Building A Fair Transition

Creating a fair circular built environment in the Dutch province of South Holland

Spatial Strategies for the Global Metropolis
Delft University of Technology • MSc Urbanism

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Abstract

"Building a Fair Transition" strives for a fair circular built environment in the Dutch province of South Holland. By 2040 South Holland aims to have built 210.000 new dwellings to meet the rapidly growing housing demand. This transition in the built environment should align with current climate agreements and be as energy neutral as possible. To meet these goals, a lot of material and renewable energy are needed. However, the current linear economy creates inequalities for current and future generations. Therefore, radical changes towards circular construction and the demolition sector are needed. At the same time, energy poverty is an issue that calls for immediate actions in order to make the much-needed transition truly sustainable. Nevertheless, the country lacks a comprehensive measurement framework that considers social aspects to address the phenomenon. The main research question is how to manage the transition in South Holland towards a circular built environment while ensuring that this transition is done in a fair way.

In order to make this possible, a tremendous change in organisational structures is required. An interscalar approach is needed to create a symbiosis between the regional scale and the actions needed at a local level. In this work, bottom-up initiatives are encouraged and embraced within a bigger top-down mainframe. Through an assessment analysis, the goals towards a sustainable built environment are classified into three categories: materials, energy and knowledge. These goals will strengthen the social foundation of our report and fit the ecological ceiling that all development must respect. In our work, phasing of interventions is based on the urgency needed. In that sense, actions are prioritised in the most vulnerable areas while pilot projects serve as the research ground for testing feasibility and potential upscaling. The most urgent areas will be addressed first according to the criteria of low liveability, building energy performance, low income and ownership status. The overall goal of this strategy is to create a just sustainable built environment characterised by circular material flows and fair energy transition. More precisely, the aim is to strive for affordable and adequate housing for all, a regenerative and stable labour market and knowledge exchange. Concerning material flows, the target of closed material loops is achieved through renewable raw materials used, upcycling of waste flows and optimal use. Finally, democratisation of energy has become a key theme. Supply and demand for renewable energy sources is controlled to minimise energy losses. A decentralised energy system enables every citizen to become a prosumer of energy leading thus to democratisation of energy.

Keywords: circular economy, social justice, inclusive energy transition, material flow, South Holland

1. Introduction: Urgency of transition

The current pandemic and climate crisis are the greatest threats of almost every contemporary society. These challenging emergencies have resulted in multiple and daring goals on the way to eliminate them. The rich variety of goals in relation to their ambitious timeframes have resulted in simultaneous and intersecting processes to achieve them. Zero emissions, one million new homes, a circular built environment, all strategies planned to be achieved by 2050. All these ambitious and complex strategies in relation to rapidly growing urbanization, attempt to drastically reshape our societal identities.

Numerous actions are taking place in the Netherlands. One of the most challenging ones is reducing by 55% CO_2 emissions by 2050 compared to 1990. In accordance with the European green deal, the end goal is to reach neutrality. In addition, acknowledging the fact that the sustainable development goals are created to deal with multilevel complex challenges is also a powerful reminder that during the transition, poverty, affordable and clean energy, decent work and economic growth, the reduction of inequality, peace, justice, among many other goals, are pursued in order to create a sustainable built environment for South Holland.

Concurrently, the enormous number of new houses needed to be built in the near future in combination with the linear economy of the construction and demolition sector, that produces 40% of the total waste in the Netherlands and is responsible for 35% of the CO_2 emissions, is one of the greatest obstacles of this transition. Political negotiations include a substantial risk of de-greenifying the path to circularity. The true challenge is to use ambitious goals to create both ecological and social resilience. A careful planning of the transition, ensuring that the most sensitive groups of people are fairly treated, is crucial to proceed not only in a circular and sustainable environment, but to an inclusive as well. The transition's potential to reform society's identity to a more sustainable mindset might be the greatest challenge of all.

In conclusion, a plethora of actions are taking place in South Holland until 2050. The main aspiration of our team is to ensure that the transition to a circular built environment is just one that in the end, it will create a fairer built environment in the region of South Holland.

The Construction and Demolition sector is responsible for:

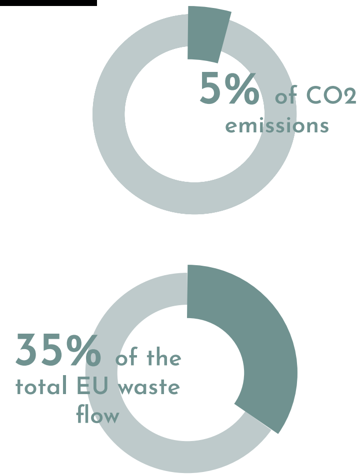


Fig. 1: Statistics of the Construction and Demolition sector
Based on (Circular construction. Most opportunities for demolishers and wholesalers, 2017)

Fig 2. Powerplant, Photo by Jan Antonin Kolar on Unsplash

1.1 Build, build, build!

Urban Growth

Most of the cities in the Netherlands have gradually evolved through time leading to great urbanisation during the 19th century (Amsterdam, Rotterdam, The Hague, Utrecht). Even with this extent of urbanisation in some cities and the shrinkage of others through the centuries, a more evenly distributed growth was achieved than other European countries. The Netherlands has evolved into a country that consists of a polycentric, highly urbanised landscape (Nabielek, Hamers, & Evers, 2016). The most striking fact is that from the beginning of the 21st century not only these large, urbanised cities have experienced extreme growth, but also the new, smaller towns or suburbs have experienced major growth. This could also be considered as an indication of where the expected urban growth will occur until 2030.

Across the period of 2019-2050, the growth of these cities is expected to increase by 15% in relation to the present population. Someone can argue that growth will occur mostly due to migrants. The population is expected to become even more diverse in 2050. As a result, the built environment must increase its housing stock to sustain the expected growth and the already existing housing demand. The housing section, in collaboration with the Dutch municipalities, plans to build one million new homes during this decade of which 67% will be affordable housing (Séveno, 2021). Moreover, 210.000 of the one million new dwellings are expected to be built in the Province of South Holland from now till 2040 (PZH, 2020).

Large city residents tend to have shorter lifespans due to the unhealthy built environment of the urban areas. Also, lower-income people usually live-in social housing or the least attractive neighbourhoods of the Netherlands which are mostly found in big cities (Nabielek, Hamers, &

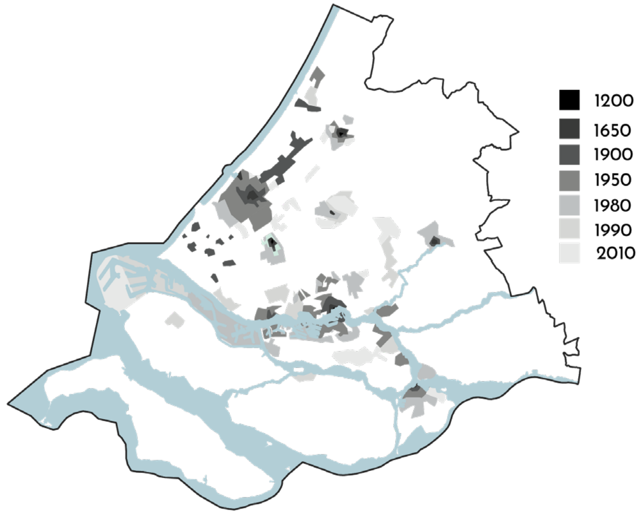


Fig. 3: Historic urban growth

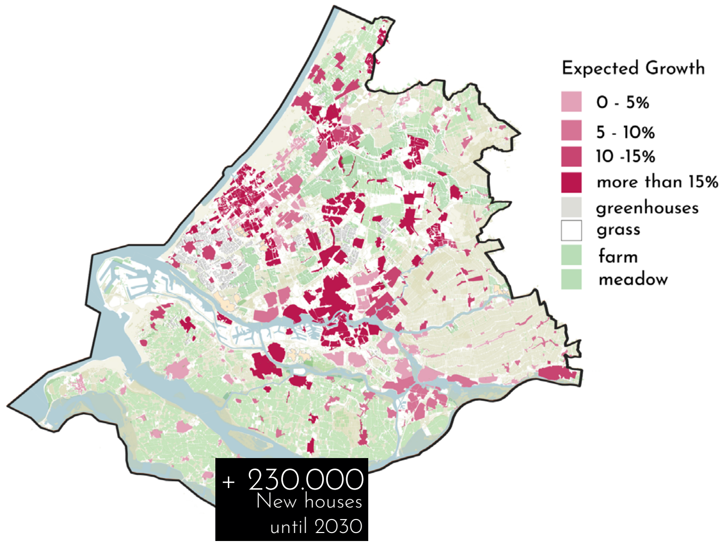


Fig. 4: Urban growth 2018-2050 in relation with the current unbuilt areas

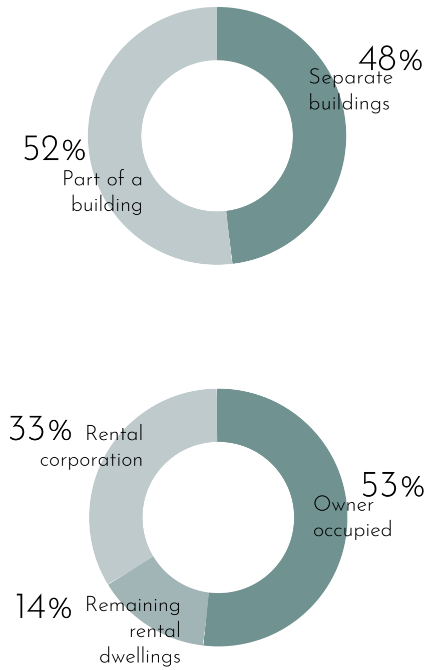


Fig. 5: Dwelling types in South Holland
Based on: (AlleCijfers, 2020)

