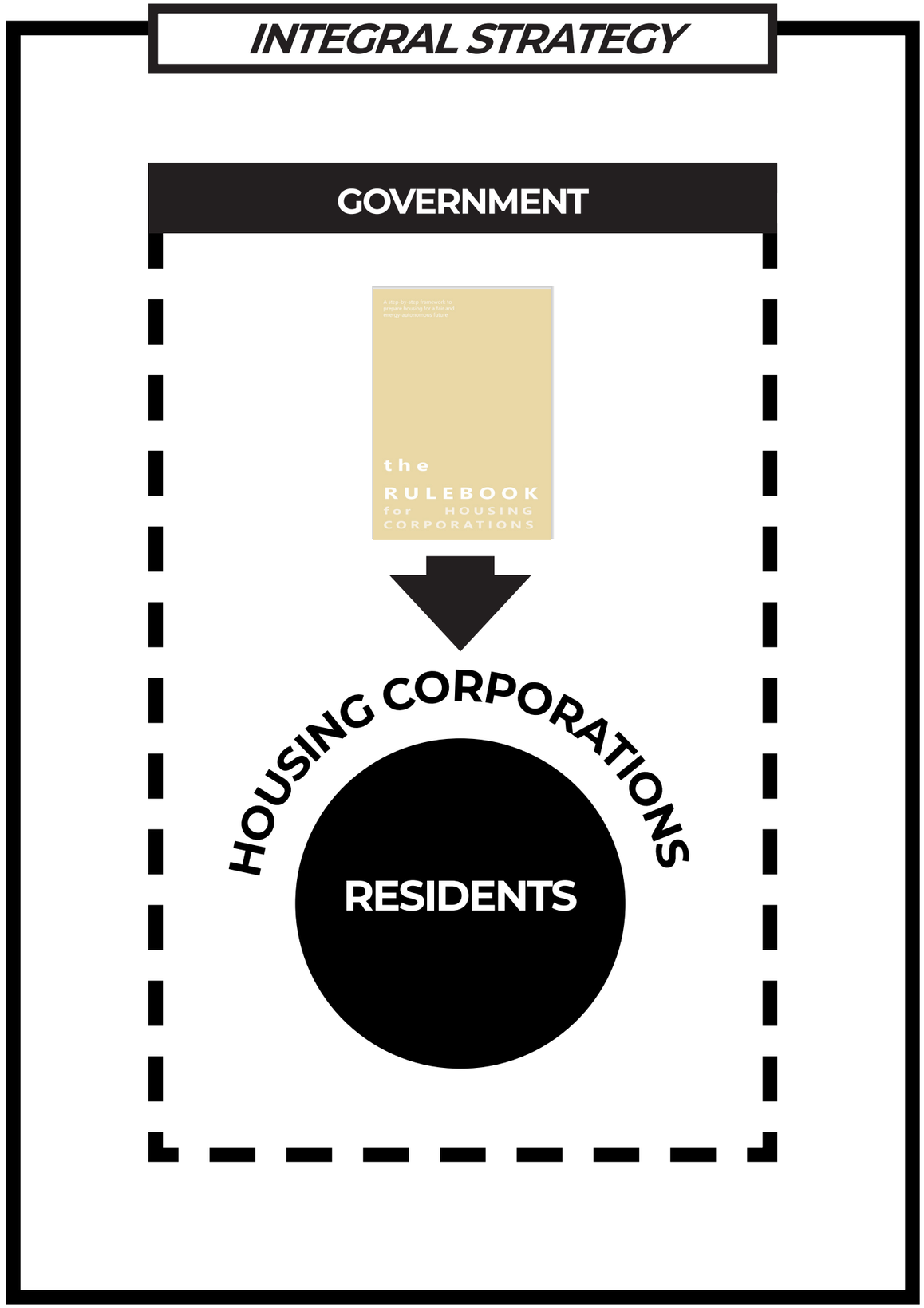
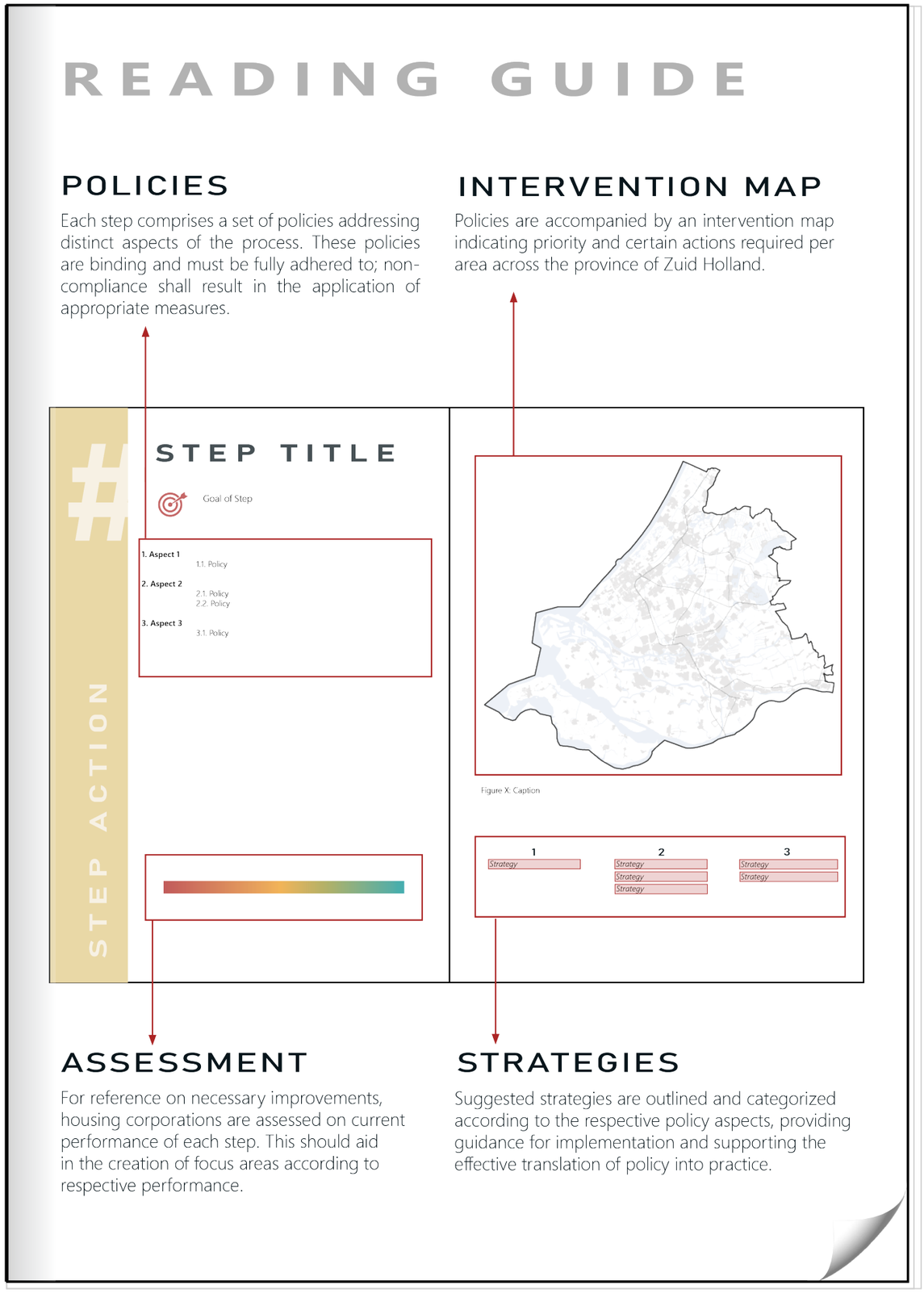


Figure 73: Integral Strategy Diagram.

As mentioned earlier, housing corporations play a central role in shaping residents' daily lives. These enterprises follow goals and regulations set by the governing bodies; this is where the rulebook intervenes. By adjusting and introducing specific policies in a structured and phased manner, the rulebook guides housing corporations toward the overall vision, the creation of energy autonomous communities. It provides a clear framework for action and procedure, aligning their core task with the needs and values of the residents; ensuring interventions are not only technically effective but also socially just. In doing so, it strengthens accountability, supports informed and participatory decision-making, and enables a more inclusive approach to the energy transition, ultimately contributing to improved living conditions and increased resident agency.

The rulebook is structured in steps, aligning broadly with the integral strategy phasing and standard construction timelines and considerations. The steps include short-term interventions to relieve burdens, collective decision-making on the future of the neighbourhoods, relocation and informed rebuilding. Each step is accompanied by a map to demonstrate the action areas in terms of priority and intervention type, therefore making the policies spatially applicable and easier to follow.

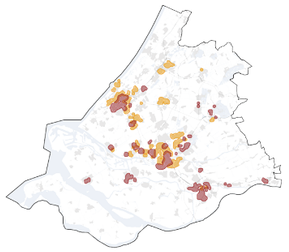


A step-by-step framework to prepare housing for a fair and energy-autonomous future

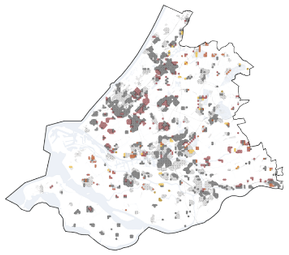
the RULEBOOK for HOUSING CORPORATIONS

THE STEPS

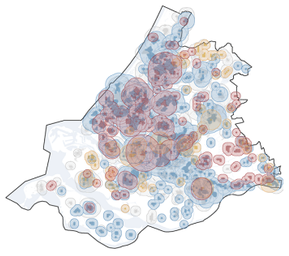
1 RELIEF



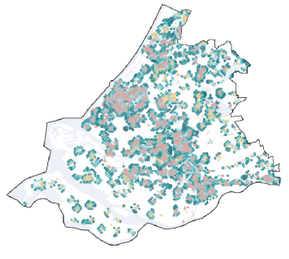
2 DECISION-MAKING



3 RELOCATE



4 REBUILD



RELIEF

1 RELIEVING THE BURDENS

Addressing the urgent causes of stress for the community: health, social cohesion and financial struggles.

1. Improving Health

1.1. Identify and mitigate housing-related health risks.

1.2. Collaborate with municipal authorities and health organizations to implement proactive health monitoring and support.

1.3. Promote awareness of healthy living practices.

2. Provision of Community Support

2.1. Facilitate the establishment of accessible, neighborhood-based support structures to assist residents in housing-related matters: energy use, wellbeing, and housing conditions.

2.2. Should actively engage with community to determine site-specific concerns.

2.3. Encourage the appointment and training of local community representatives or intermediaries to assist residents on a local-level, improve communication and strengthen trust between resident and enterprise.

2.4. Promote initiatives that foster social interaction and collective engagement within neighborhoods.

3. Financial Support

3.1. Collaborate with municipal and social service providers to ensure that residents have clear and facilitated access to available financial aid and energy support schemes.

3.2. Support creation of Communal Energy Fund.

3.3. Introduce and expand the implementation of price caps on energy bills.

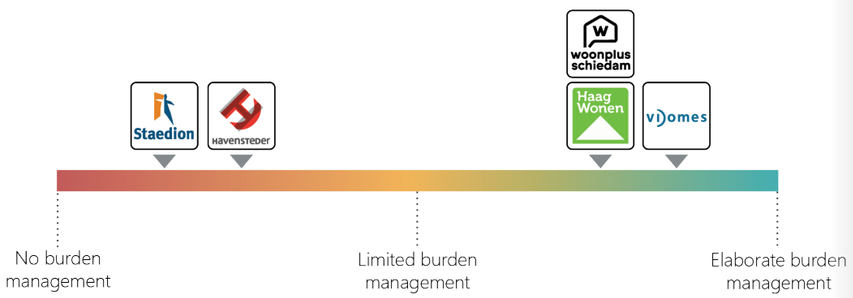


Figure 74: Housing Corporations Assessment Step 1 Diagram.

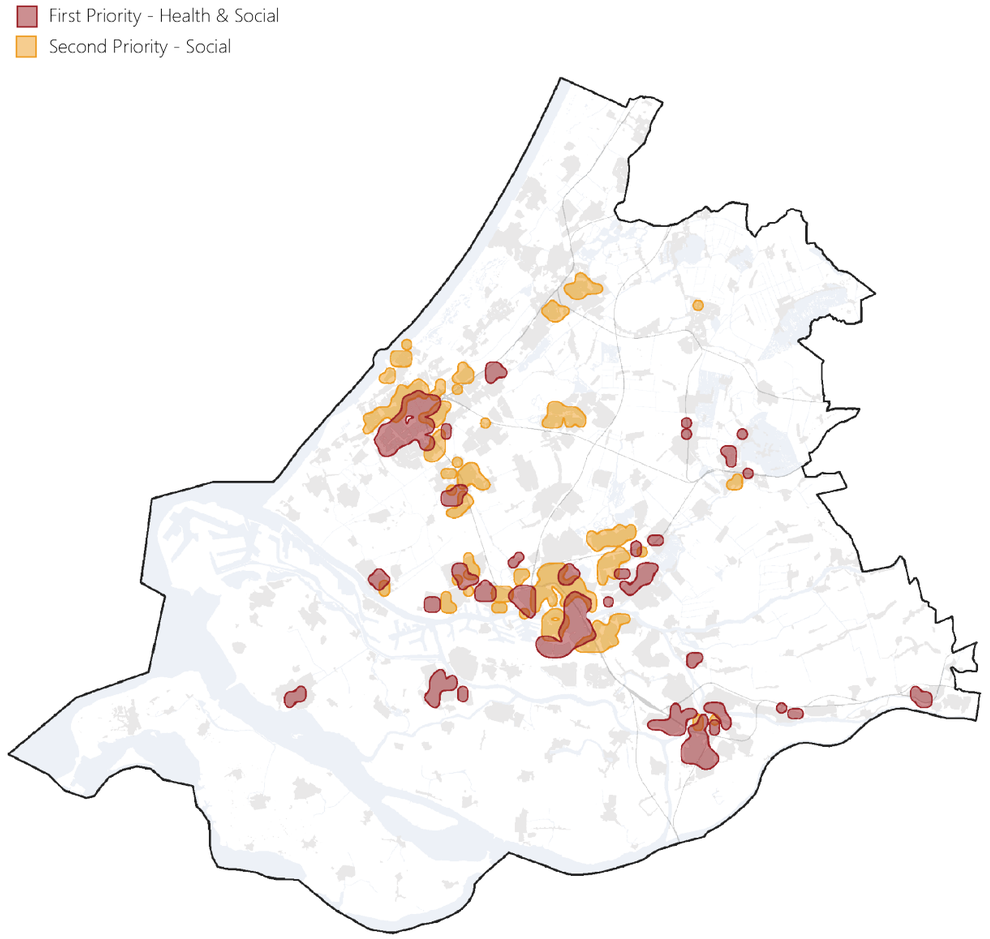


Figure 75: Step 1 Intervention Areas in Priority (refer to Appendix to understand typology construction).

1	2	3
Housing Stock Assessment	*Community Support Hubs*	*Energy Commons*
Intervention Programs	*Local Representatives*	*Pro Bono Finance Advisors*
Communal Health Checks	*Personalized Guidance*	*Energy Saving Care Boxes*
Local Health Professionals	*Energy Coaches*	*Accessible Application Information*
Preventive Care Initiatives	*Local Hot-Lines*	*Price Ceilings on Energy*
	Support Social Initiatives	

DECISION-MAKING 2

COLLECTIVE DECISION-MAKING

Working alongside the community to make long-term decisions on the neighborhood andl housing

1. Community Involvement

1.1. Engage residents at the earliest stages of demolition and renovation planning, ensuring that proposed interventions are communicated prior to decision-making.

1.2. Implementation of structured participatory frameworks to incorporate community into interventions

1.3. Provide clear justification for demolition or renovation decisions, including technical, environmental, and economic assessments, in an accessible format

1.4. Maintain continuous, transparent and accessible communication with residents throughout process.

1.5. Special measures should be taken to include vulnerable and underrepresented groups.

1.6. Establishment of mechanisms to collect resident feedback and address concerns throughout the process, ensuring accountability.

2. Demolition & Renovation

2.1. Identified areas requiring further assessment shall prioritize in-depth technical evaluation before any decision toward demolition is undertaken.

2.2. New construction and renovations must adhere to current housing standards for housing associations and have a minimum energy label of B.

2.3. New construction and renovations must be gas-free.

2.4. Plans should minimize displacement, duration of relocation, and disruption to residents' daily lives.

3. Urban Mining & Circularity

3.1. All housing stock within the portfolio shall be documented through detailed material inventories by 2035 to support future urban mining and resource recovery.

3.2. Implement education and training programs for employees and planners on circular construction methods and urban mining.

3.3. Circular and modular building practices must be incorporated in demolition, renovation and reconstruction plans.

3.4. Recovered materials from demolition shall be prioritized for reuse within local projects, supported by the development of regional material exchange and storage systems.

3.5. Projects shall establish measurable targets for the reduction of construction and demolition waste, with monitoring and reporting mechanisms in place.



Figure 76: Housing Corporations Assessment Step 2 Diagram.

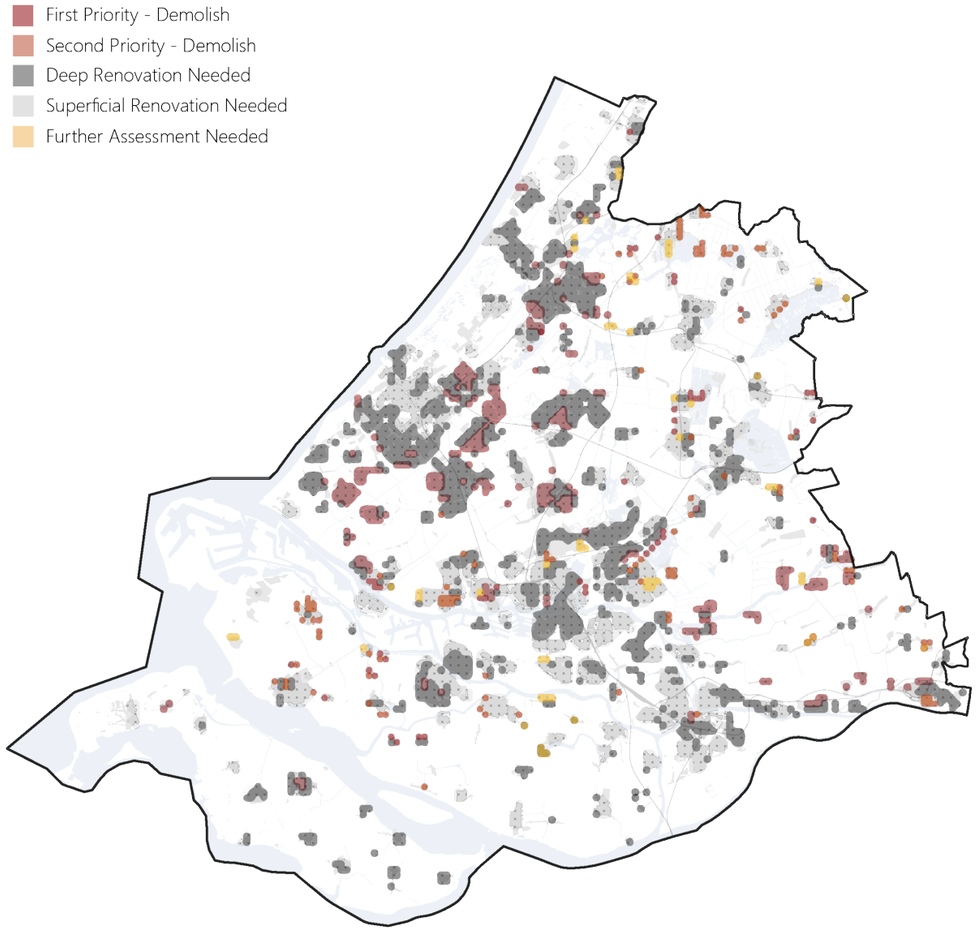


Figure 77: Step 2 Action Areas with Site-Specific Intervention (refer to Appendix to understand typology construction).

1	2	3
Interactive Design Workshops	*Technical Assessments*	*Detailed Material Inventories*
Local Representatives		*Circular / UM Workshops*
Consultation Hours		*Shared Cloud of Inventories*
Assimilatory Planning Sessions		*Circular / UM Building Practices*
Multiple Methods of Contact		
Surveys		

RELOCATE

3 RELOCATION & RESIDENT CONSIDERATION

Interventions cause inconveniences and disturbances for residents; these must be accommodated for.

1. Resident Consideration

1.1. Relocation housing must adhere to target housing standards on matters of ventilation and thermal comfort.

1.2. Residents should be relocated within a specified a specified distance, for both temporary and permanent relocation, to maintain proximity to social networks, employment and essential services.

1.3. Maintain continuous, transparent and accessible communication with residents throughout process.

1.4. Residents undergoing relocation shall be safeguarded against loss of tenure, unjust rent increases, or deterioration in housing conditions as a result of relocation.

1.5. All relocation-related costs, including moving expenses and utility differences, shall be fully covered or compensated.

1.6. Additional support shall be provided to vulnerable residents (e.g., elderly or disabled)

2. Permanent Relocation

2.1. Provide suitable alternative housing units within portfolio wherever possible, aligned with resident's current housing situation.

2.2. Where internal housing provision is not possible, active assistance for residents in securing alternative accommodation should be provided.

2.3. Shall not result in an increase in total housing costs beyond an agreed affordability threshold.

3. Temporary Relocation

3.1. Temporary housing solutions are possible if relocation is no longer than a month. These solutions must be adequately ventilated, thermally comfortable and furnished.

3.2. Residents shall be guaranteed the right to return to their original dwelling or neighborhood following temporary relocation.

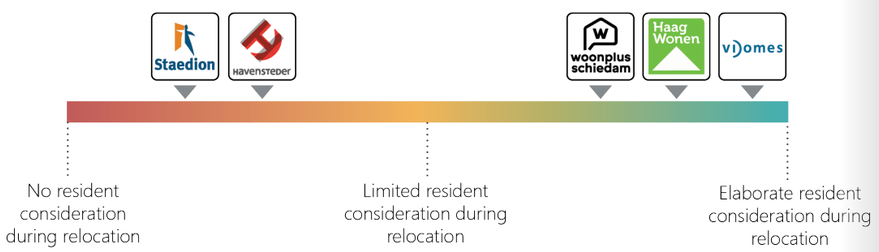


Figure 78: Housing Corporations Assessment Step 3 Diagram.

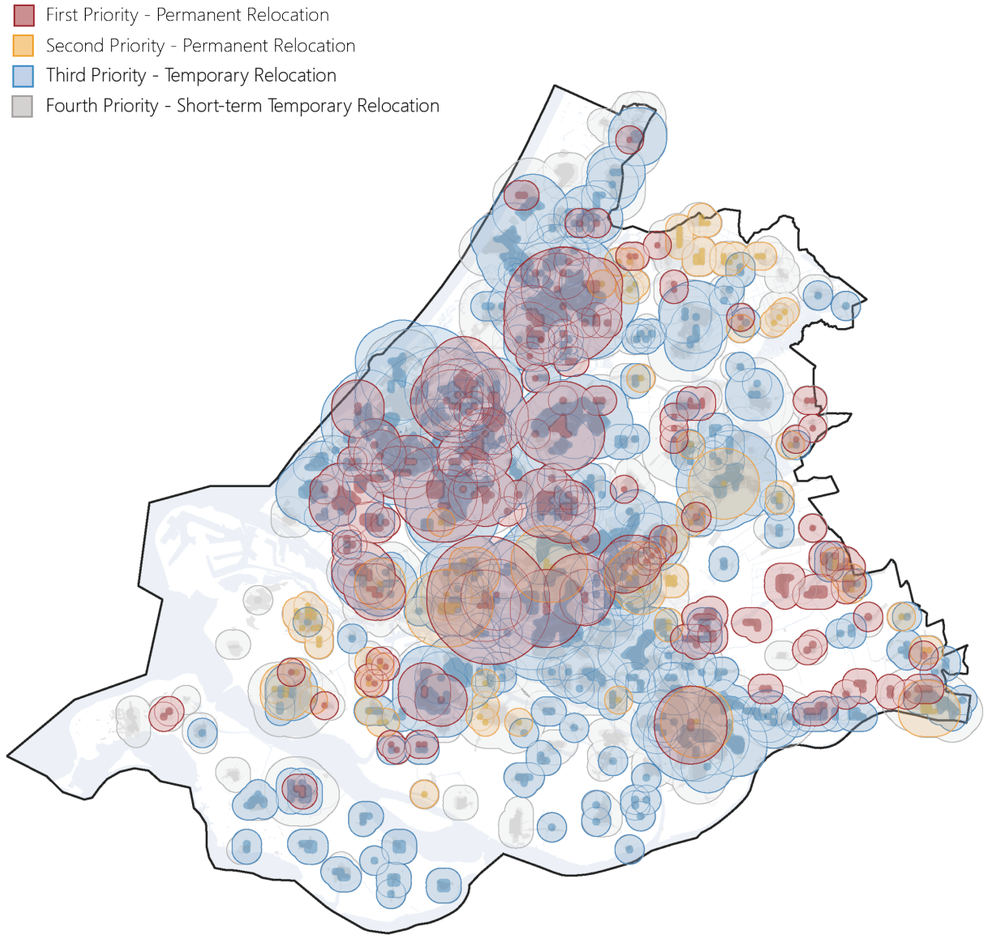


Figure 79: Step 3 Relocation Radii per Area (refer to Appendix to understand typology construction).

1	2	3
Tailored Relocation Assistance	*Six Month Allowance*	*Modular Container Housing*
Multiple Methods of Contact	*Granted Priority Access*	*Temporary Bungalows*
Scheduled Meetings	*Dedicated Relocation Program*	*Right to Return*
Consultations Hours		
Feedback Surveys		

4

REBUILD

INFORMED REBUILDING

In order to foster future energy autonomy among communities, energy potentials must be considered beforehand. Densification is also considered for future growth.

1. Energy Potentials

1.1. All reconstruction and densification initiatives must incorporate infrastructure that enables the utilization of site-specific renewable energy potentials, including geothermal and solar energy.

1.2. Local energy strategies shall be aligned with municipal and regional energy networks to ensure compatibility and long-term system integration.

2. Densification

2.1. Densification shall only be undertaken where adequate social infrastructure, public services, and green networks are established or planned in advance.

2.2 Densification in designated intervention areas shall not exceed a density threshold of 95%, calculated as the ratio between the population of the neighborhood and the average population of the municipality.

2.3 Densification processes shall prioritize affordability and prevent displacement, ensuring that existing residents benefit from improvements.

2.4. Densification initiatives shall promote mixed-use development and functional diversity to support accessibility, reduce travel demand, and enhance neighborhood vitality.

3. Fostering Autonomy

3.1. Facilitate the formation of a core resident group that is representative of the local community's interests.

3.2. Enable collective knowledge development on energy processes and management.

3.3. Encourage and support small-scale, community-led initiatives to build local capacity and trust.

3.4. Contact external experts to provide guidance and expertise, these actors should remain in a supportive role.

3.5. Final decision-making authority regarding priorities, implementation strategies, and definitions of success shall remain with residents and housing corporations, ensuring that outcomes reflect local needs and values.

3.6. Development of cooperative structures done with transparency to ensure low-threshold entry conditions and accessible participation for all residents.

3.7. Benefits generated through cooperative structures shall be reinvested, in part, into the broader neighborhood to support collective wellbeing.

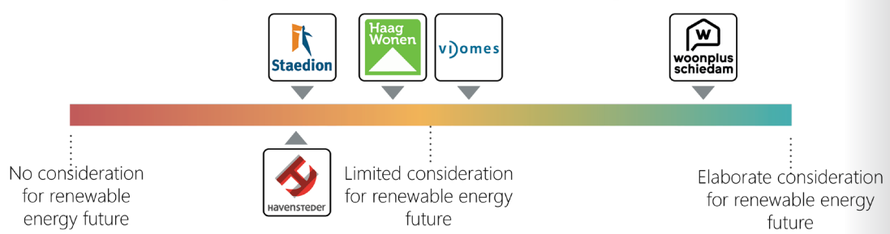


Figure 80: Housing Corporations Assessment Step 4 Diagram.

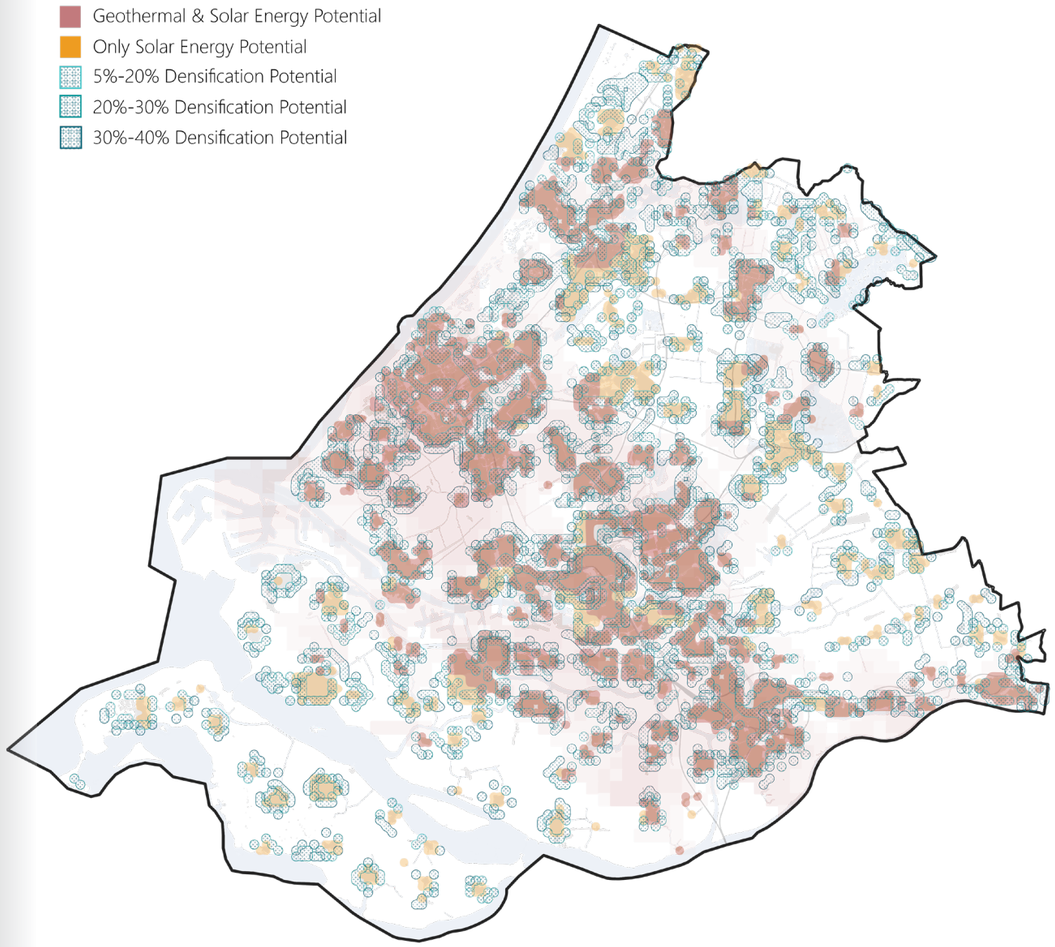


Figure 81: Step 4 Site-Specific Energy and Densification Potentials (refer to Appendix to understand typology construction).

1	2	3
Local Pipelines	*Modular Building Extensions*	*Shared Energy Literacy Sessions*
Communal Battery Allocation	*Unit Splitting*	*Pilot Projects*
Convertors & Grid Connection		*Collective Energy-Saving Measures*
Roof Reinforcement (Solar)		*Accessible & Inclusive Communication*
Energy Development Plans		*Local Energy Commons / Hub*
		Subsidy Registration Aid
		Communal Energy Fund Access

VISUAL REPRESENTATIONS for COMMUNITY

Visual aids to create bridge between policy and spatial intervention plans, ensuring accessible and transparent communication.

1 ADDRESSING URGENT CONCERNS



Figure 82: Visual Representation of Step 1.

2 COLLECTIVE DECISION-MAKING



Figure 83: Visual Representation of Step 2.

3 RELOCATION & REBUILDING



Figure 84: Visual Representation of Step 3.

4 FOSTERING AUTONOMY



Figure 85: Visual Representation of Step 4.

Phase 1: Remediation

Phase 2: Implementing

Phase 3: Fostering

STEP 1
RELIEVING THE BURDENS →

STEP 2
COLLECTIVE DECISION-MAKING →

STEP 3
RELOCATION & RESIDENT CONSIDERATION →

STEP 4
INFORMED REBUILDING

HOUSING & ENERGY

Urban Mining & Circular Practices
Creation of Urban Mining Body
Organise Urban Mining Inventory
Establish Urban Mining Centers

Relocation
Transformation & Retrofitting
Assess Current Housing Stock
Establishing Relocation Plan
Densification Strategy
Implement Temporary Housing Solutions
Demolishing & Building

Installation of Renewable Energy
Energy Coaches for Residents Energy Transition
Conduct Renewable Energy Workshops
Accommodate for Renewable Energy Potentials
Implementation of Heating Network Infrastructure
Execute Green Networks

HEALTH & WELL BEING

Community Support Groups
Install Energy Commons in Communities
Distribute Energy Care Box to Residents

Improve Health Conditions
Mold Removal
Health Checkups for Residents
Instill Health Professionals Neighbourhood

Relieving Financial Burdens
Administer Overconsumption Tax
Establish Communal Energy Funds
Initiate Price Caps on Energy Bills

CLAIMING AGENCY

Cooperative Decision Making & Involvement
Cooperative Meetings for Housing Corporations
Form Energy Core Groups
Perform Low-Threshold Energy Cooperative Action
Energy Cooperative Formalisation

SPATIAL INTERVENTIONS

● Housing Corporations
● Government

Figure 86: Timeline of Phasing and Strategies.