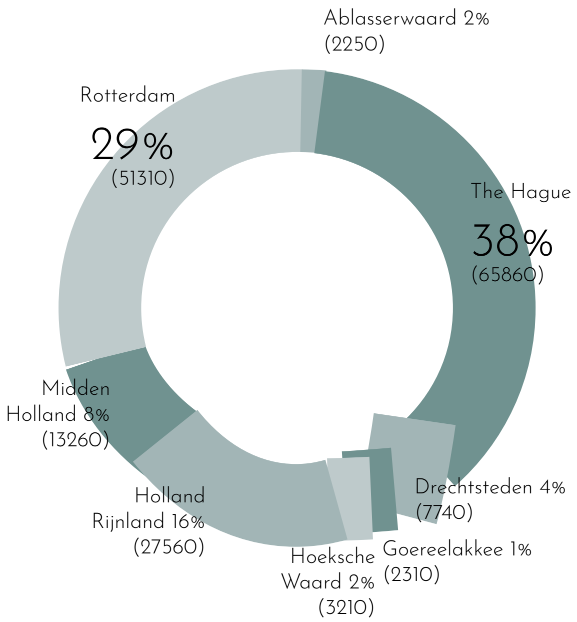


Fig. 6: Newly Built Dwellings per Region
Based on: (AlleCijfers, 2020)

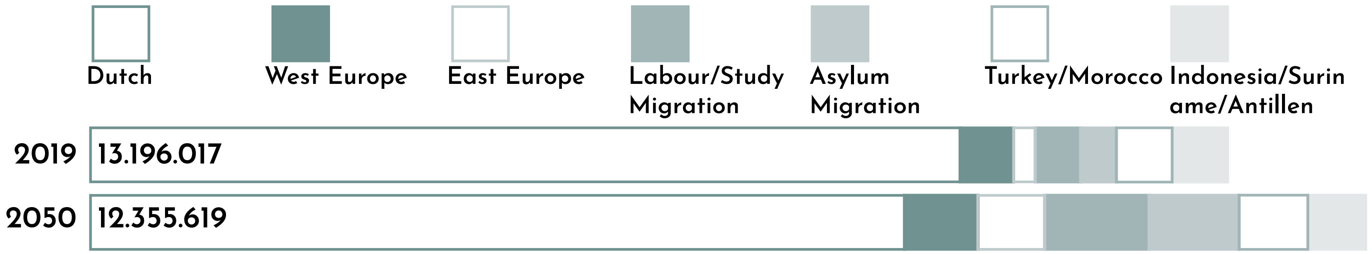


Fig. 7: Current and Expected Inhabitant Background, Netherlands
Based on CBS, (Prognosis: Population will continue to grow for the next 50 years, 2018)

Evers, 2016). Therefore, during the future urban growth of the cities towards sustainability and circularity, these areas should be carefully considered.

In short, the Netherlands is an exceptionally densely populated European country, and the Randstad is the densest part of it. Right now, Randstad's population is growing rapidly, and it is expected to grow even more in the future. The fact that the Randstad has a positive natural growth, where the number of new births exceeds the number of deaths, in relation with the fact that its population is remarkably diverse, raises many questions on the conditions under which the housing demand will occur in the future in both short and long term.

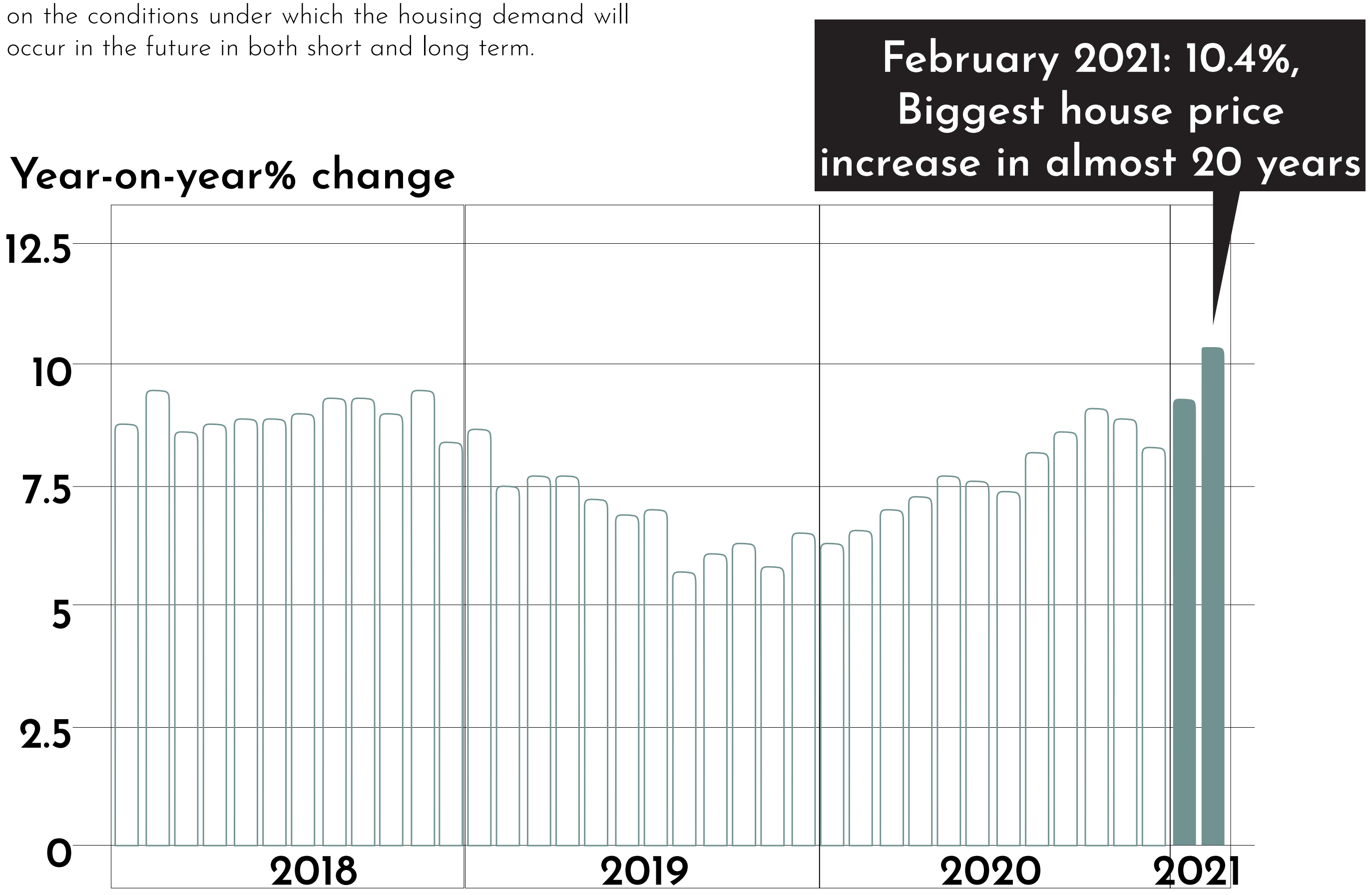


Fig. 8: Price development of existing owner-occupied dwellings in The Netherlands. Based on: (CBS, 2021)

Circularity and Material Demand

The immergence of the housing demand opens discussion on the way we should build. The existing and new housing stock should also contribute to the circular model that the area aims to have reached by 2050. A lot needs to be built; therefore, a lot of new raw materials will be needed in the area. Currently, the circularity level of fossil fuel materials, the most common building raw material, is extremely low in the European Union. Unfortunately, this is also the case in the Netherlands as 95% of the demolition materials are downcycled (Netherlands circularly 2050, 2016). Issues of the scarcity of the most used raw materials in the construction sector are alarming. Drastic changes are needed in reshaping the construction and demolition sector towards a circular built environment.

The process of meeting the housing demand intersects with the energy transition, as the country plans to move towards neutrality of its housing stock relies only on renewable resources and minimise the energy losses where possible until 2050. This also applies in the construction and demolition sector as, while building all these new housing stock, space for the renewable resources must also be found in the already extremely urbanised landscape of the area.

Green electricity production up by 40% since 2019

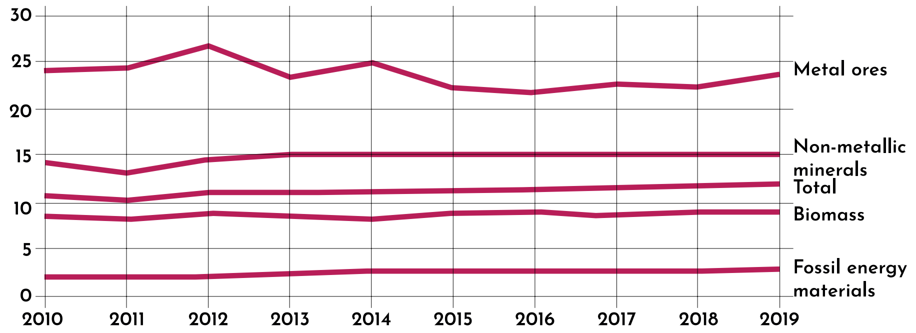


Fig. 9: Circular material use rate by material categories EU-27 2010-2019
Based on: (Eurostat, 2020)

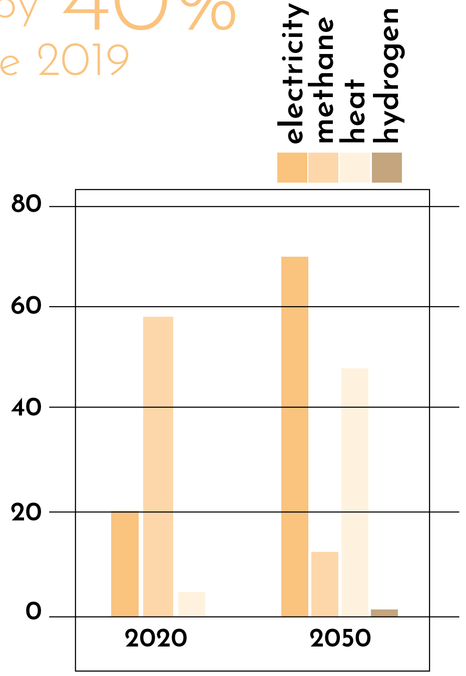


Fig. 10: Energy transition in South Holland, from fossil fuels to renewable resources.
Based on: (Leguijt, et al., 2021)

1.2 Why so Unjust?

1.2.1 Linear Material Flows

How much is left for us?

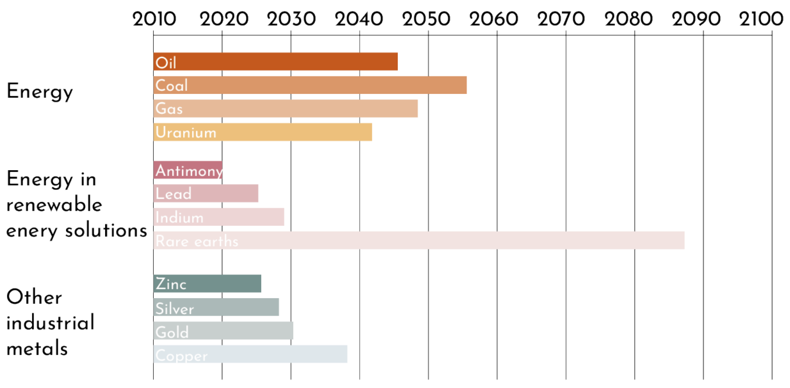


Fig. 11: Years remaining if the production continues to grow at current rates

Based on: (Vlaanderen Circulair, 2010)

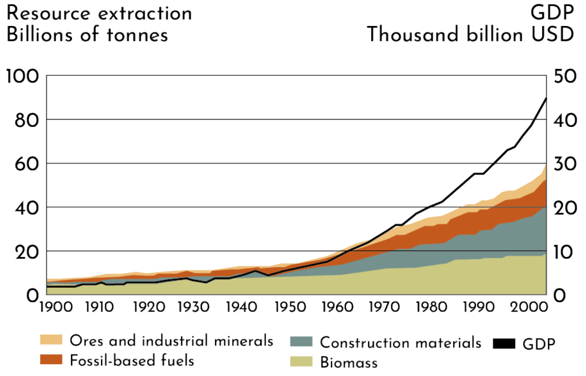


Fig. 12: Worldwide resource extraction in billions of tonnes, 1900-2005

Based on: (Vlaanderen Circulair, 2010)

As a result of global population growth, the demand for raw materials is ever-growing. As the diagrams above show, if the demand and production continue to grow at current rates, the elevated risk of exhausting raw materials is inevitable.

In South Holland, there is rising demand for raw materials due to the relatively large numbers of new buildings compared to renovation and demolition (Zuid Holland, 2018). As evidence shows, the Netherlands gets 68% of its raw materials from abroad (CBS, 2011). In the future, there will be severe resource shortage problems. The Economic Institute for Construction (EIB) has estimated that up to 2030, only one-third of the required building material can be filled with raw materials from residual flows (vanHoek, 2018). This shortage gives rise to an unstable material market with an effect on prices and supply. This means that the subsequent increasing inequality in access to raw materials may lead to the suffering of the poorest population, which contributes to the non-achievement of the Sustainable Development Goals (SDG's). (Netherlands circularly 2050)

Another important aspect of the current linear economy is waste management. Inefficient waste disposal and ignorance of the potential value of some waste have a large loss in the economic aspects and are not environmentally friendly. According to the official report, the construction sector uses half of the raw materials in the Netherlands and around 97% of demolition materials are downcycled, while they could be recycled to be of higher value. Although, outgoing material flows from the demolition part, such as copper, steel and aluminium (3,411 tonnes) could form a valuable source

Distribution of construction materials applied in the Netherlands (weight)

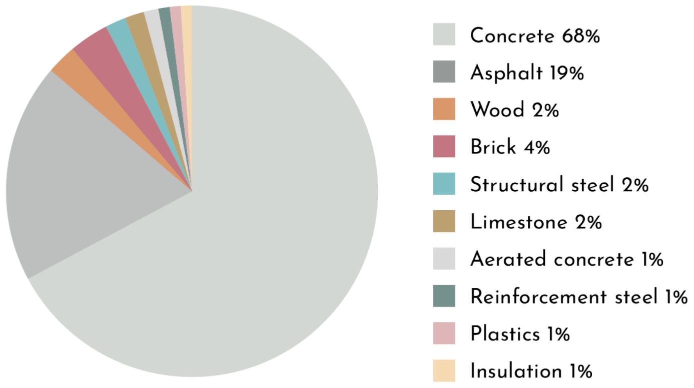
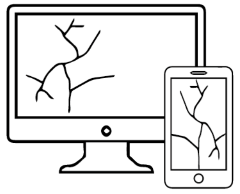


Fig. 13: Construction material distribution, The Netherlands.

Based on: (van der Velde & van Leeuwen, 2019)

50% of the released waste flow of the construction sector in South Holland include stony rubble (1.1Mton)

The Sustainable Development Goals Report 2o2o



Electronic waste

Grow by **38%**

But less than

20% *is recyled*

But **95%** of stony rubble is recycled in a **low-grade** way

of new raw materials for South Holland, a large part of them is currently being melted down (Zuid Holland Circular 2018). These facts, in combination with the lack of circular material flows during the construction and demolition process, lead to about 40% of the total waste created in the Netherlands and 35% of the CO2 emissions. (Circular South Holland, 2019)

As a result, these linear material flows loom social justice. It threatens the sustainability of new developments, by exacerbating unequal distribution of resources, the loss of diversity and severe climate change. Furthermore, it destroys equal opportunities to enjoy natural resources and a sustainable natural environment for our future generations.

Overall, the current situation and future threats put pressure on the material market of South Holland. With applications of innovative technologies emerging, the transition towards circularity in the material flows is urgent and promising.

1.2.2 Energy Poverty

It is an undeniable fact that CO2 emissions must be reduced and that fossil fuels be replaced by sustainable energy sources. According to the EU Regulation on the Governance of the Energy Union and Climate Action 2018/1999, every state-member is obliged to submit a national energy and climate plan. Based on that, the country's route to a carbon-free economy is outlined in the following documents: The Netherland's Climate Agreement and the Climate Act.

Undoubtedly, the desired energy transition implies radical economical and societal changes. As it has already been stated by the Minister of the Interior, the energy transition ought to be 'feasible, affordable and fair' (Koninkrijksrelaties, 2020). However, there is a risk lurking distribution justice since there is a high potential that the costs and benefits of this transition are not evenly distributed throughout society.

According to academic literature, a just energy transition is defined by three main principles: accessibility to energy services, participation in the decision-making concerning the upcoming changes and the recognition of the potential inequalities associated with it (Carley & Konisky, 2020; McCauley, Heffron, Stephan, & Jenkins, 2013). One of the main concerns that arises is the energy poverty. Although there is not a generally accepted European term for it, the scale of the problem and its negative repercussions are widely recognized. The most crucial among them are the effects on physical and mental health, social isolation and financial problems. It becomes clear that this theme is a multidimensional one and can act as a limiting factor for achieving the UN Sustainable Development Goals (SDGs) (Schonewille & Crijnen, 2019). In this sense, this report tries to address this issue within the scope of the energy transition.