SPATIAL INTERVENTIONS

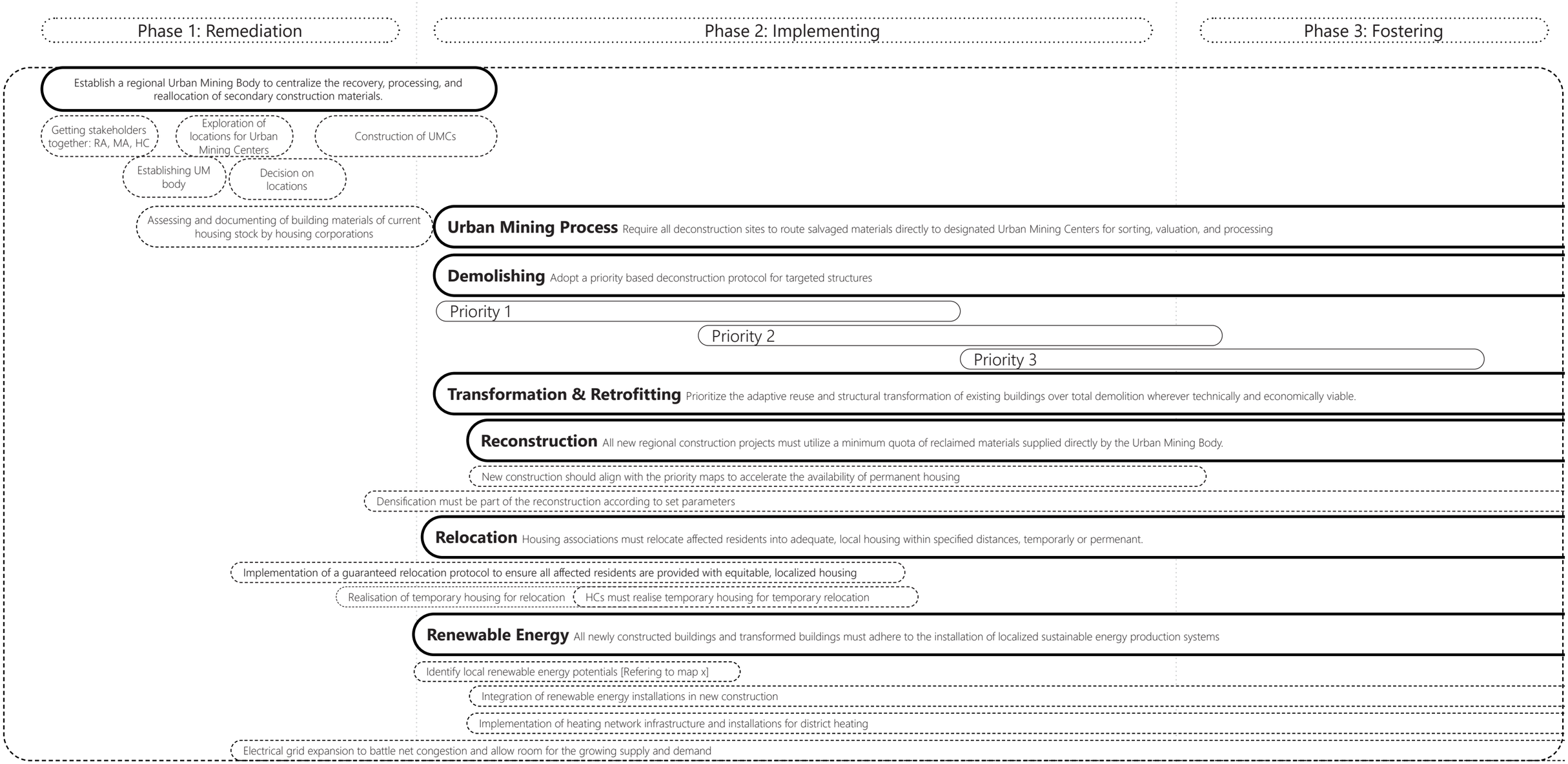


Figure 87: Breakdown of Spatial Strategies.

SPATIAL INTERVENTIONS

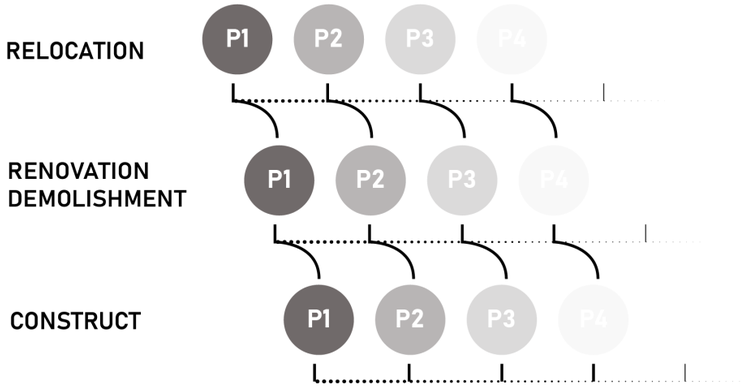


Figure 88: Phasing of Relocation, Renovation, Demolishment, and Construction in Terms of Priority.

The spatial interventions in the strategy follow the three main phases: Remediation, Implementation, and Fostering. The primary goal of this initial phase is to establish a regional Urban Mining Body to centralize the recovery, processing, and reallocation of secondary construction materials

Relocation: Handling the human impact is a continuous priority. Housing associations are required to relocate affected residents into adequate, local housing, whether temporarily or permanently, within specified distances. This relies on housing corporations implementing a guaranteed relocation protocol to ensure equitable treatment and requires housing corporations to realize temporary housing solutions locally (refer to Figure 88).

Transformation & Retrofitting: Total demolition is not the default. The policy mandates prioritizing the adaptive reuse and structural transformation of existing buildings wherever it is technically and economically viable. After temporary relocation, the buildings will be transformed and retrofitted to meet today's housing standards and adhere to present renewable energy options.

Demolishing: After the relocation of current residents, the demolition of buildings can start. Demolition follows a priority-based deconstruction protocol for targeted structures. This ensures buildings of worst quality are addressed first.

Urban Mining Process: A strict policy requires all deconstruction sites to route salvaged materials directly to designated Urban Mining Centres. The materials will be sorted, valuated and processed in these centres (see Figure 89).

Reconstruction: To ensure circularity, all new regional construction projects must utilize a minimum quota of reclaimed materials supplied by the UMCs. To accelerate the availability of permanent housing, new construction should align with the priority maps. Densification must be factored into reconstruction according to set parameters.

Renewable Energy: To future-proof the housing stock, all newly constructed and transformed buildings must adhere to the installation of localized sustainable energy production systems. This comprehensive policy includes identifying local renewable energy potentials, integrating these installations into the new constructions, implementing heating network infrastructure for district heating, and expanding the electrical grid to battle net congestion and support growing energy demands and supply.

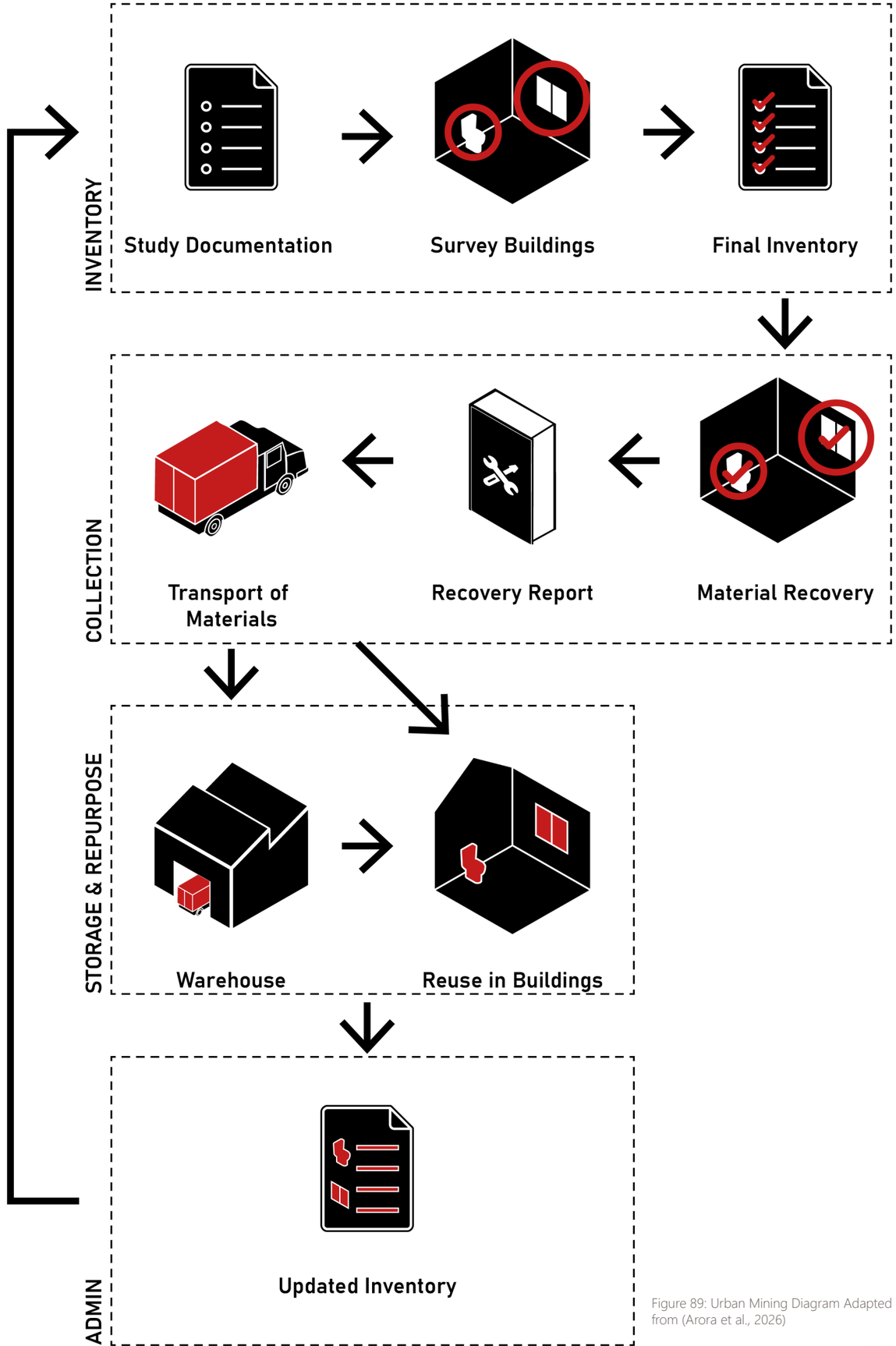


Figure 89: Urban Mining Diagram Adapted from (Arora et al., 2026)

ZOOM-IN: PHASE 1

In phase one immediate burden relief is the centre of attention. Burden relief has been differentiated into two separate priorities. These priorities are based on the South-Holland grid maps (refer to appendix). The first priority areas are defined by high social housing and low perceived health and the second priority areas by high social housing in combination with low social cohesion. The first priority areas often coincide with social cohesion as well; therefore, the remedies are a combination of a broad array of interventions including;

Energy saving boxes: Include energy-saving measures such as, radiator foil, draft strips, heat loss detection meters, LED lights, water saving showerheads and energy use meters.

Community support: Social support networks are built for those with distinct needs and vulnerabilities like the elderly and other minorities.

Energy consumption tax: To incentivise the high-income areas to consume less energy and distribute resources evenly, a tax on energy overconsumption is implemented.

Communal energy fund: Through this fund housing corporation can ensure that communities are granted energy bill caps and have sufficient capital for future interventions. Fund is subsidized through the overconsumption of energy tax.

Health check-ups: Because of mold and other overlapping health problems these areas get health check-ups.

Energy coaches: These coaches in the neighbourhood provide advice on energy questions.

Mold removal: In these areas mold is a problem leading to airway problems. Therefore, in these areas the houses will be inspected for mold and subsequentially removed.

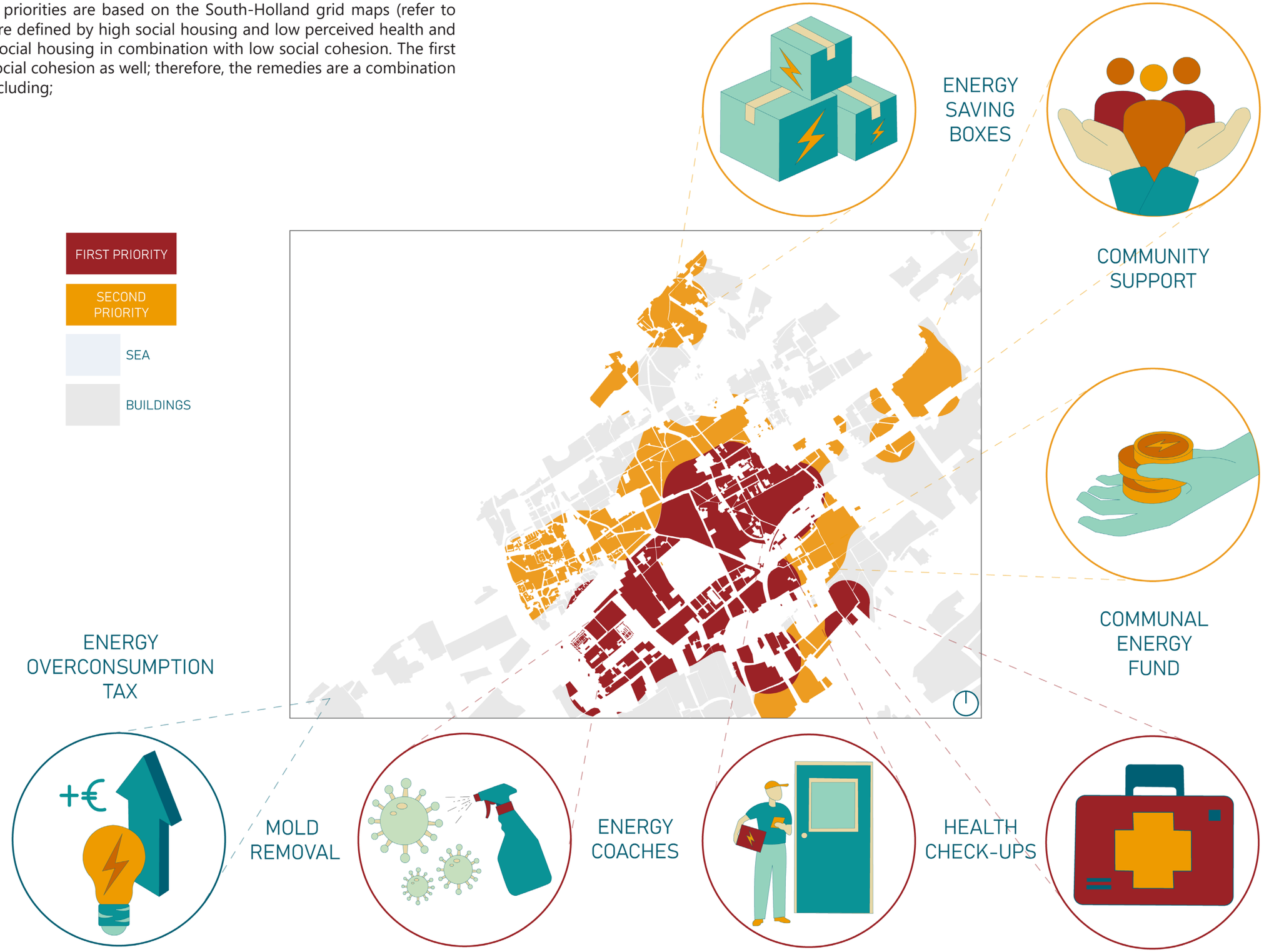
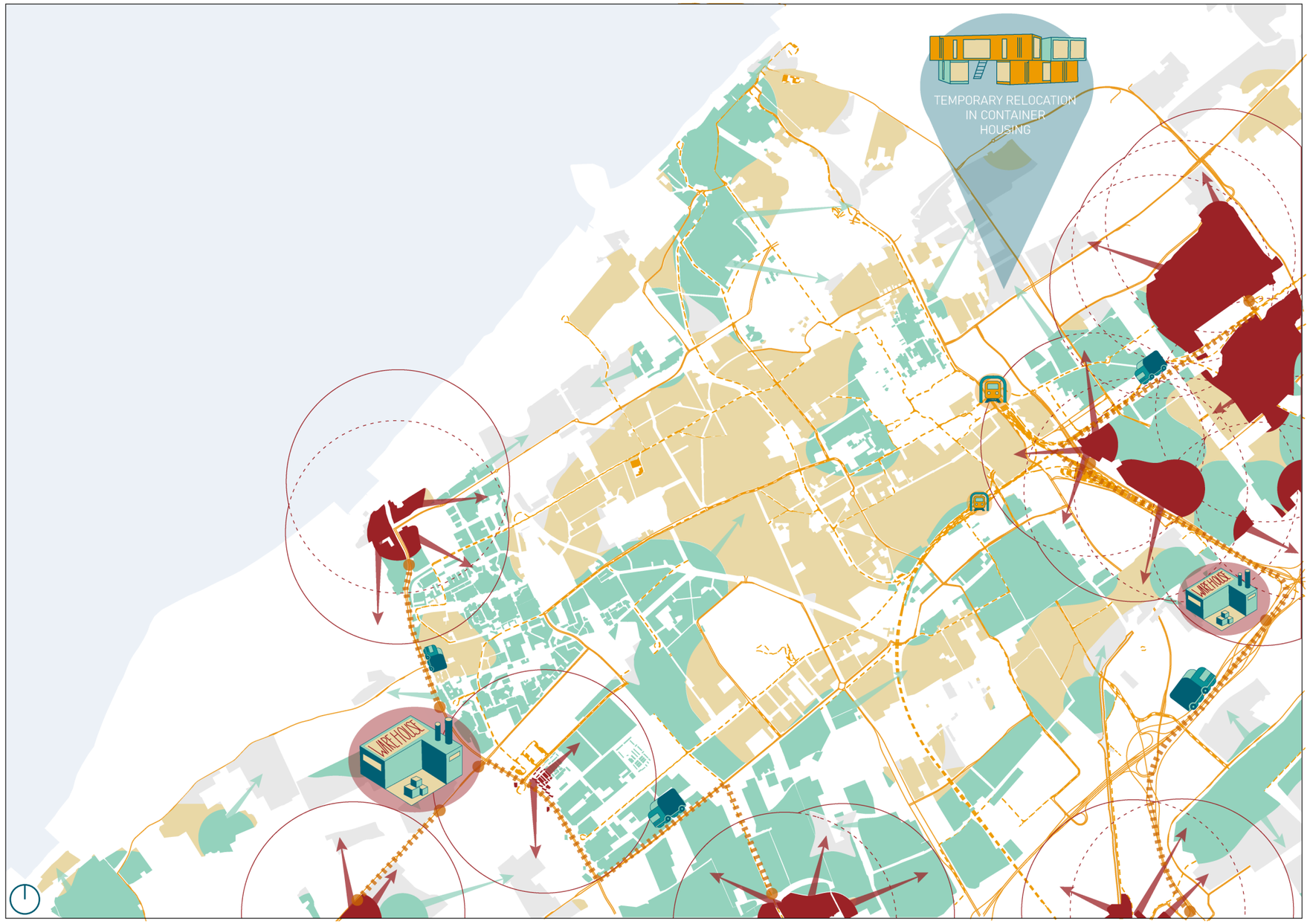


Figure 90: Zoom-In Phase 1.