It becomes clear that the first step is to measure the extent of the phenomenon. In order to gain a clearer understanding, we should focus beyond the usual suspects of poverty and inequality that have to do with socio-demographic parameters such as income and education. As TNO's white paper on the issue remarks, energy poverty is, also a consequence of poorly insulated housing, high energy prices and taxes. Until recently, the Netherlands was only focusing on the affordability of energy bills for measurement purposes, although disposable income and other expenses should also be considered. More precisely, so far, 'energy burden' has been heavily used as an indicator for measurement. The latter refers to the percentage of energy costs in relation to the total income of a household. It has been argued that a household is considered energy-poor if it spends more than 10% of its income on energy. Similar to this,

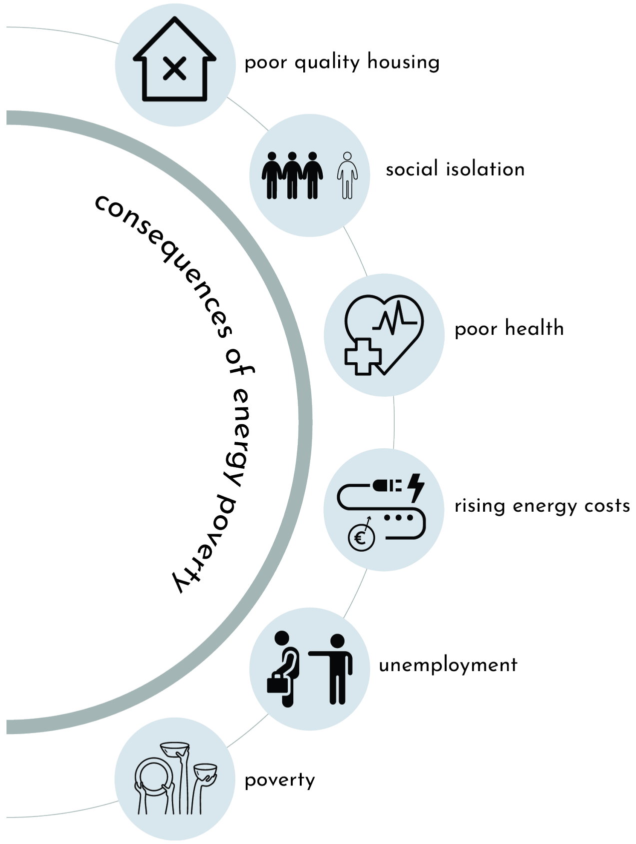


Fig. 14: The consequences of energy poverty. Based on: (Middlemiss, et al., 2020)

another indicator is the number of households that are in arrears concerning their energy bills (payment risk). Indeed, a study by NIBUD (National Institute for Family Finance Information) showed that 38% of Dutch households face difficulties in this (McCauley, Heffron, Stephan, & Jenkins, 2013). Moreover, research driven by PBL in 2018 that used the earlier indicators, concluded that approximately 8% of households in the country are energy poor. (Middlemiss, et al., 2020)

However, energy poverty is such a complex and dynamic phenomenon that more aspects should be considered. For instance, 'hidden energy poverty' describes the state in which a household is under consuming energy in order to stay within budget. Also, a situation when someone lives in at too cold house or heats partially a house to minimise expenses is referred as 'spatial shrinking'. Another overlooked aspect is the degree of peoples' accessibility to sustainable technology that permits energy savings. Scholars have stated that there is even a gender inequality in the phenomenon of energy poverty (Clancy et al., 2017) Also, a study by Mashhoodi et al. shed light on the geographical differences of the phenomenon between neighbourhoods (Mashhoodi, van Timmeren, & Stead, 2018). The underlying financial, socio-demographic and housing causes confirm that context-specific policies should be opted rather than one-size-fits-all measures (Middlemiss, et al., 2020).

It becomes clear that, since there is not sufficient information on the number of households affected, it gets very difficult to measure and address energy poverty using only the aforementioned indicators. When it comes to energy transition, things get even more complicated.

The effect of the energy transition on energy poverty

On the one hand, in the long term, energy transition is expected to lower costs due to the growing use of sustainable technology and decreased reliance on fossil fuels (Faaij & van den Brink, 2019). On the other hand, in the short and medium-term, energy transition is expected to increase energy costs, intensifying thus the problem of energy poverty. The main reason for this is the investments needed in new technology. For example, the capacity of electricity grid must be increased by network operators to allow the connection of new wind and solar farms. Also, the switch from natural gas to electricity for heating implies the use of new sustainable technology like heat pumps. However, as it has been remarked in literature, sustainable technology is usually mostly used by high incomers (Carley & Konisky, 2020). Thus, concerns about potential inequalities regarding the energy transition arise (Borenstein & Davis, 2016).

It becomes evident that households with limited financial means will be faced with increasing energy costs. This becomes even more obvious given the possibility of fossil fuels becoming more expensive as an effort to encourage the transition to renewable sources. Considering the property status of buildings is also critical. Tenants have less authority to invest on sustainability than homeowners. Also, those who rent from housing associations are different from those renting from a private landlord. These three target groups should be addressed as actors with different agendas. Finally, another crucial factor is the illiteracy that characterises many households concerning potential subsidies and schemes on offer. Many households lack the resources, information, or skills to become more energy efficient. In conclusion, in order not to halt the much-needed transition, it is critical to address energy poverty.

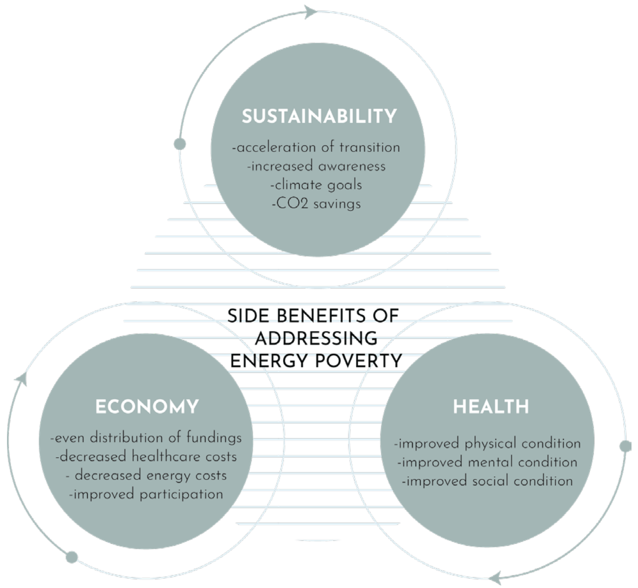


Fig. 15: The side benefits of addressing energy poverty. Based on: (Middlemiss, et al., 2020)

1.2.3 Gentrification as a Regeneration Policy

Gentrification has been extensively promoted as the answer to neighbourhood decline in many cities across the globe. As many scholars have stated, it is often viewed as one of the main neoliberal toolboxes for the shaping of the built environment (Kallin & Slater, 2014; Paton, 2014; Smith, 2002). It has even been acclaimed as the last resort for cities' salvation against decay (Duany, 2001; Municipality, 2007). However, this has been criticized as a 'false choice' binary while little research has been conducted on the lived experience of the phenomenon, namely the view of those displaced or under threat of displacement (Doucet & Koenders, 2017).

The urban areas of the province of South Holland are calling for immediate consideration with the city of Rotterdam being one of the most striking examples. The municipality, in order to address issues of low-income neighbourhoods that lie in proximity with the city centre, has enforced policies that actively promote gentrification. This is highlighted in the policy documents Stadvisie (Urban Vision) and Woonvisie (Housing Vision), published in 2007 and 2016, respectively. The last decade, the phenomenon has been mainly observed through large-scale demolition of areas with high percentages of social housing units. Those are being torn down to give their place to new owner-occupied ones and privately rented apartments. Through policies and programmes, the municipality targets in a general upgrade in terms of population and amenities in the neighbourhoods with an emphasis on owner-occupied dwellings. In that way, as Roland Atkinson states, gentrification has become a 'strategy of regeneration' (Atkinson R. , 2003). As Doucet and Koenders astutely remark, this stated-led gentrification is often rebranded and marketed 'as social-mixing or urban restructuring'. Although, many positive outcomes may come from this, it is well argued that this is an ultimately top-down and market-driven approach that aims to 'civilise' and control disadvantaged areas. In that sense, gentrification is used as a policy tool for the creation of pricey housing in usually low-income neighbourhoods (Hackworth & Smith, 2001; Lees, 2008; Uitermark, Duyvendak, & Kleinhans, 2007).