ZOOM-IN: PHASE 2



DEMOLITION

DEEP RENOVATION

SUPERFICIAL RENOVATION

SEA

BUILDINGS

UM CENTRE

UM ROUTE

TRAINSTATION

RELOCATION

ROADS

RAILWAY

In this phase inadequate dwellings are demolished and/or renovated. During this process the community is informed and involved in the decision making. Some tenants will need to be relocated permanently, and the housing corporations must provide other housing within a specific radius depending on the density of the area. Container housing within the area is available for temporary relocations that are shorter than a month.
During demolition and renovation, urban mining practices are performed. For a part of the urban mining process warehouses are required. These will be built close to main railway and highway roads for accessibility.

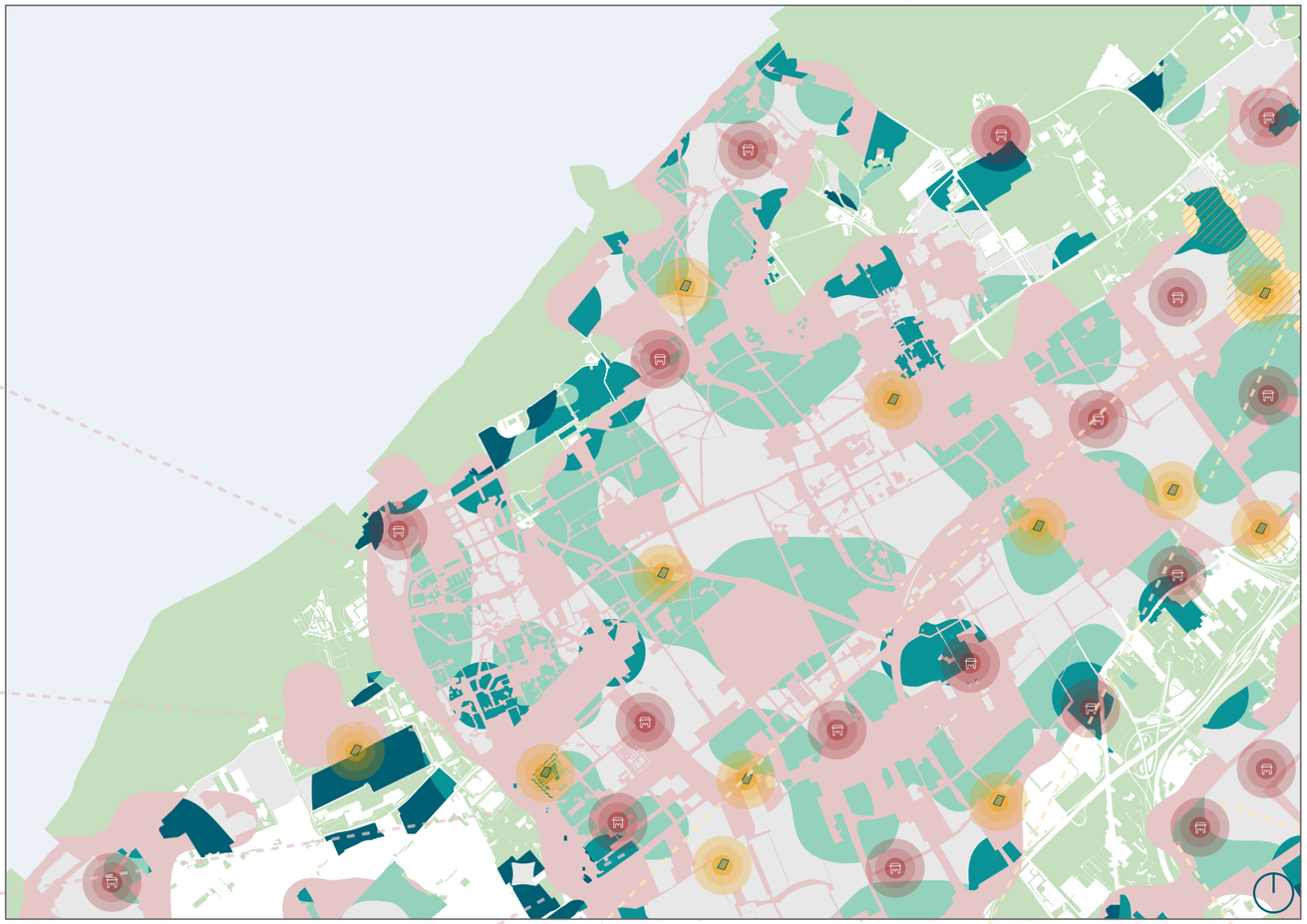
Figure 91: Zoom-In Phase 2.

ZOOM-IN: PHASE 3

This phase focuses on fostering autonomy. This is done by the creation of energy cooperatives. These cooperatives are especially important in the south of the Hague where, as shown in the analysis, communities often lack autonomy and have lower social cohesion and lower perceived health. These cooperations create agency within a neighbourhood and will be able to locally produce their own energy. This can be done with the use of communal batteries, powered by solar panels on buildings sometimes in combination with geothermal energy.

ENERGY COÖPERATIVES





DENSIFICATION 30-40%

DENSIFICATION 20-30%

DENSIFICATION 0-20%

SOLAR ENERGY POTENTIAL

GEOTHERMAL & SOLAR ENERGY POTENTIAL

SEA

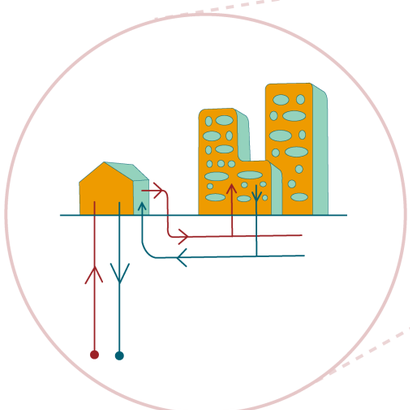
BUILDINGS

GREEN

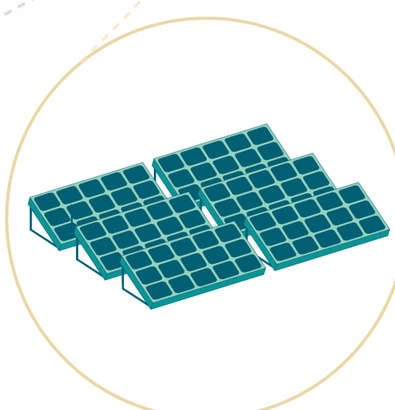
LOCAL GEOTHERMAL NETWORK

LOCAL SOLAR ENERGY NETWORK

GEOTHERMAL ENERGY PRODUCTION



SOLAR PANELS



COMMUNAL BATTERIES

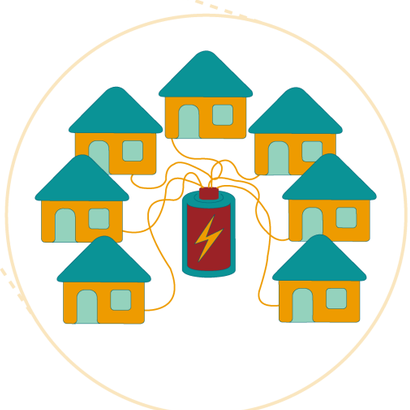


Figure 92: Zoom-In Phase 3.

CONCLUSION

PROJECT EVALUATION

Spatial Justice Framework

The three dimensions of spatial justice are recognitional, procedural, and distributive.

Recognitional: The analysis revealed that low-income groups in Zuid-Holland face energy poverty primarily because of living in homes of poor energetic quality, which in turn causes expensive energy bills. Monthly energy bills are only heightened by national policy implementation towards the energy transition, namely the increasing tax and volatile gas prices, which these homes still rely on to warm their homes, cook their food, and heat their water. These communities already face socio-economic struggles and are further pushed to the sidelines by a narrow-lensed energy transition. The strategy, therefore, addressed current and potential vulnerabilities among these communities, ensuring the inclusion of these groups in future policy and interventions towards the energy transition.

Procedural: The most important actors identified for the strategy were the low-income communities and the housing corporations. The vision was created in direct accordance with the community's values, concerns, and vulnerabilities; therefore, the strategy centres the community in its development, instructing housing corporations on how to act and directly aid and include the community. An integral strategy is additionally developed to include other important stakeholders, namely governing bodies, while still with the focus on an inclusive energy transition.

Distributive: Across various scales, the strategy aims to distribute the benefits and burdens of the energy transition more evenly among the diverse actors. For example, the incorporation of an overconsumption tax to fund a communal energy fund for the benefit of vulnerable communities or granting allowances and priority access for residents during relocation. The project does not address the burdens that occur on an international scale, specifically in areas where materials are extracted for building materials or electrical components.

Governing the Commons & Participatory Design

The project aligns with the theory Governing the Commons by framing energy as a shared resource and emphasizing community involvement in its governance and production. Rather than relying solely on top-down or market-based approaches, it emphasizes equal power relations, positioning low-income communities as active participants in the energy transition, supported by housing corporations and public authorities. Democratic practices are embedded through workshops, collective decision-making, and cooperative structures. The project aimed to create the foundation for energy autonomous communities, therefore, the inclusive operational aspects of these cooperatives were not thoroughly developed. However, the principles of mutual learning and diverse tools of collaboration were addressed towards housing corporations, institutions, low-income communities, and higher-income groups; supporting inclusive engagement.

CONCLUSION

Sub-Research Questions
What are the current socio-spatial vulnerabilities of the local residents', including aspects such as, wellbeing, social cohesion, welfare, employment, etc?
In what ways do existing policies, power dynamics, and stakeholders enable or constrain marginalized neighbourhoods from contributing in the evolving urban energy landscape?
What are the current and potential socio-spatial impacts of the energy transition on local residents' well-being, community dynamics, and local sustainability outcomes?
How can bottom-up local initiatives be integrated into a larger regional spatial strategy addressing energy poverty?

Main Question

How can a strategic spatial plan ensure socioeconomic and spatial justice among the local communities of Zuid-Holland, amidst the increasing risk of energy poverty?

This report addressed the challenge of how energy transition can be carried out more justly in social housing areas across Zuid-Holland, where low-income residents are often face poor housing condition, energy vulnerability, limited influence over decision-making, and wider forms of social inequality. In response, the project developed a strategy that frames the energy transition not only as a technical task, but as a social, spatial, and political process that must be shaped with vulnerable communities rather than imposed on them.

The findings suggest that a just transition in these neighbourhoods cannot be achieved through renovation alone. Better housing performance is necessary, but it is not enough. The project shows that the transition must respond to the uneven realities within social housing, where residents experience vulnerability differently and do not have the same capacity to adapt. For this reason, residents should not be treated as passive recipients of policy, but as active participants in shaping priorities and decisions. A fair transition also requires support and investment to reach first those already living in the most fragile conditions. In this sense, the project answers the research question by showing that a just transition depends not only on better buildings, but on changing how governance and support are organised around affected communities.

A key outcome of the project is the rulebook for housing corporations. It is conceived as a practical guide for the energy transition process and reflects the central role these actors play in neighbourhood change. Because they control a large share of the housing stock, housing corporations can strongly influence investments, renovation processes, tenant relations, and implementation. The rulebook makes the strategy operational by guiding them toward a fairer and more locally grounded approach.

The social relevance of the project lies in addressing a clear risk: that the energy transition may improve the performance of buildings while leaving vulnerable residents behind. The report argues that lower energy costs, healthier homes, and a stronger voice for residents should not be secondary outcomes, but part of the transition from the start. Its spatial relevance lies in showing how these ambitions can take form in the neighbourhood itself, through shared energy systems, collective heating and storage infrastructures, community spaces, and local support networks that help residents navigate housing change together. In this way, the project treats justice not as an abstract value, but as something that must be built into the spaces, infrastructures, and everyday structures of neighbourhood life.

Based on these findings, several recommendations follow. Municipalities, housing corporations, and other institutional actors should direct investment toward the neighbourhoods with the greatest need and treat participation as a continuous part of the process. Housing corporations in particular should be encouraged to use the proposed rulebook to guide decision-making, tenant involvement, and implementation. At the methodological level, future work would benefit from deeper engagement with residents, longer observation of participatory processes, and stronger evaluation of how justice outcomes develop over time. Further research could explore how neighbourhood-based commons can remain open and effective while also staying financially and institutionally supported without losing their local character.

Ultimately, the project argues that the energy transition can only be just when technical change is tied to social support, shared decision-making, and a more equal distribution of costs and benefits. Where housing corporations are given a central role, they must also be equipped to act with responsibility toward the communities whose lives they are helping to reshape.

INDIVIDUAL REFLECTION

Lucia Scanlan-Bloor

As an exchange student from Australia, I began this project with limited knowledge of Zuid-Holland and the Dutch context. While I recognized some parallels with challenges in Australia, such as the housing crisis, most issues surrounding energy justice and the energy transition were new to me. This resulted in a steep but rewarding learning curve, where I developed a clearer understanding of the Netherlands' path toward a more sustainable future.

One concept that stood out was urban mining, which reshaped my perspective on sustainability by highlighting innovative ways to reduce construction waste and reuse materials. The site visits in Zuid-Holland were particularly valuable, as conducting interviews with local residents was a new experience for me. This direct engagement added depth to my understanding of the social dimensions of energy justice and grounded the project in real-world experiences.

Our group work involved extensive discussion, especially during the strategic planning phase. These conversations were essential in shaping our project, as they allowed us to combine our diverse perspectives and knowledge bases. I found this collaborative process highly insightful, as it encouraged critical thinking and the exchange of ideas. I contributed by applying my background in urban design, particularly my experience with QGIS. Although I was familiar with the software, adapting to the workflows at TU Delft was both challenging and enriching. I was also impressed by the accessibility and quality of spatial data in the Netherlands, which enabled more detailed analysis. Overall, this project has broadened my perspective on both energy justice and urban sustainability. It has also strengthened my ability to work collaboratively in an international setting and adapt to new academic and professional practices.

Maddalena Raimondi

This quarter was one of the most difficult, but also one of the most meaningful parts of my academic path so far. Entering a group process that was already taking shape made me feel, at times, out of step with the project, and I had to work hard to find my place in it. That effort stayed with me throughout the quarter, but it also became an important lesson in persistence. I learned that even when the starting conditions are not ideal, I can still move forward with commitment and consistency.

My contribution to the group was not always easy for me to measure, especially because I often felt I was trying to catch up rather than shape the work from the beginning. Still, I tried to support the project seriously and to be present wherever I could strengthen the group's thinking. This made me reflect on contribution in a different way. I realised that being useful is not only about visibility or taking the lead, but also about showing up with care and reliability.

The strongest insight I gained this quarter was that the energy transition cannot simply be designed from above. What changed my perspective was understanding how necessary it is to begin from the community itself, especially from the lives of people who are usually overlooked in planning processes. This course also made me much more aware of the energy transition as a field in itself. Before this quarter, it still felt distant; now I feel more able to move within such a complex topic. More broadly, it showed me that urbanism is not only about individual places, but about larger systems, policies, and transitions. What I want to carry forward is the ability to work within that complexity without losing sight of the people most often left at the margins.

Juliana Boschero

The group process was relatively smooth and collaborative compared to past projects. While I typically avoid taking on the leadership role, throughout this studio, I usually took on responsibilities related to managing progress, distributing specific tasks, and setting internal deadlines. This position required me to navigate different working styles, schedules, and expectations, which ultimately strengthened my ability to be patient, adaptable, and considerate within a team dynamic. It also made me more aware of how informal leadership can shape both the workflow and the overall quality of the project.

This quarter's project differed significantly from earlier studios in the Master's program. Its systematic, procedural, and multi-scalar nature introduced a level of complexity that challenged me to think beyond spatial design alone. Instead, the project required engaging with governance structures, policy frameworks, and issues of justice, making the learning trajectory both steep and highly rewarding. It aligned closely with my initial expectations of the Master's, particularly in addressing complex socio-spatial issues and exploring how design can intervene more ethically and equitably.

My positionality has strongly influenced how I approached the project. Having lived in cities such as Nueva Córdoba (Argentina), Beijing (China), Doha (Qatar), and Rio de Janeiro (Brazil), contexts marked by deep socio-spatial inequalities, I have developed a sensitivity toward issues of marginalization and uneven development. Although the Dutch context operates under different systems and scales of inequality, this project allowed me to connect these experiences and translate them into a new setting.

Critically, the project reinforced the importance of integrating community perspectives into spatial strategies. It highlighted that technical or spatial solutions alone are insufficient without addressing underlying power dynamics. This insight will continue to shape my approach to future projects, emphasizing the need for inclusive, context-driven, and justice-oriented design.

Menne González Kieboom

This project was my first course in the urbanism master, and I started out quite intimidated by QGIS and my relative inexperience with urban projects. However, my groupmates helped me a lot regarding to this and taught me a lot about QGIS and Illustrator. The spatial and social justice part of this project instantly captured my interest, and I learned a lot about the complexity of social urban challenges.

In bigger projects like these I can sometimes lose overview, find myself lost on where we are and what to focus on. However, our meetings and group discussions helped a lot with this, and I would often come back feeling a lot better about our process after our meetings. I have thoroughly enjoyed our small coffee breaks, researching and finding data on the neighbourhoods, making collages and maps, and now in my work, I can visibly see how much I learned working on this project.

The excursion was especially insightful. Seeing a glimpse of our analysis in real life while talking to social workers and residents, made me realize the importance and urgency of projects like this and this fuelled my motivation. It gave me a glimpse into the responsibility an urban planner would have towards the affected people and made me think a lot about the role of an urban planner. How does an urban planner account for unheard voices? How far should an urban planner meddle into people's lives? I sometimes found myself questioning who I even was to be making such decisions over so many peoples livelihoods. Even though I wouldn't say I have the answers to all these questions now, I do now understand the position of an urban planner better and I appreciate the profession even more for it.

Jouke Heeres

When I started the master Urbanism, I saw the field and study as the simple translation: Stedenbouw; the building of cities, creating physical spaces and streets to improve live in the city. Although it has become clear to me that it is so much more than just simply the physical elements. It has a whole social aspect to it. From my experiences I knew this social aspect of Urbanism existed but not the big injustices that occurs around the world.

This specific project we focussed on injustices that might occur with the energy transition. I always thought the energy transition would be positive for all, and in the end, this is still true, but the way HOW and for WHO is a major facet I have overlooked. During the course I learned a lot about this, through reading and discussion. Energy transition is good for the planet and us, but who can afford it transition? Certainly the rich can and the middle class are also up there with cheaper and more efficient options of producing electricity, making homes energy efficient or even travel (electric cars or bikes). But it is the poor and underprivileged that are left behind. They cannot afford to invest in making their live more 'sustainable', they are most often just surviving and cannot afford expensive electric cars, although the gas prices are skyrocketing, cannot invest in their homes to make them more energy efficient, while the energy prices keep on increasing. They are reliant on the persons and organizations above them, social housing associations or the government (even us probably), to make their life liveable and healthy. Stedenbouw is much more than just creating nice looking streets and spaces, it is essential to identify, address and design against injustices, not creating them (like Robert Moses), not just in the energy transition.

The scale this project worked on was way bigger and much more complex in nature than courses before this and meant doing a lot of research on different topics. Although this scale is not new to me, I studied Spatial Planning and Design, it was new to me in the sense of the way I worked with this scale and how serious I took this project. It was challenging to manage all the information gathered and make sure our story made sense. Teamwork and group discussions in that sense were key to focus each other on the task at hand and make sure it all makes sense.

During this course I also further honed my skills with different design skills. Although I have not used a lot of sketches this quarter, I did learn a lot about using QGIS and its combabilities for this scale. Using this software to analyse and visualize maps keeps on interesting me. Although there is much for me to learn, I felt I could contribute a lot to our teamwork by creating grids and maps. Although, I do need to learn more on how to visualize and communicate maps clearer and understandable.

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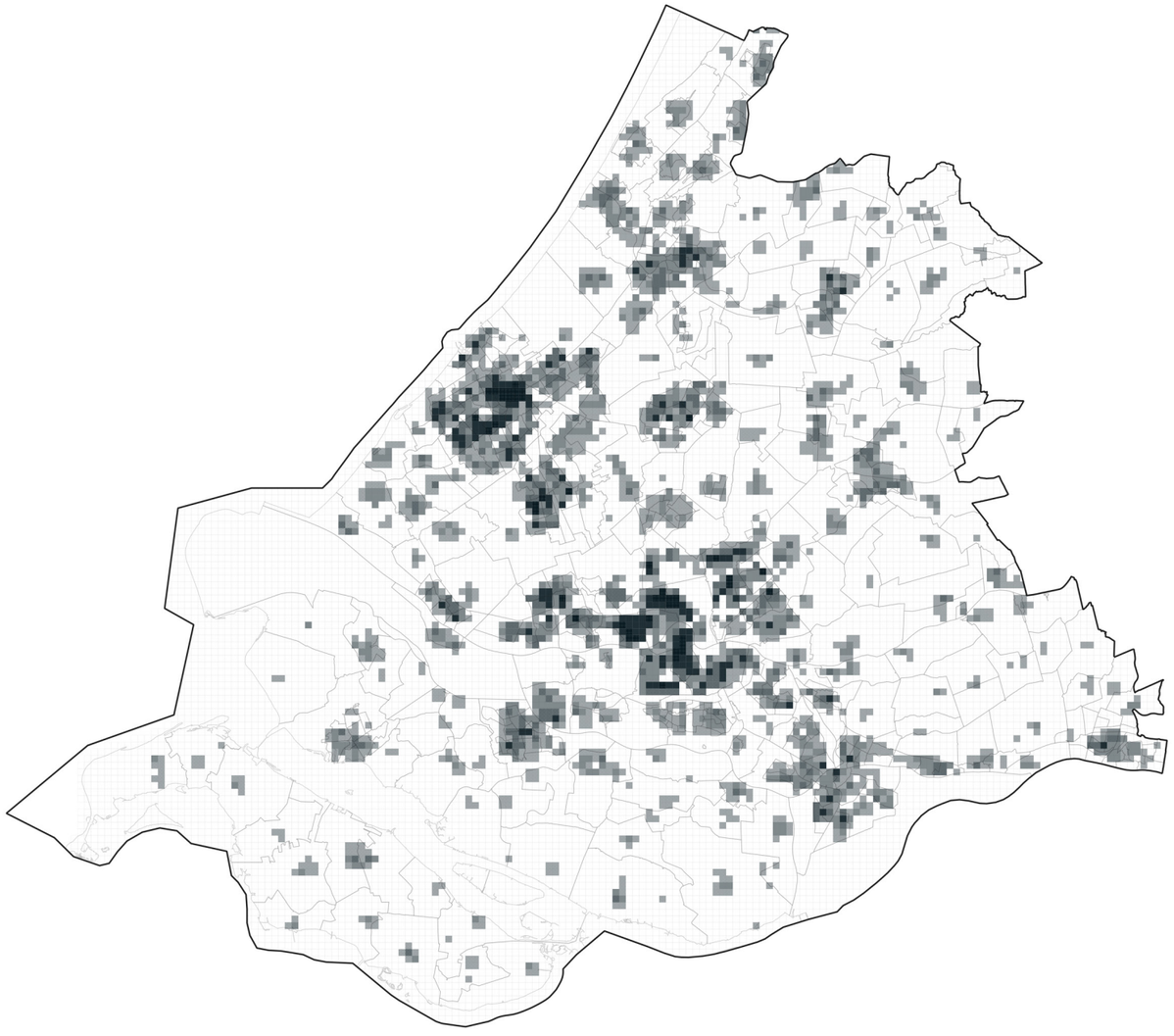
APPENDIX Local housing corporation matrix

In the chosen neighborhoods, the housing corporations present were identified and analyzed through their missions, plans and stock volume. The analysis gave insight into the different "personalities" and priorities of each housing corporation.

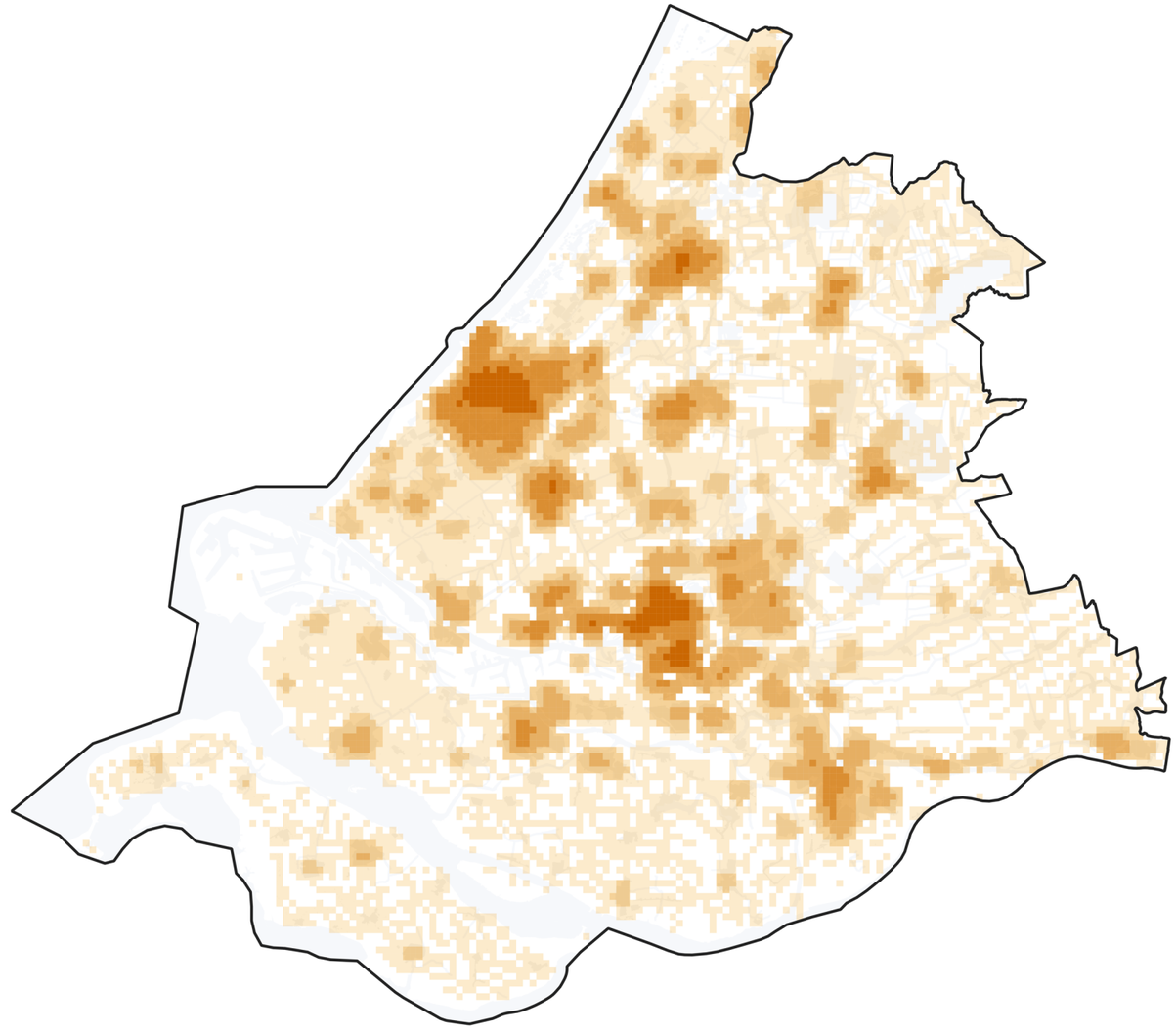
City	Housing Corporation	Housing Stock	Neighborhood	Mission
The Hague	***Hof Wonen***	Social Housing: 16909 Non: 1808	Bouwlust, Moerwijk, Morgenstond, Rustenburg & Valkenboskwartier	*"Together with about 240 colleagues, we work on **good living for everyone**. This means **good maintenance, making homes more sustainable, new construction, affordable rents and nice neighborhoods**."*
	Haag Wonen	Social Housing: 2063 Non: 230	Bouwlust, Laakkwartier en Spoorwijk , Moerwijk, Morgenstond, Rustenburg &	*"We are Haag Wonen. **We are building a beautiful city**, The Hague. A city **where people can live well and affordably**."*
	Staedion	Social Housing: 32067 Non:2778	Bouwlust, Laakkwartier en Spoorwijk , Moerwijk, Morgenstond, Rustenburg & Valkenboskwartier	*"**By increasing the resilience of neighbourhoods, the quality of life and the housing supply, we are continuously working on the social task of The Hague** and the surrounding area, together with residents and stakeholders. In doing so, we show courage and ambition."*
Schiedam	***Woonplus***	Social Housing: 11001 Non: 186	Groenoord, Kethel	*"Woonplus is there for people who struggle to make ends meet on the housing market. As a housing corporation, it is our task to ensure that they can find sufficient affordable and suitable homes in Schiedam. It is important that these **homes are also located in liveable, diverse, and sustainable neighborhoods**. Only then are we able to contribute to a solid foundation in their lives."*
Delft	***Vidomes***	Social Housing: 4444 Non: 85	Buitenhof	*"For the coming years, we highlight four ambitions: - **Accelerate and innovate**. We want to act faster on what society demands, with new solutions if the old ones don't work. - **Building and making it more sustainable**. We will add 2000 social rental homes up to and including 2030. And we are accelerating the energy efficiency of our homes. That is far from settled, but we are going for it! - Vidomes, **partner in the region**. #echtsamenwerken is essential to build, to keep the neighbourhoods liveable and to work effectively and efficiently. You can count on Vidomes! - We are a top employer. In this way, we attract and retain the people we need."*
	Stedelink	Social Housing: 4280 Non: 1257	Buitenhof	*"Affordable housing is important to us. We **build new** homes, **make existing ones more sustainable** and provide neighbourhoods **where people live together comfortably**."*
Delft + Rotterdam	***Woonbron***	Social Housing: 25589 Non: 2562	Buitenhof, IJsselmonde	*"**We work in a businesslike and decisive way**. We always do this from **our social heart**. We are at home in our neighborhoods. We intervene in the event of residential nuisance to ensure undisturbed living pleasure for our residents. Our buildings and homes are **clean, intact and safe**. We continue to i**mprove our homes through maintenance, sustainability measures, renovation and sometimes by building new ones**. In this way, we can continue to guarantee affordable housing. That is and remains our core task."*
Rotterdam	***Hef Wonen***	Social Housing: 19256 Non: 4876	IJsselmonde	*"Hef Wonen is a Rotterdam-based housing authority with over 30,000 rental units, commercial spaces, parking spots, and residential care complexes. **Every day, we work toward sustainable housing happiness.** That means creating quality, affordable homes and livable neighborhoods. **We do this together with residents and partners in the city**. We have an ambitious goal: **by 2033, residents will speak proudly of their homes and neighborhoods**. To achieve this, we roll up our sleeves, stay close to our residents, communicate our actions, and follow through on our promises. That's how we take the HEFt into our own hands!"*
	Woonstad	Social Housing: 43803 Non: 6981	Charlois, Feijenoord, IJsselmonde	*"**Good service, good maintenance and a little help if needed.** In this way we ensure a pleasant place to "wonen" and "leven". But also by contributing to a neighborhood in which you feel good. And by **paying attention to social developments** in the city."*
	Havensteder	Social Housing: 29719 Non: 1553	Feijenoord, IJsselmonde	*"We are Havensteder. A housing corporation in the core of the Rotterdam city region. **We rent, manage and maintain** more than 45,000 homes. We do this with about 550 people. **We offer residents a home.**"*

APPENDIX

Social housing density grid

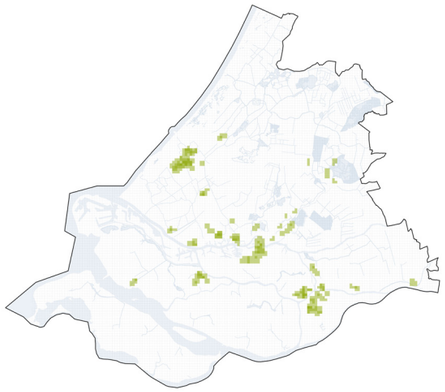


500 m grid with amount of social housing present in that cell.
Data: CBS vierkantstatistiek (2022).

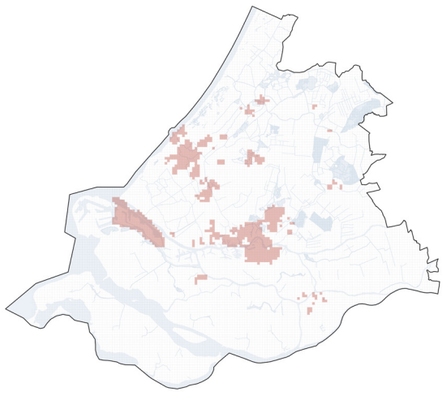


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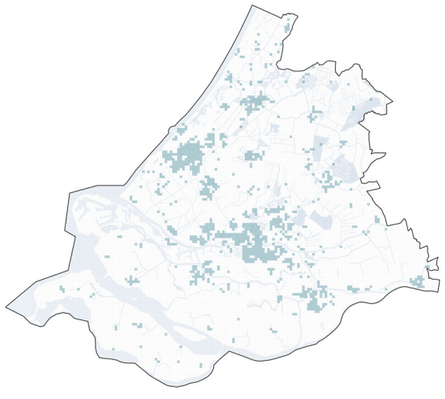
Priority grid health and social cohesion