Many homeowners regard gentrification outcomes positively since the value of their property increases. However, tenants are most likely forced to relocate since the rent for the same property increases disproportionately. Also, displacement should be regarded in a broader context, considering all possible forms of loss of identity and community. (Atkinson R. , 2015; Davidson, 2009; Shaw & Hagemans, 2015) Undoubtedly, this can intensify anxieties and tensions with consequences in the physical and mental health of people (Doucet & Koenders, 2017).

The role of the housing sector/housing corporations in gentrification

In the Netherlands, gentrification practices have been comparatively mild and regulated. This is ensured mainly thanks to the presence of a robust social housing sector and tenant protection laws, such as rent regulation. (Doucet & Koenders, 2017) Neighbourhood and housing developments in the Netherlands are characterized by top down, policy-driven approaches on behalf of the government instead of processes driven by the private sector (Doucet B. , 2013; Hochstenbach, 2017; van Gent, 2013). In that way, a buffer zone by governmental actors ensures that the negative consequences of the market have the lowest possible implications. This phenomenon has been characterized as third-wave gentrification and it is intrinsically linked to systemic changes caused by neoliberalisation in the two last decades of the 20th century that affected the relationship between state, market and individuals (Hackworth & Smith, 2001; Smith, 2002). However, as Teernstra mentions, although national and local government are implied when referring to 'state-led' gentrification, housing associations also play a crucial role. Although housing corporations are charged with providing reasonably priced housing for people, they are nevertheless profit-oriented actors who rely on market activities to generate income. (Teernstra, 2015)

The country used to be a case study regarding its housing policies. The function of housing associations set the paradigm across the globe. Up to the 1990s, housing associations were financially supported by the government and the number of social housing units increased remarkably. However, since the 1990s, neoliberalism has taken its toll on this. The turning point was in 1995, when housing associations were deregulated and turned into private organizations (Teernstra, 2015). Financial support for construction and maintenance of the existing housing stock ceased while rent regulation remained (Priemus, 2003). In that way, the sector became quite unprofitable and housing associations had to rely on commercial activities in order to finance investments. Housing associations were given the right to convert social housing into privately rented property and construct owner-occupied houses. As expected, competition among them arose (Priemus, 2003). Through renovation of their stock, they managed to increase real estate values and consequently their financial sustainability. In that way, as Teernstra remarks, 'they became important stimulators of gentrification'. Differentiation of the housing stock and attraction of higher incomers in the cities has become a means to combat decline. Fortunately, the actions of housing associations are still closely monitored by the government; the number of other type of units is controlled, rent levels are monitored and surpluses must be invented in social housing the quality of which must be conserved. However, at the same time, tenure conversion (the sale of social rented units by housing associations when a tenant leaves a property) is a growing trend in the country (Boterman & van Gent, 2014).

The number of buildings owned by housing associations in the Netherlands is large though. 31% of the housing stock is socially rented while privately rented and owner-occupied account for 13% and 55% respectively (2011, varying by city). The overall quality of social housing is considered high, so quality of the building environment is not exclusively related to the property status of the buildings. It is more affected by the percentage of low-income households and the consequent social problems that arise (Teernstra, 2015). In fact, in many low-income neighbourhoods, social housing constitutes the main housing stock with Rotterdam being a striking example. Across the city 58% of the stock belong in this sector (Doucet & Koenders, 2017).

Nevertheless, the province of South Holland is characterized by extensive urbanisation. This often comes with negative connotations such as discontinuity and fragmentation of the urban fabric. Age of buildings and especially the heavy presence of post-war building blocks and lack of renovation, must also be addressed as factors that affect the liveability of the built environment. In order to address the social challenges that arise, new forms of collaboration are being promoted. It becomes clear that, nowadays, multiple actors are involved in regeneration projects, each with their own goals and agendas (Kokx & van Kempen, 2003). Context specific and careful coordination between them is crucial in order to achieve a more mixed socio-economical population in a balanced and just way.

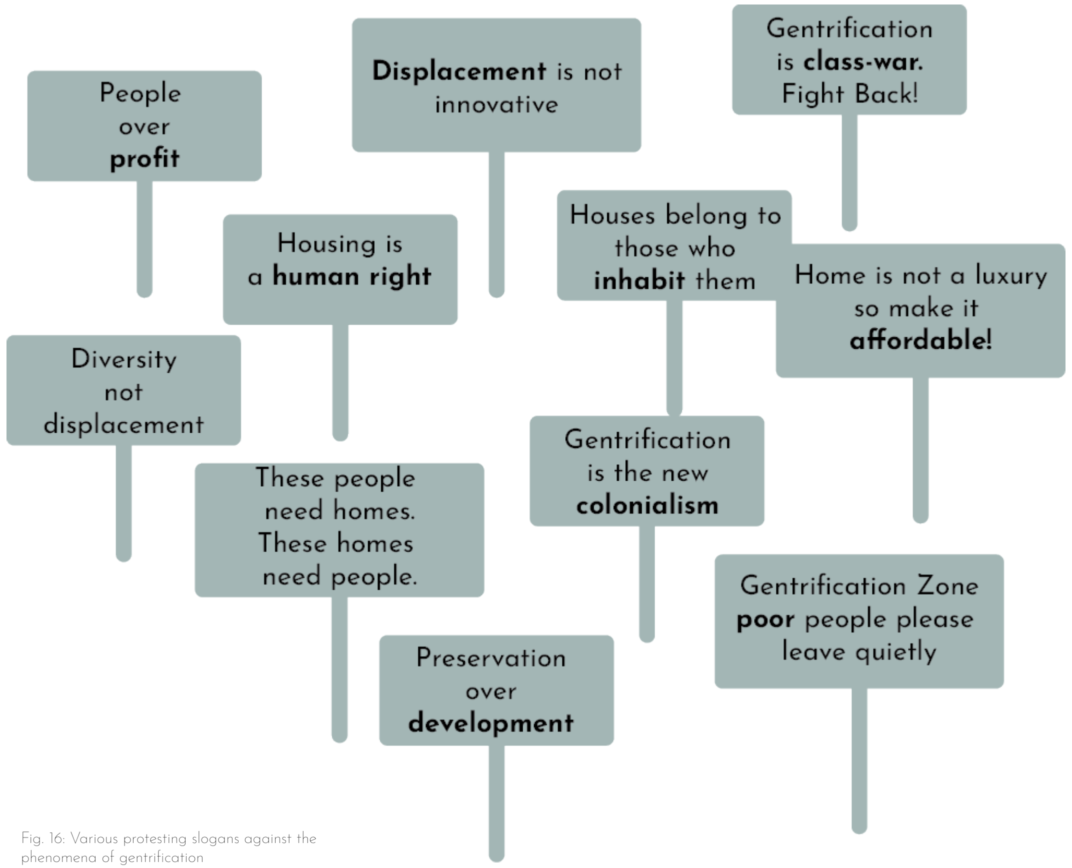


Fig. 16: Various protesting slogans against the phenomena of gentrification

1.2.4 The Injustices in the Labour Market

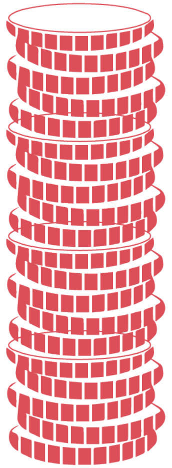
There is a globally recognized framework supporting poverty reduction and inclusive development, which mentions that a decent job should guarantee equal opportunities and equal treatment for all (ILO, 2018a).

However, in the transition process towards a circular economy, the construction employment sector is inevitably going to experience a very strong job demand decline. The demand from the extraction and raw material sectors has been declining for quite some time (European Commission, 2018). With new construction techniques appearing and better utilisation of existing housing stocks, the reduction of employment in the construction sector would continue (European Commission, 2018). According to the forecast, the number of building and related trade workers is estimated to fall by over 100,000 and the number of labourers with low-level qualifications would decrease to 33.3% in 2030 comparing to 43.4% in 2018 (Cedefop, 2018). As we know, building and related trade workers are a major occupational group that is mainly concentrated in the construction sector. The group can be classified into people who build frames, building finishers, painters, building structure cleaners, and related trade workers (European Commission, 2018). As the diagram above shows, the number of building and related trade workers will fall by over 100,000. Besides, the number of drivers and mobile plant operators will also have a big decline. To sum up, workers with low-level skills in the construction sector will suffer most from a job loss in the future.

Meanwhile, low-wage and safety issues caused by exposure to harmful substances often appear in jobs of waste management and recycling in the construction sector (European Public Service Union, 2017). This also leads to the phenomenon of inequality concerning fair income and security in the workplace.

According to the official document, the construction sector of South Holland is responsible for € 13 billion in added value and 100,000 jobs. What is more, it is expected that it can cause about 2 million new jobs for a growth of 550 billion euros in the new circular economy (Netherlands circularly 2050), which means great chances of social value. Thus, with the unfair job opportunities and unsatisfactory working treatments appearing in the transition process in the construction sector, it is necessary and urgent to regard the concept of circularity as an opportunity to redesign labour markets.

Fig. 17: Number of part-time and full-time construction workers
Source: (LISA, 2019)



The construction sector in South Holland account for

€13 billion in added value &

100,000 jobs

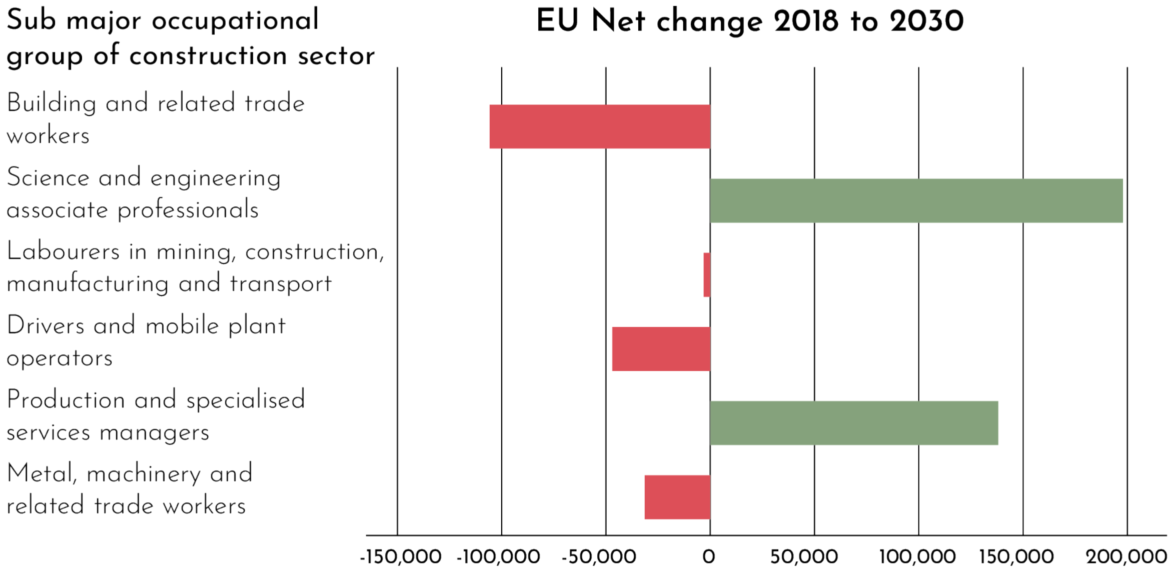


Fig. 18: EU NET change 2028-2030. Based on: (European Commission, 2018)

2. Approach: How to Persevere Change

Fig. 19 Rotterdam Central Station, Rotterdam, The Neterlands, Photo by Jurriaan Snikkers on Unsplash

2.1 Problem Statement

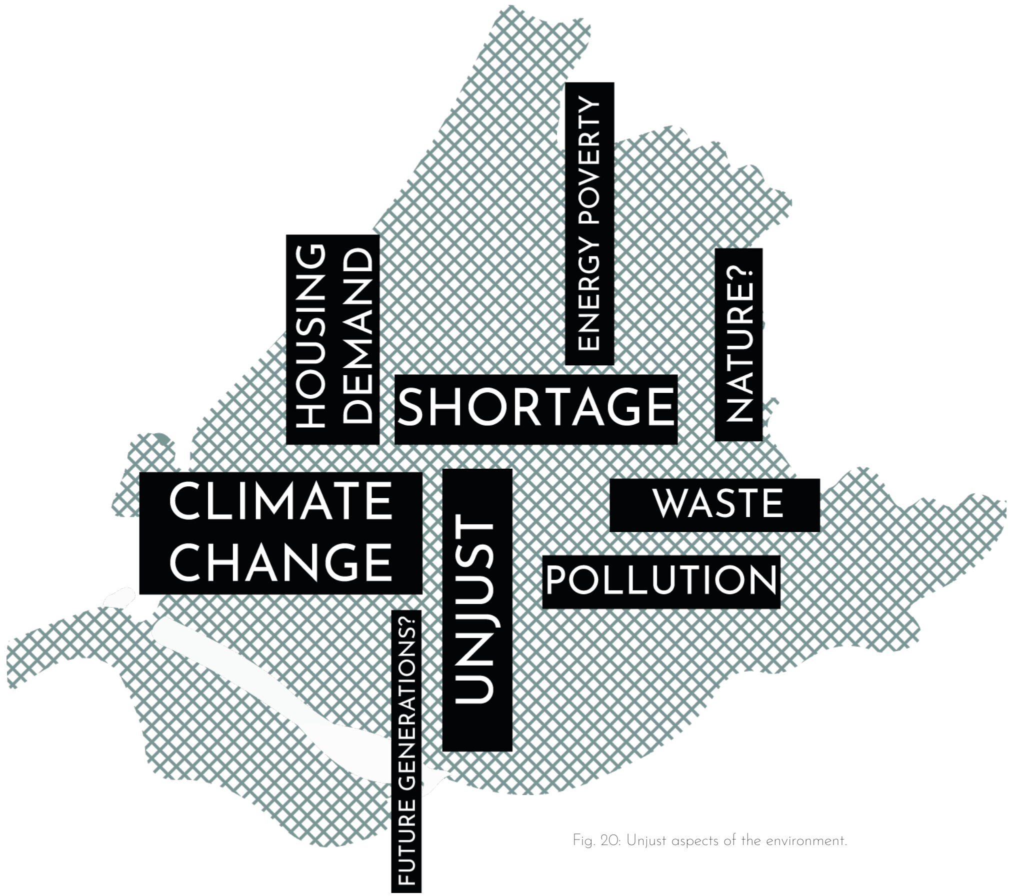


Fig. 20: Unjust aspects of the environment.

South Holland is facing a huge transition. Due to the growing housing demand South Holland has set a goal to build 230.000 new dwellings by 2030. Above this fact, there is also an agreement that all buildings should be energy neutral by 2050. However, in this enormous project lies the danger of overlooking certain vulnerable stakeholders. The current linear economy and the material demand for building those new dwellings can lead to material shortages. This, in its own turn, can lead to unjust phenomena in the future. Moreover, combating energy poverty is another issue that calls for immediate action in the Netherlands. Till now there have been no policies dealing with this, let alone how to help these people in the transition to renewable energy sources.

To meet the housing demand, solve material shortages and transit to renewable energy sources, South Holland should change to a circular economy. This transition will be a multi-actor and long-term process that will reconfigure the institutional and organisational structures and systems of our society. Nevertheless, if these changes are made right, some of the unjust aspects of the linear economy can be turned around in the new circular economy.

2.2 Research Questions

Energy
- What are the spatial implications of the inequalities in the linear economic system of the current energy landscape?
- What are the just prospects of low carbon, renewable energy sources?
- How do we create a circular energy landscape in terms of social justice?

Materials
- What are the unjust aspects of the current material flow?
- What are the circular alternative ways of handling the material flows?
- How can we eliminate the unjust aspects while transitioning to a circular material flow?

Circular Economy Model
- Who are the actors involved in the transition? Which are the most vulnerable social groups during the transitions?
- What synergies should be created, strengthened, or weakened during the transition to a circular built environment to ensure a just transition?
- How can equal accessibility to the transition be ensured?

How does the **energy** and **material** demand for the growing **housing need** of South Holland be integrated into a circular economy model, to create a **just built environment** for everybody?

Built Environment
- What are the characteristics of the areas that have a high potential to be treated unfairly during the transition and how can we prevent it?
- How can the interventions in the built environment assist in improving the liveability of the urban space?

2.3 Conceptual Framework

As shown in figure 25, Building a fair transition is not only based on a transition which deals with the current climate crisis. Instead, it also considers the social foundation of our world. The doughnut model measures economic welfare through realizing the social foundation without overshooting the ecological ceiling. (Raworth, 2011) The question arising with this model is how we supply welfare for everybody within the carrying capacity of the Earth. In Building a fair transition we want to achieve a circular built environment to keep our world intact whilst improving some of the social shortcomings mentioned before.

The next paragraphs will explain the slices of the doughnut which will be relevant to this research. The sustainable development goals are also introduced to show which element of this will come back in this report. Finally, the notion of justice will be elaborated to solve the shortfall on the social foundation.

Ecological ceiling

Cities have a significant impact on biodiversity loss. Due to the sewage, solid waste, and air pollution they put pressure on the fauna of its surroundings. (J.A.Puppim de Oliveira, 2011) The city and its hinterland also house various kinds of biodiversity because of their different biotope. So, when a city spreads into the surroundings the urban biotope puts pressure on the already endangered biodiversity of its hinterland.

The CO2 emissions and the climate change they cause are already a clearly stated problem. The built environment in relation with the building and demolition process, should be changed drastically as they are the main contributor to this problem. (Metabolic and Drift, 2018)

Additionally, there is the scarcity of raw materials, which is not per se a dreadful thing for the environment., but mostly because our welfare is built upon these materials.

So, if we will not switch our use to bio-based materials, we will quickly fall short on our social foundation.