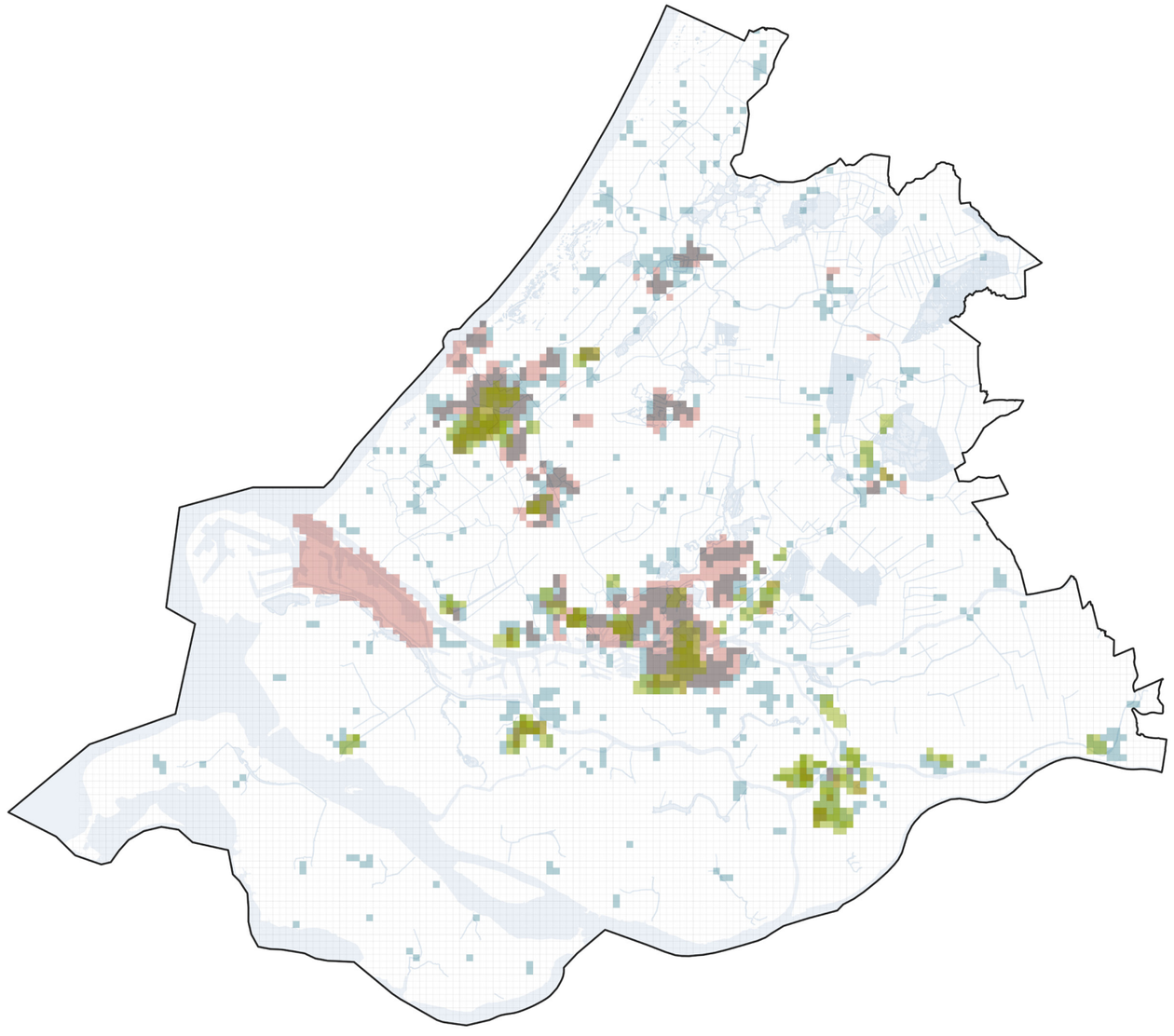
Self perceived health <60%



Low social cohesion <60%



Percentage low income >40%

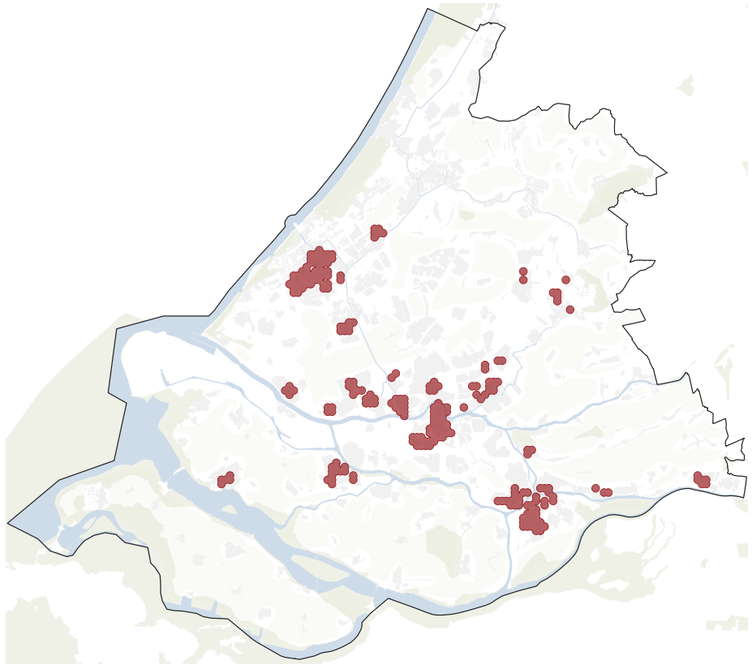


Overlap grid map showing priority areas

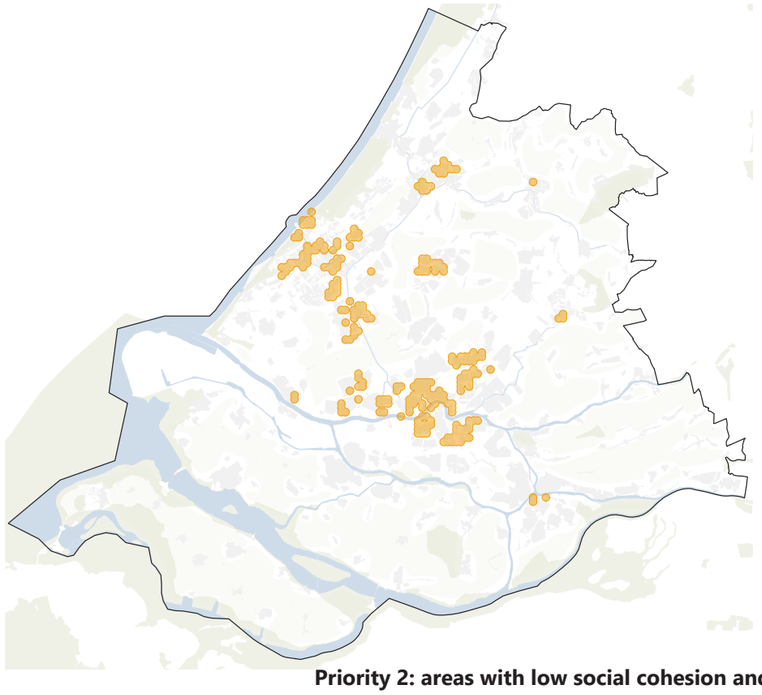


APPENDIX

Priority grid health and social cohesion

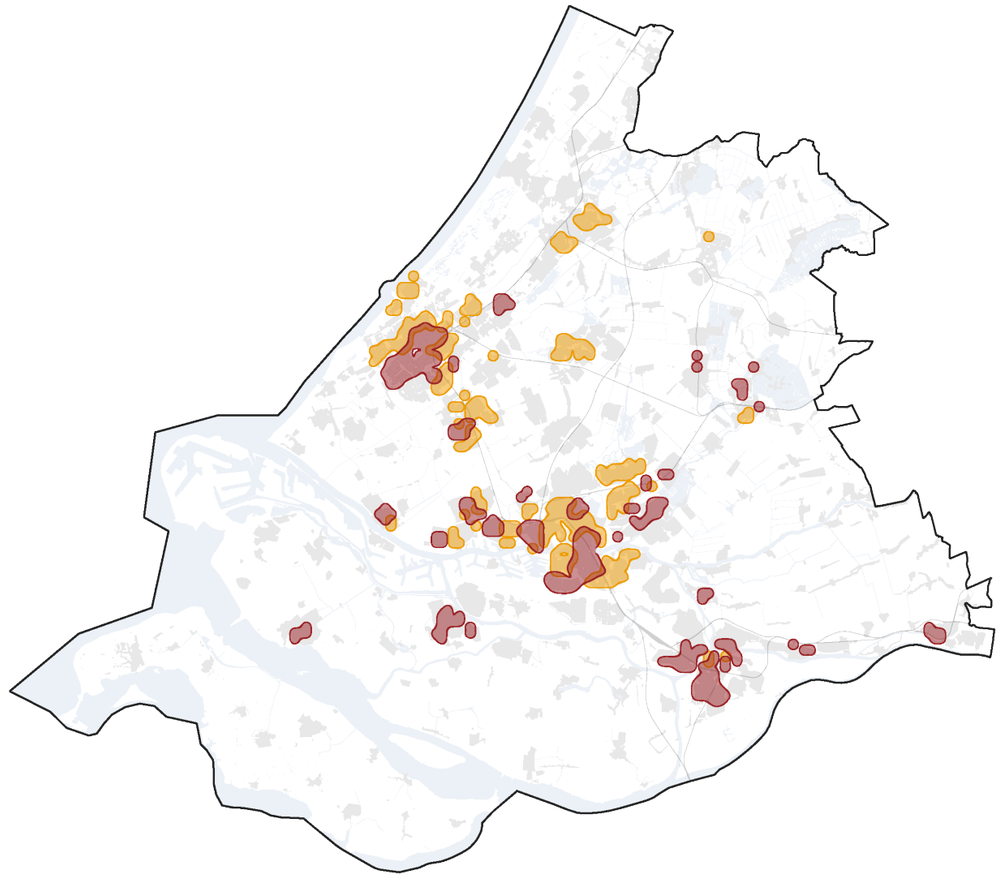


Priority 1: areas with low health and low income



Priority 2: areas with low social cohesion and low income

0 7.5 15 km



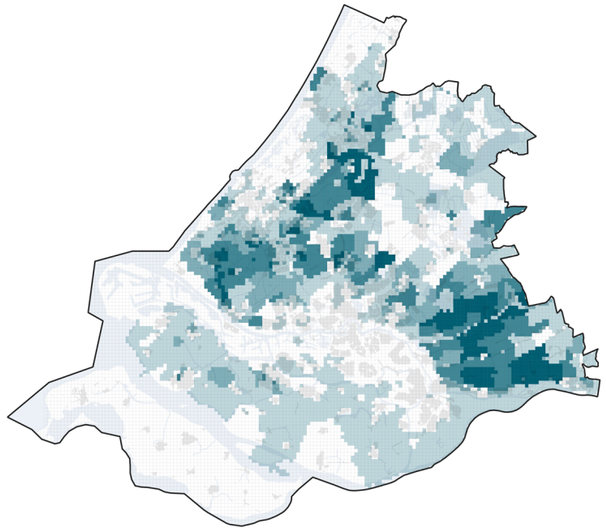
Phase 1 priority map

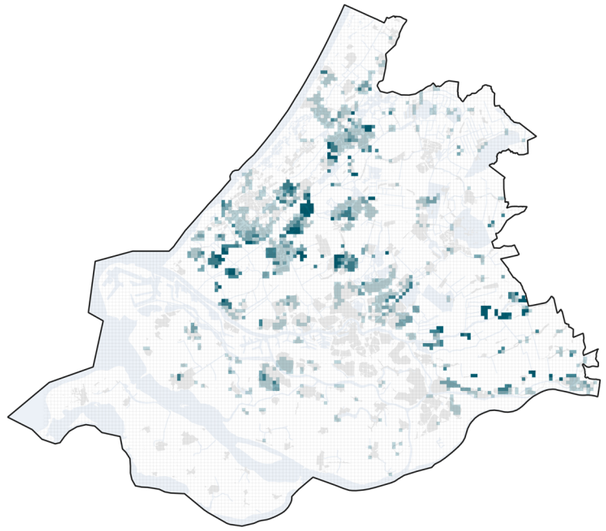
First Priority - Health

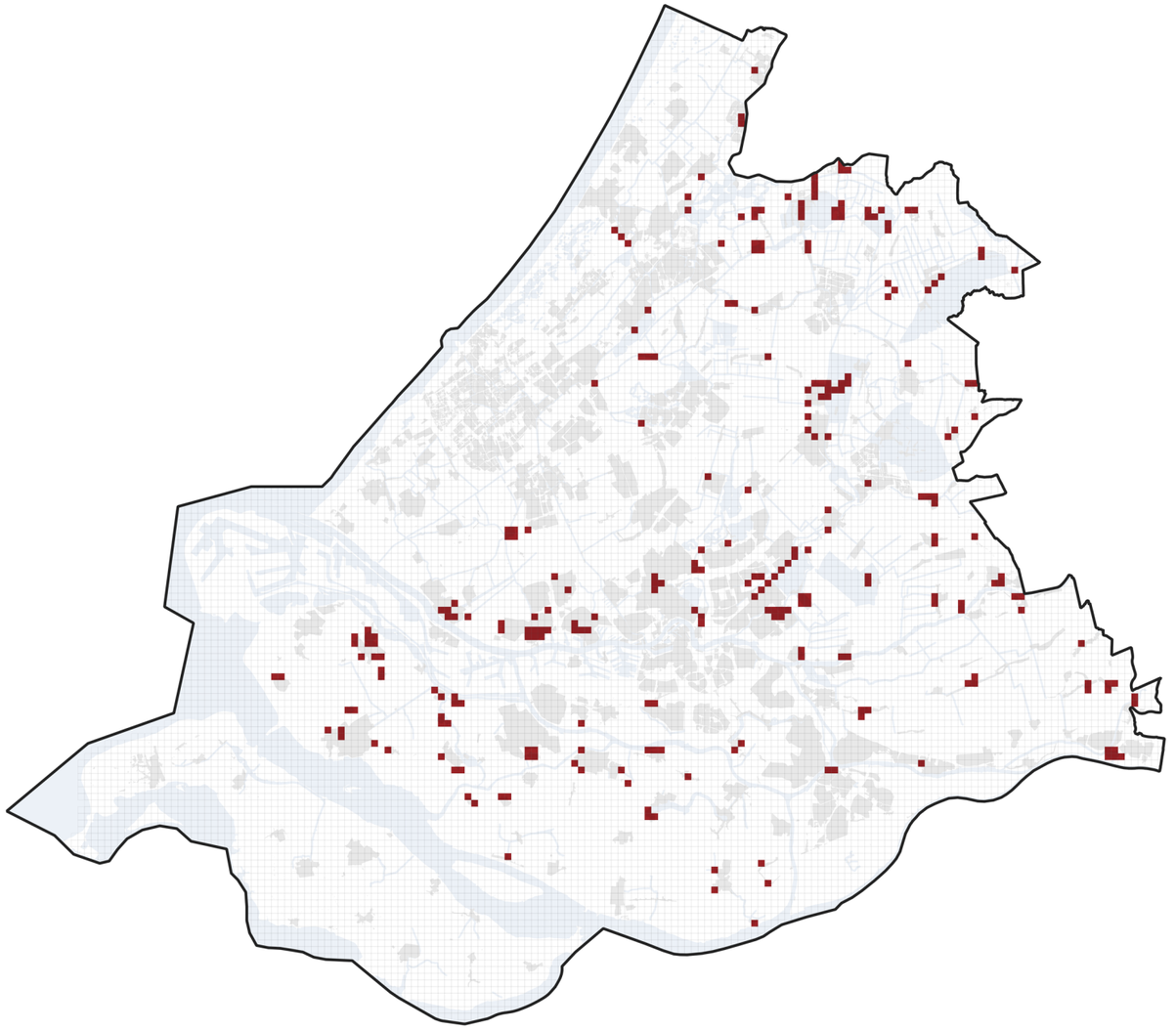
Second priority - Social cohesion

APPENDIX

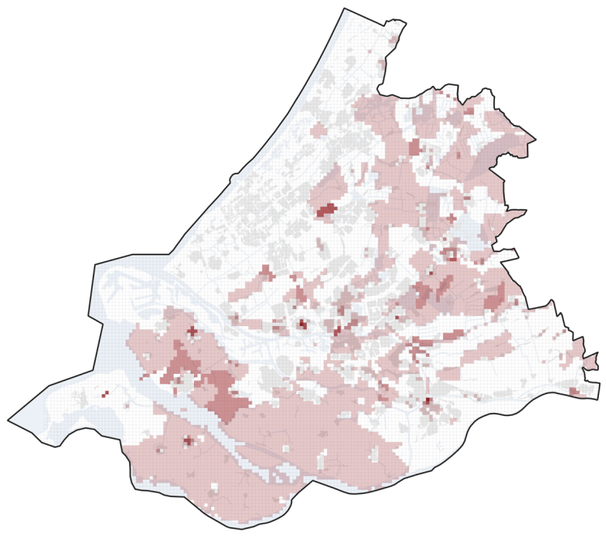
Demolition priority grid

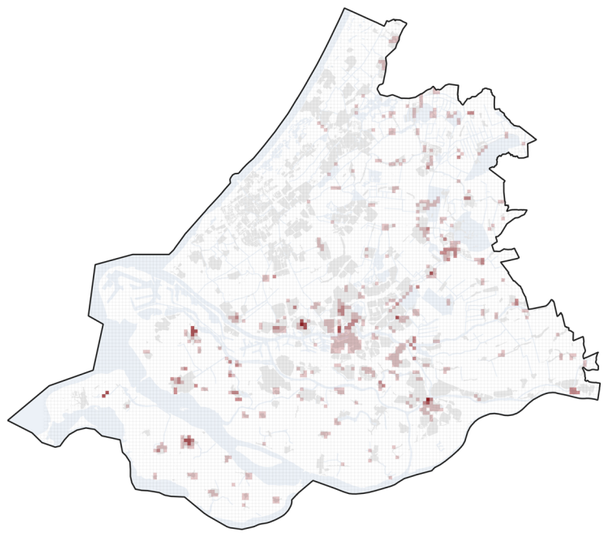






Social housing at risk of tilting and pole rot in 2050. First priority demolition