The last section of the housing development, which is taking its toll on ecology, is the demolition waste. This waste does not only make the need for new materials bigger because they are not re-used, but it also pollutes a lot of its surroundings. (J.A.Puppim de Oliveira, 2011)

Social Foundation

The social foundation is based on three clusters. (Raworth, 2011) The first one is wellbeing which consists of food security, healthy water and sanitation, health care and adequate income. Since these basics to wellbeing are not a big issue in the Netherlands, they

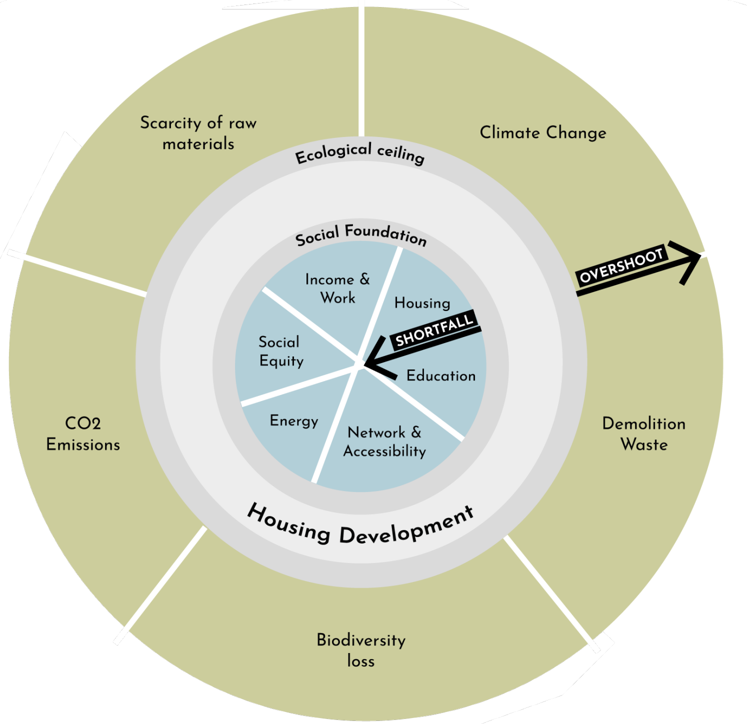


Fig. 21: Socioecological sustainable model. Based on the Doughnut economy model (Raworth, 2011)

are not included in the housing development doughnut. However, housing is added to the basics of wellbeing. Housing is one of the fundaments of human rights which the United Nations already stated in 1948 and the South of Holland is currently short falling on this. (United Nations, 2015)

The second cluster is the productive one which expresses the things needed to really contribute to society where we find the categories in which the housing development can also grow. Firstly, there is decent work which exists, but it should be further guided into the circular economy. Secondly, there is education, meaning that the people who are already working in the construction and demolition sector should be given the possibility to transit their working field into the new circular standards. The third one that the project focus onis energy. Intrically connected to it, are the networks that provide accessibility to people, but it is not always reached now. Networks and accessibility do not refer only to energy but also to other goods, resources, and services.

The last cluster is about empowerment which consists of gender equity, social equity and having a political voice. For the housing development of South Holland, the focus lies on social equity as there are various This is because you can see spatial inequalities between diverse groups of people that should be fixed to support the social foundation.

Definition of Sustainability

There has been much discussion on the definition of sustainability. (Scoones, 2010) But out of these discussions three main dimensions of it often come forward. These are economic, environmental, and social dimensions.

Sustainable Development Goals

Building a fair transition is in alignment with the Sustainable Development Goals (SDGs) made by the United Nations. (United Nations, 2015) These goals have been classified into 3 categorizations which are aligned with our idea of the social foundation and the ecological ceiling, while showing the focus of the strategy.

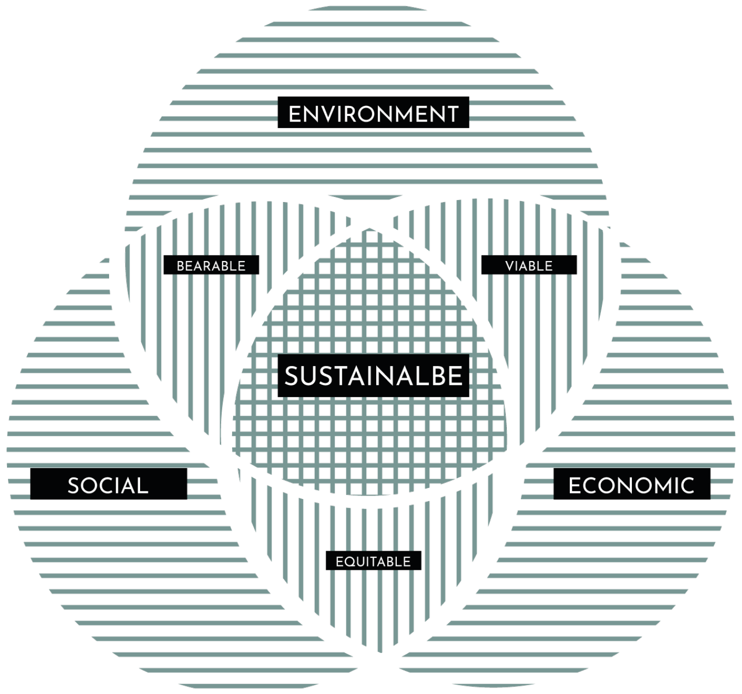


Fig. 22: The pillars of sustainable development. Source unknown-Common domain

When looked into the SDG another layer of the reach to sustainability is added. Specifically, goals sixteen and seventeen are especially important to achieve the transition to a circular economy. The presence of strong institutions can help and guide people through this transition. Moreover, to make this transition successful, everybody should be involved while big players should work together to be the catalyst of sustainable change. Finally, goals 7, 11 and 12 are the main ones of this report that show the interrelation between people and the planet.

Social justice

A lot of the aforementioned developments and goals are about social equity and just environments. To reach full social justice there should be a clear understanding of what it consists of. Schlosberg described social justice as a three-dimensional term (Schlosberg, 2007). The first one is distributive justice which implies that everyone should have the same access to public goods, resources, and services. The second one implies the justice of recognition in which vulnerable stakeholders and inclusiveness are recognized. The last dimension is procedural justice. It states that decisions should reflect everyone's voice. When planning such drastic transitions like South Holland is, these kinds of justice should be reflected in the decision-making process.

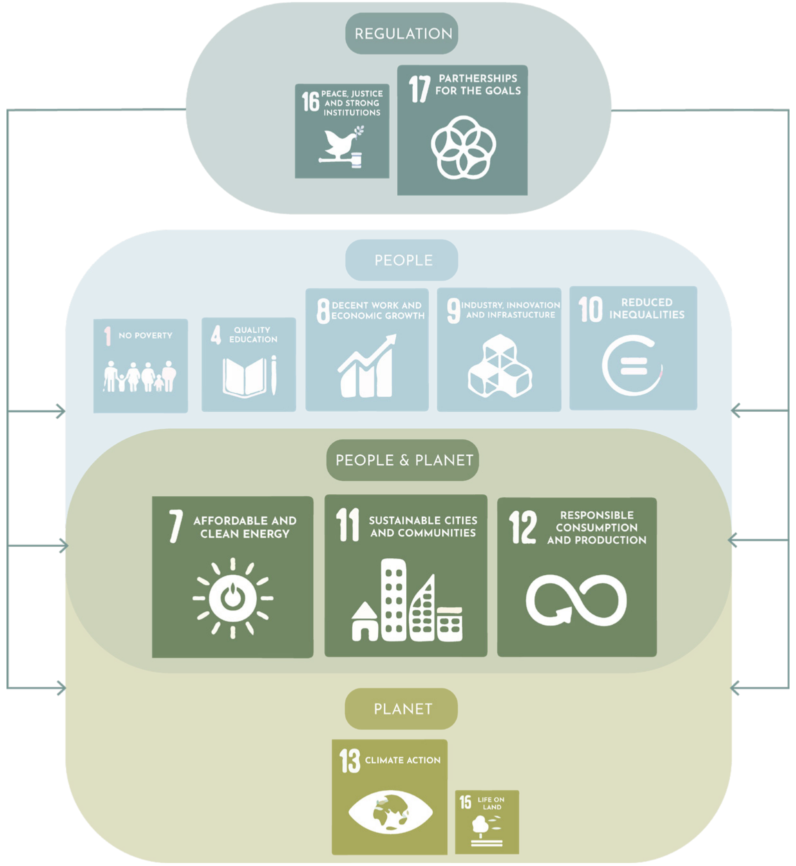


Fig. 23: SDG Goals. Based on: (SDG Nederland, n.d.)