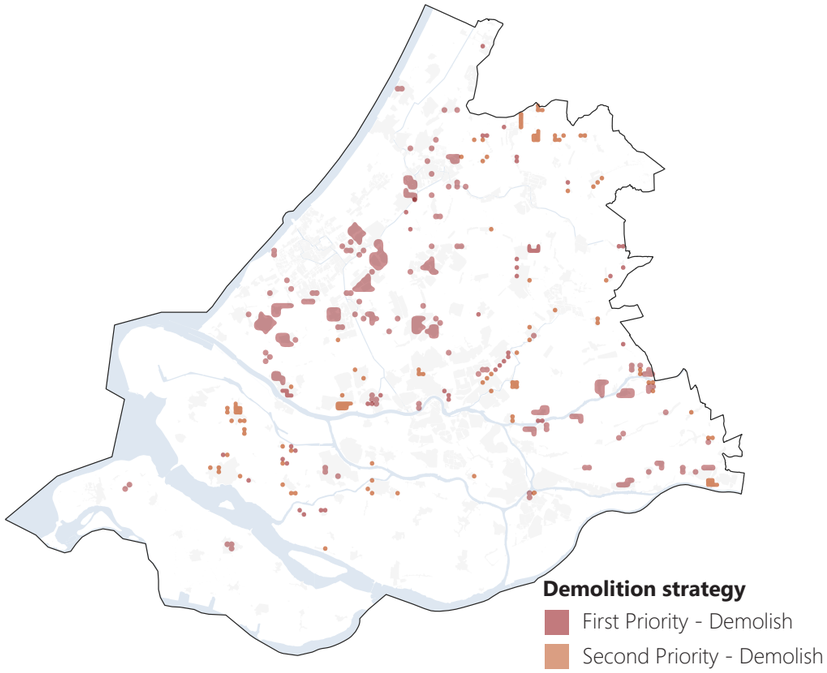


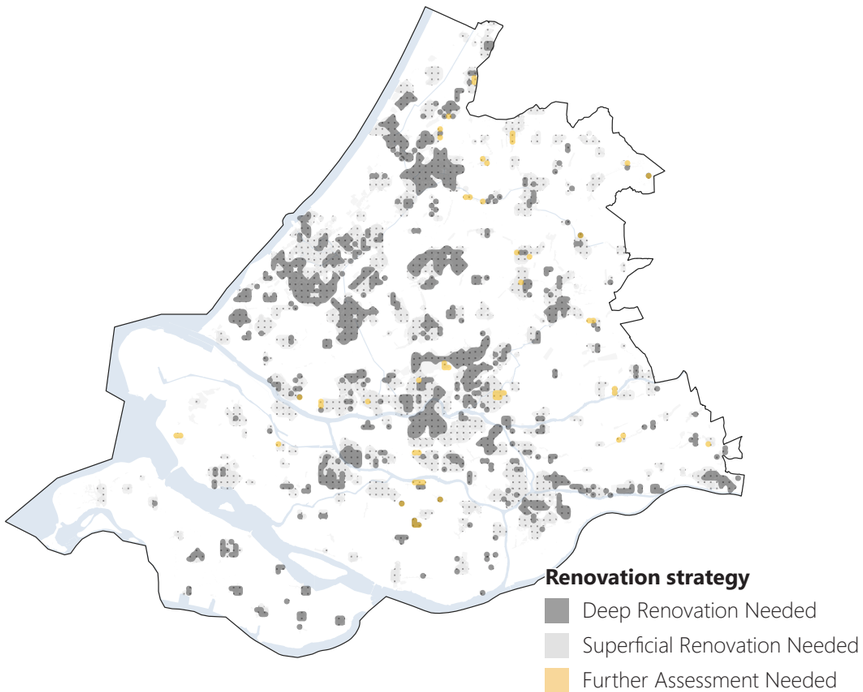


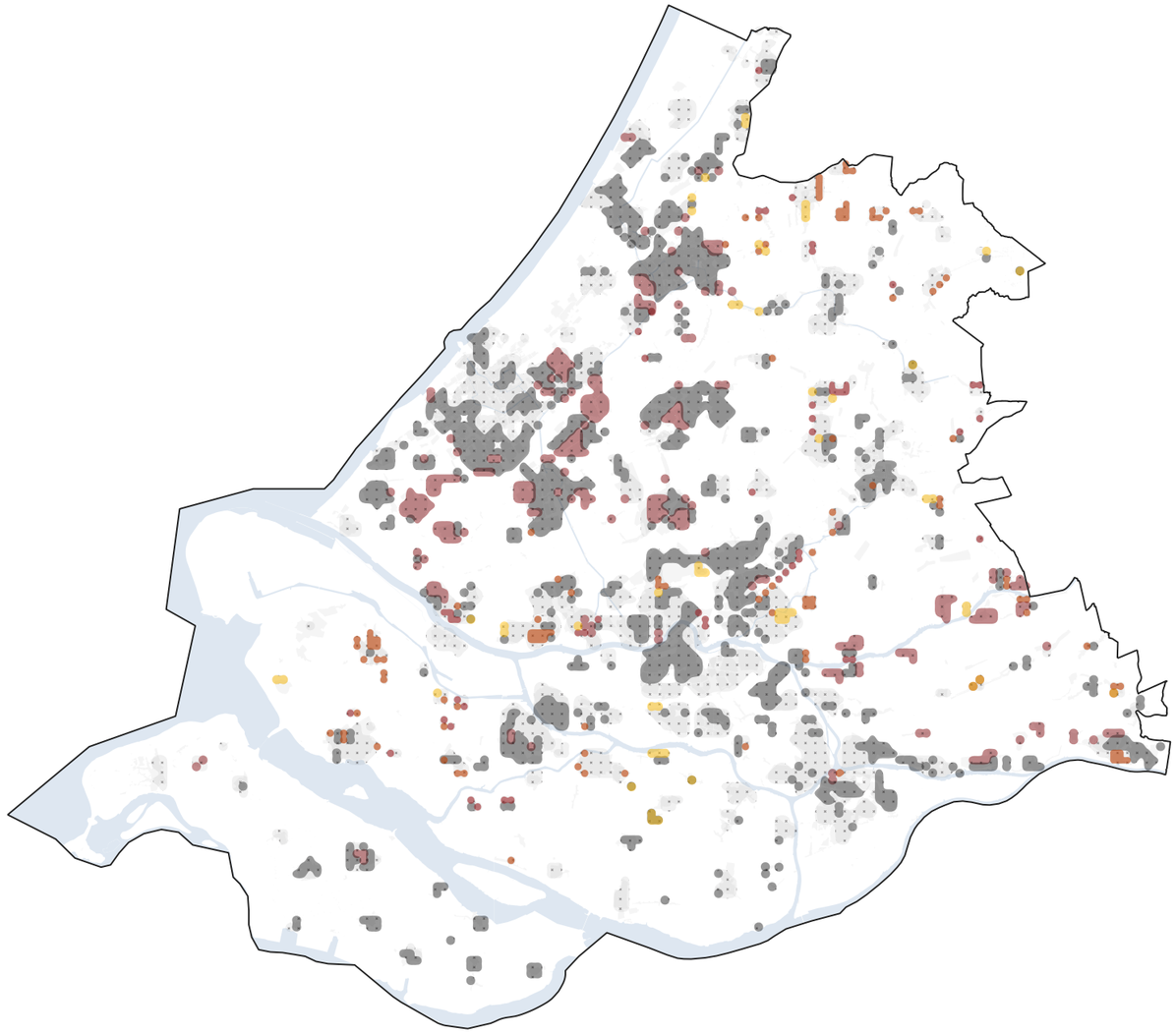
All data adapted from Klimaateffectatlas (2026)

APPENDIX

Demolition and renovation priority grid

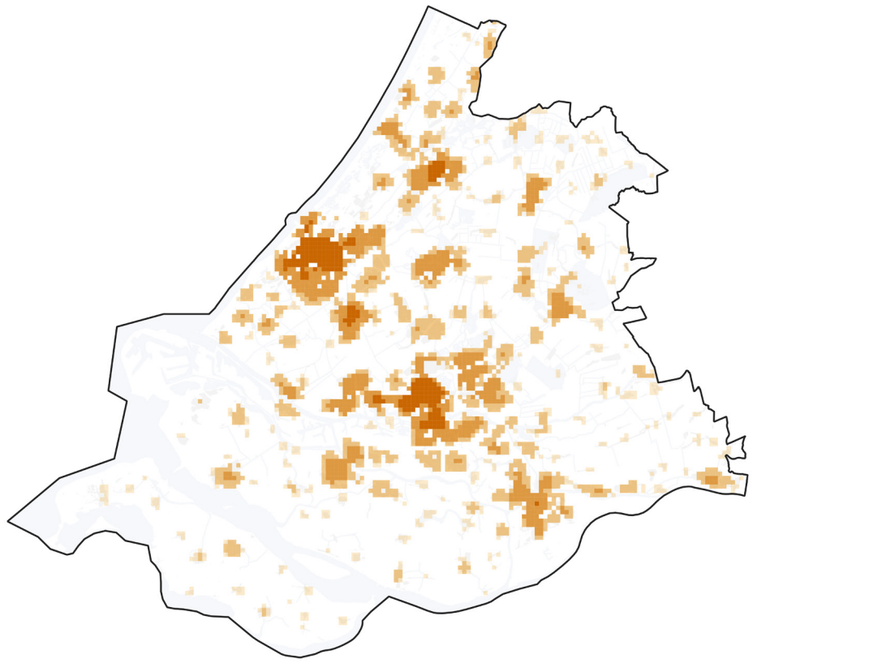






APPENDIX

Relocation



Density in grids where social housing is present

- < 800
- 800 - 2200
- 2200 - 4500
- > 4500

0 7.5 15 km

Relocation parameters

>4500 inhabitants per km2 must be relocated within a 5km radius

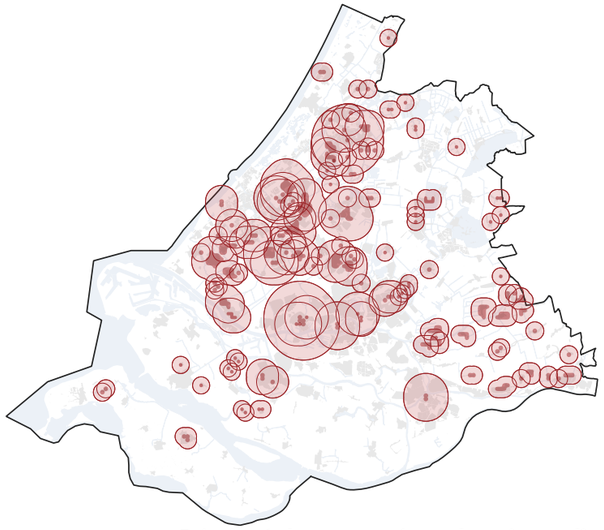
2200-4500 inhabitants per km2 must be relocated within a 3km radius

800-2200 inhabitants per km2 must be relocated within a 2km radius

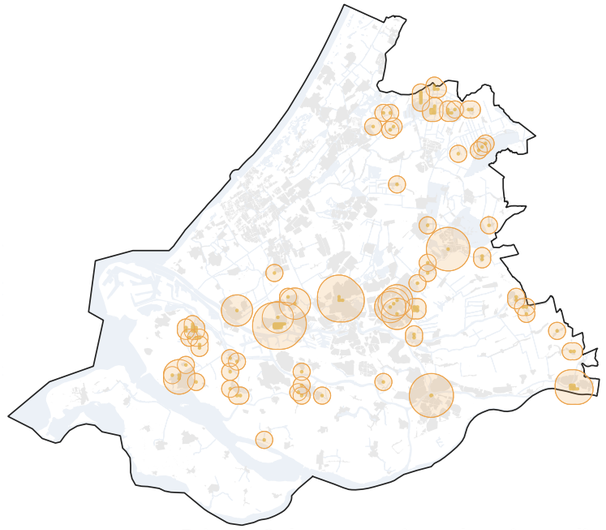
<800 inhabitants per km2 must be relocated within a 1km radius

APPENDIX

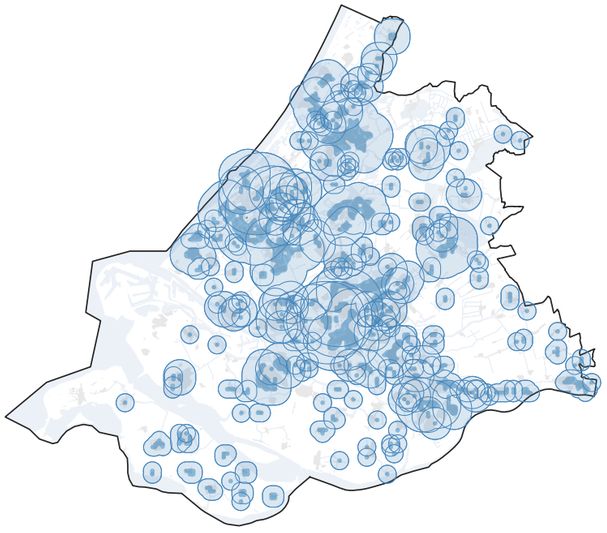
Relocation radiuses



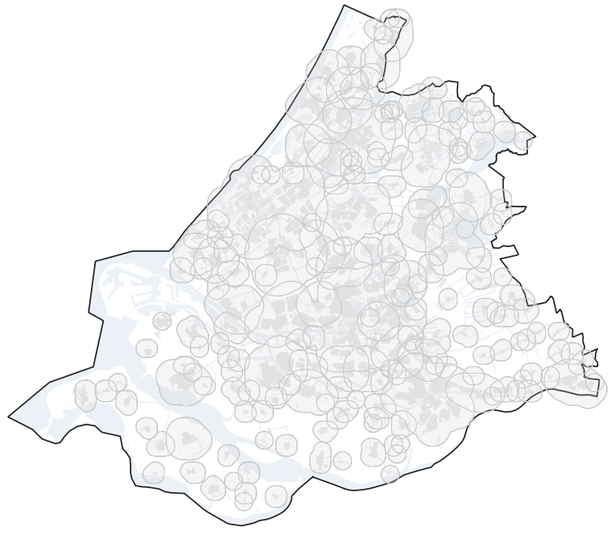
Priority 1 deconstruction relocation radius



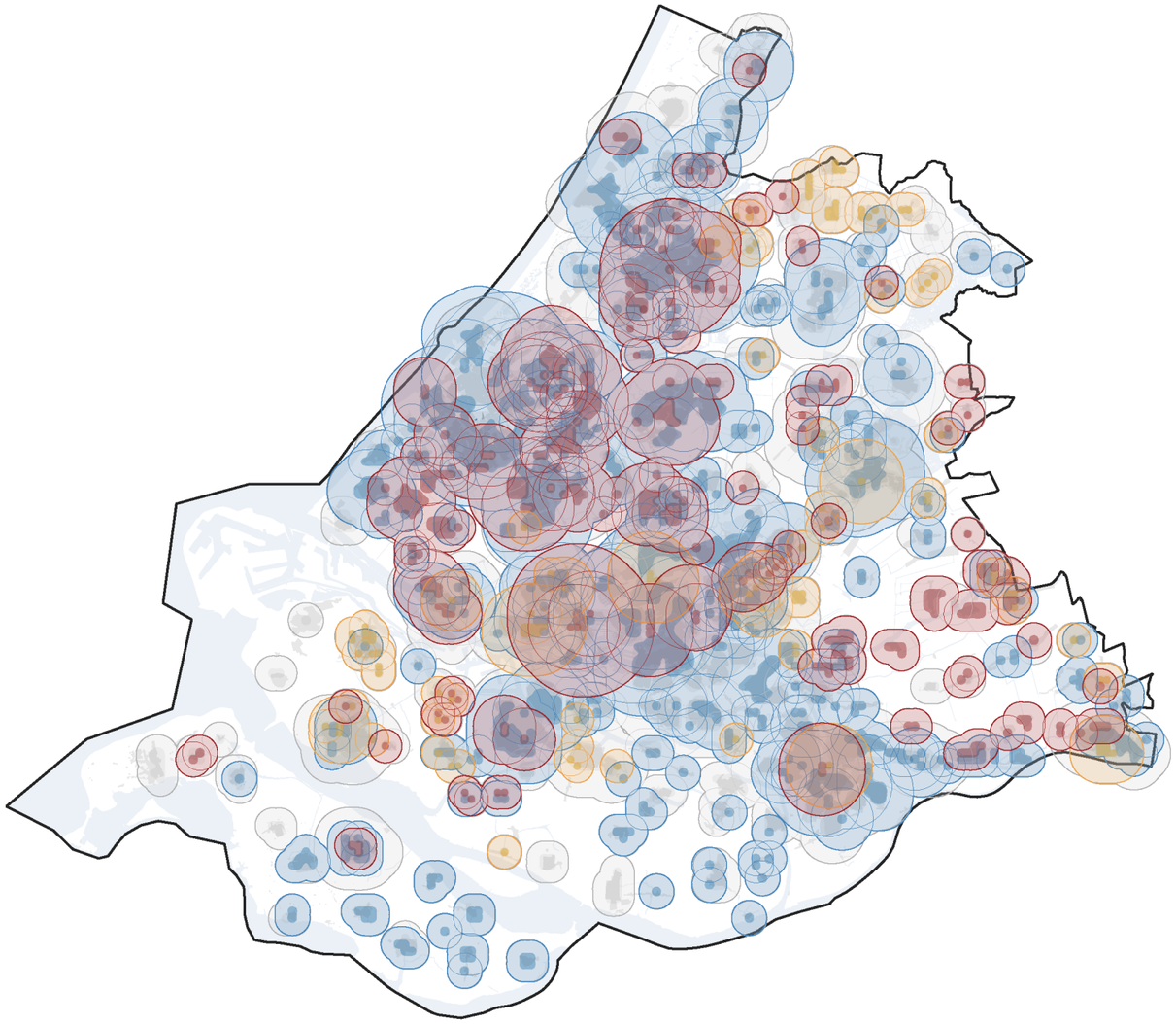
Priority 2 deconstruction relocation radius



Deep renovation relocation radius



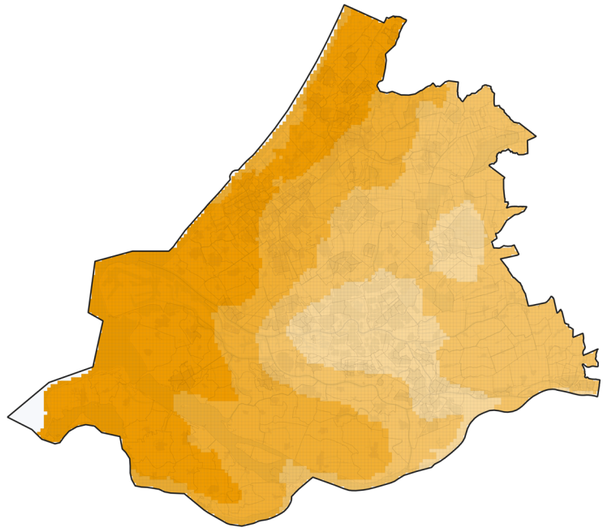
Superficial renovation relocation radius

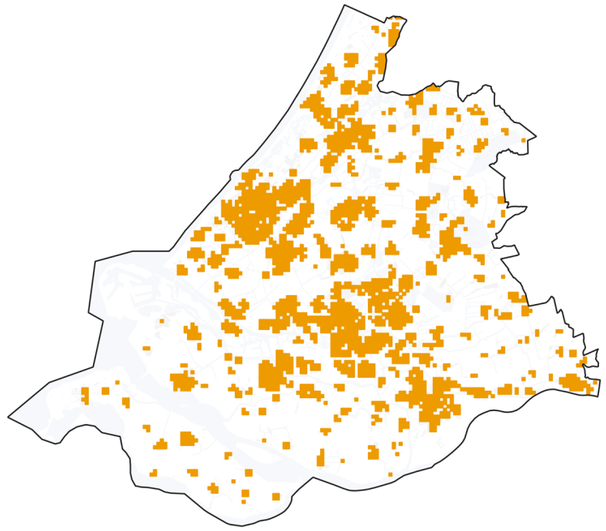


Overlap of the relocation radiuses

APPENDIX

Solar power and Geothermal installations





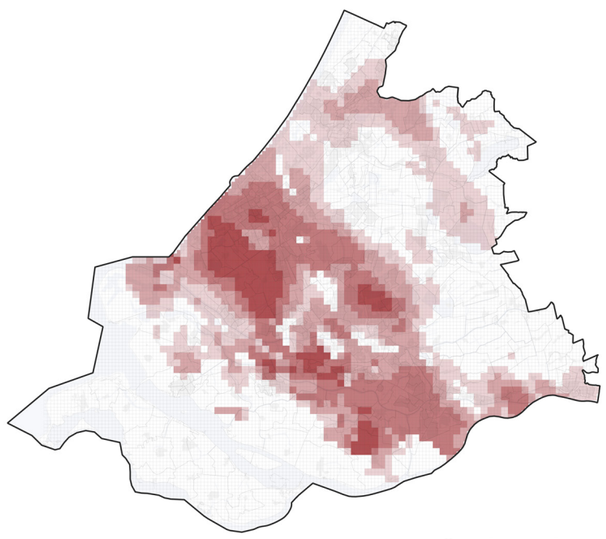
Mean yearly PV output (kWh/m2)

1035 - 1050
1050 - 1067
1067 - 1090
1090 - 1135

0 7.5 15 km

PV output clipped with social housing

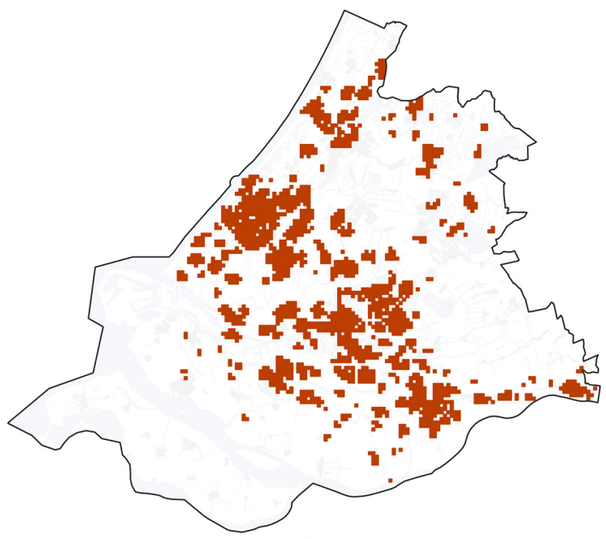
0 7.5 15 km



Geothermal potential (MWth)

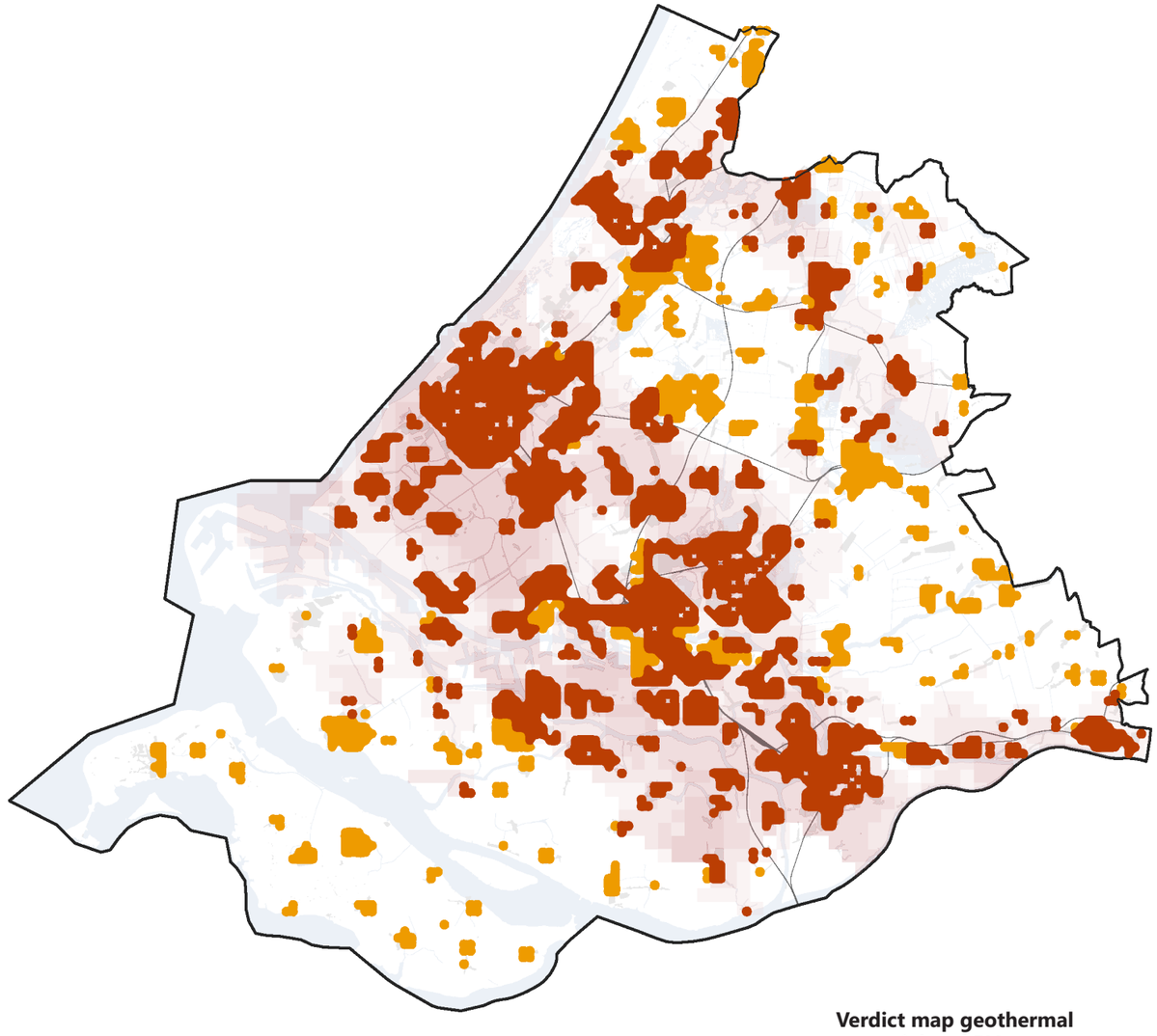
5 - 10.5
10.5 - 18.4
18.4 - 27.1
27.1 - 43.6

0 7.5 15 km



Geothermal potential clipped with social housing

0 7.5 15 km

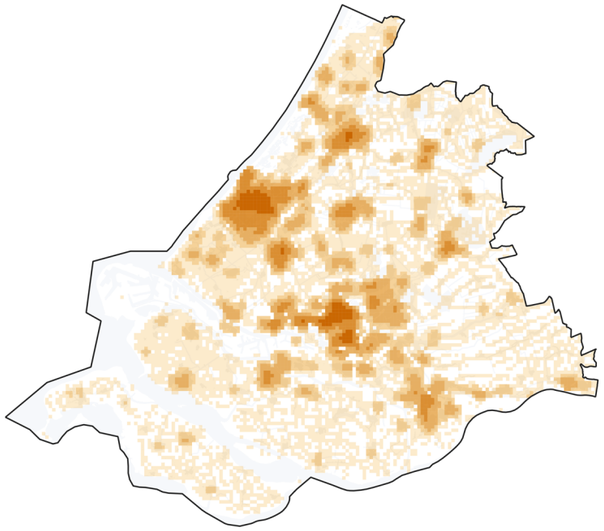


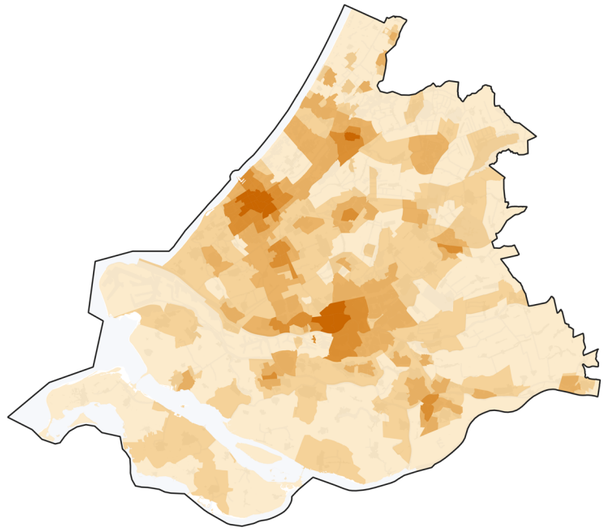
Verdict map geothermal potential and PV-output

Geothermal and solar installations
Solar power installations

APPENDIX

Densification ratio



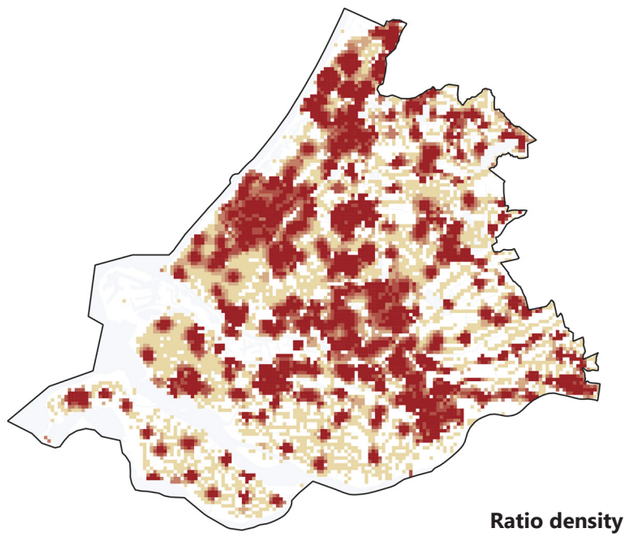


Grid density
- 0 - 649
- 649 - 1715
- 1715 - 3149
- 3149 - 5447

Neighborhood density
- 0 - 649
- 649 - 1715
- 1715 - 3149
- 3149 - 5447
- 5447 - 9289

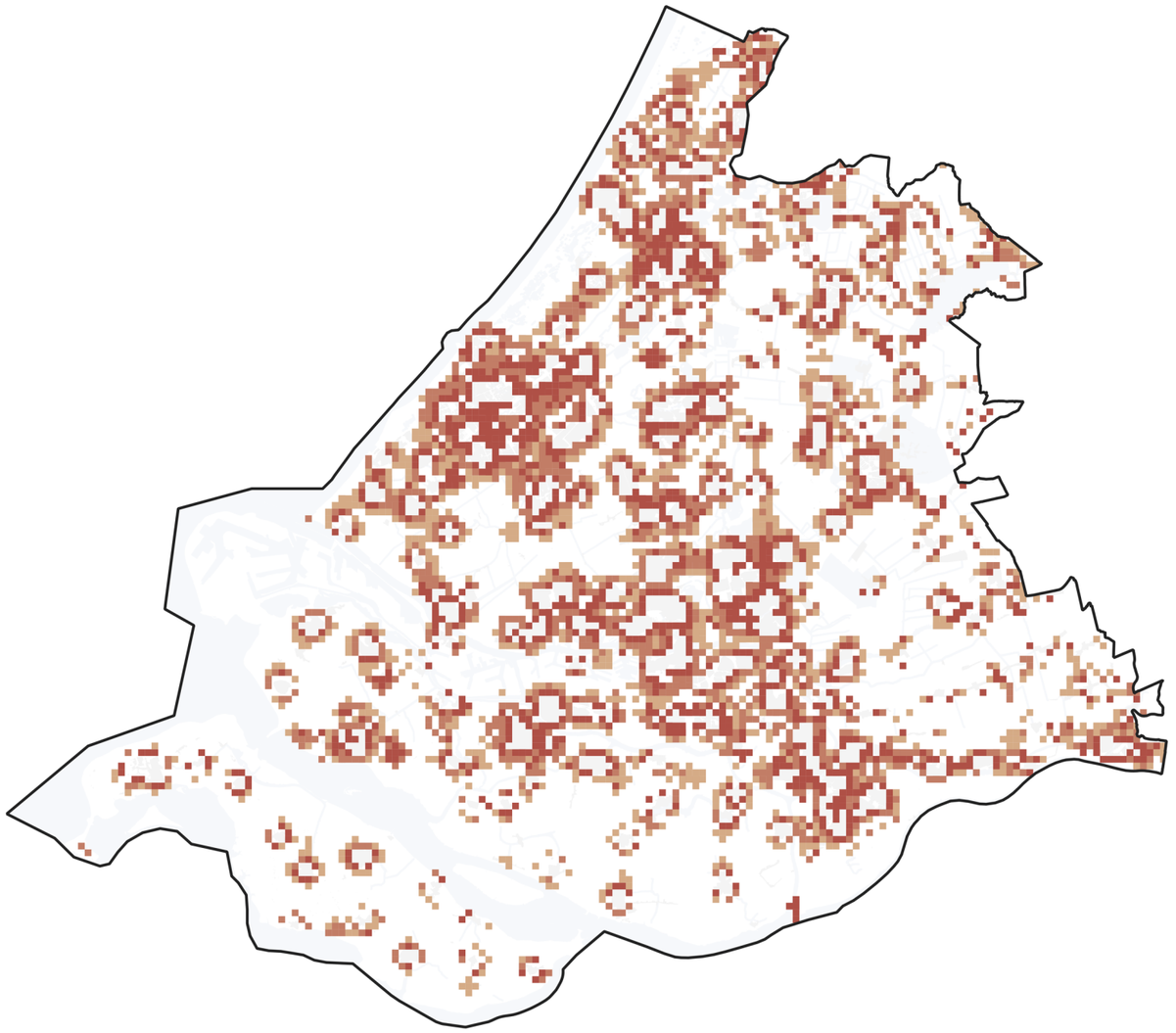
0 7.5 15 km

Grid density / Neighborhood density



Ratio density in %
- 0 - 25
- 25 - 50
- 50 - 75
- 75 - 95
- >95

0 7.5 15 km



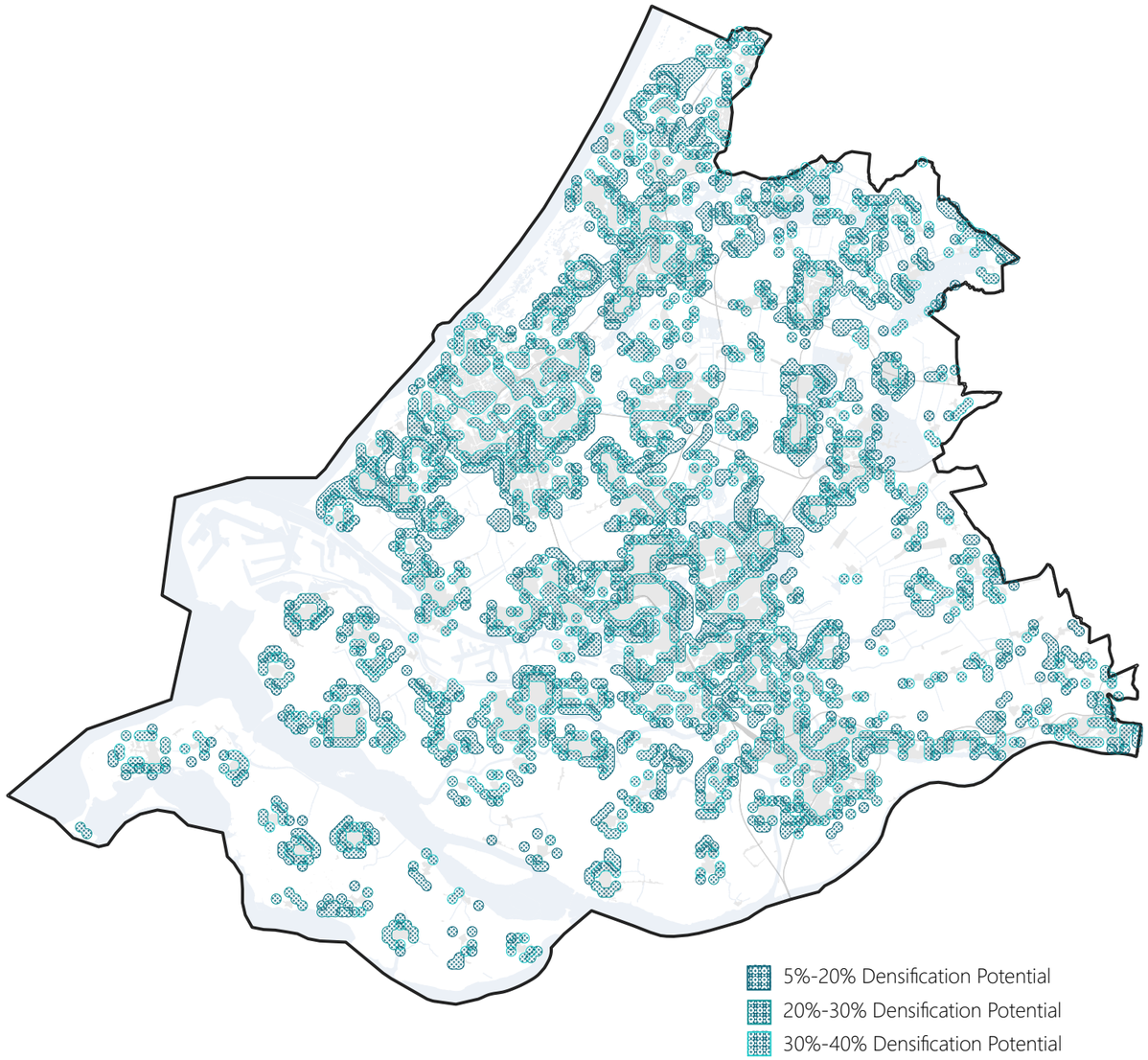
Densification parameters
If density ratio = 25-50% Then densify with 30-40%
If density ratio = 50-75% Then densify with 20-30%
If density ratio = 75-95% Then densify with 05-20%

Used density ratio for densification parameters
- 25 - 50
- 50 - 75
- 75 - 95

0 7.5 15 km

APPENDIX

Densification areas and ratio



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