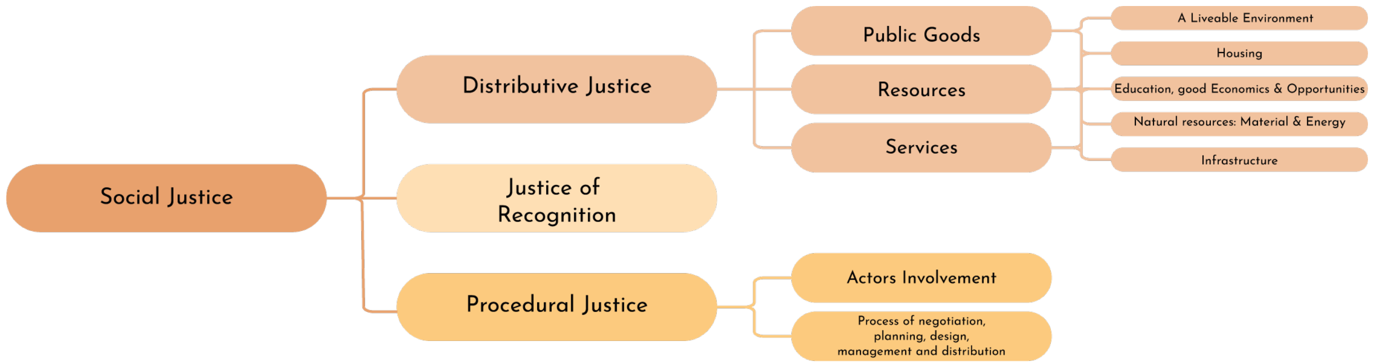


Fig. 24: Justice Framework. Based on: (Schlosberg, 2007).

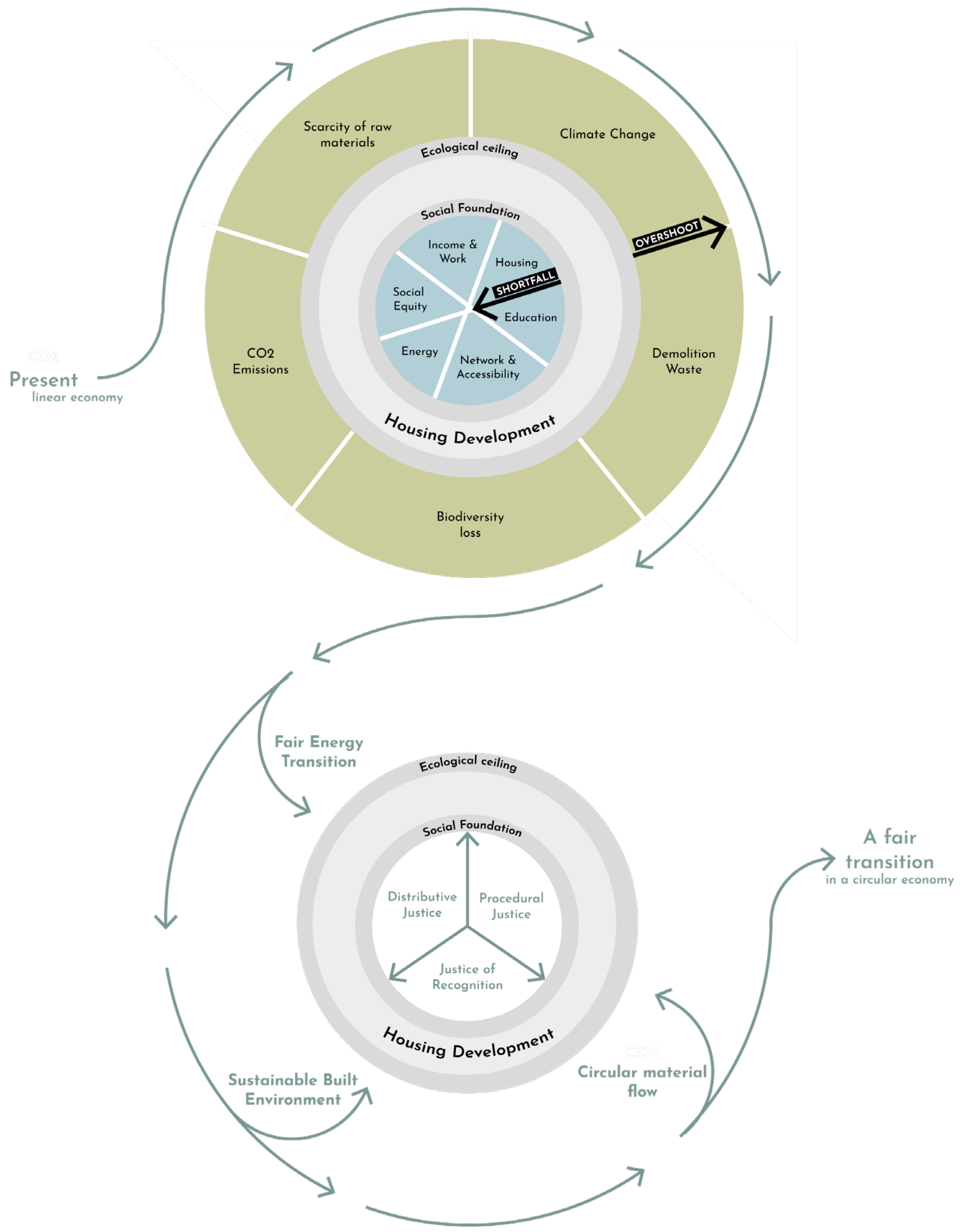


Fig. 25: Conceptual Framework

2.4 Methodology

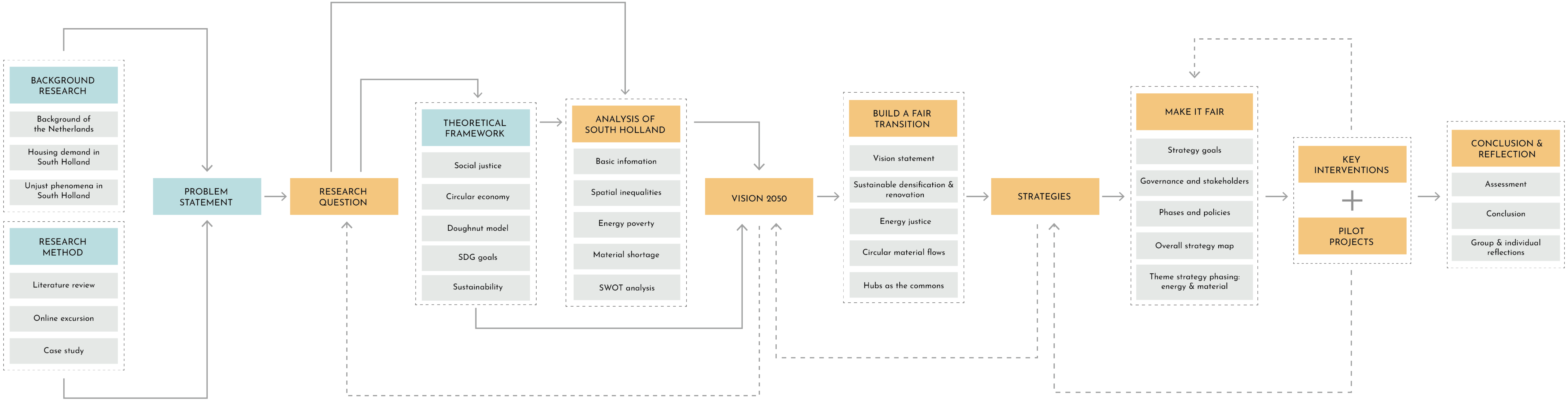


Fig. 26: Methodology framework

3. Analysis: The Good, the Bad and the Potential

Fig. 27. Shipping Containers taken from helicopter, Photo by Alex Duffy on Unsplash

Introduction

The province of South Holland counts in total an amount of 52 municipalities (PZH, n.d.) as seen in figure 28. The province does have multiple important municipalities like The Hague and Rotterdam, which are part of the Randstad (Lambooy, 1998)Rotterdam has the importance of the port. The Hague has government related activities. Industrial areas are situated along the main river and have the importance to distribute goods to the hinterland. Among the most important ones are Schieoevers in Delft, Binckhorst in the Hague and in the Rotterdam Harbour Merwe4Havens. These areas had great importance since they defined the economic activities with high labour intensity to provide the nearby cities (Boeck, 2017) Most of these plots are redundant industry and inner-city areas (De Zwarte Hond &CO-URB, 2017).

Municipalities

1.	Noordwijk	14.	Nieuwkoop	27.	Midden Delfland	40.	Albrandswaard		
2.	Hillegom	15.	Den Haag	28.	Schiedam	41.	Barendrecht		
3.	Lisse	16.	Leidschendam-Voorburg	29.	Rotterdam	42.	Ridderkerk		
4.	Teylingen	17.	Zoetermeer	30.	Capelle aan de Ijssel	43.	Zwijndrecht		
5.	Katwijk	18.	Waddinxveen	31.	Krimpen	44.	Hendrik Ido Ambacht		
6.	Oegstgeest	19.	Bodegraven	32.	Krimpenerwaard	45.	Albassemdam		
7.	Leiden	20.	Rijswijk	33.	Molenlanden	46.	Papendrecht		
8.	Leiderdorp	21.	Pijnacker-Nootdorp	34.	Maassluis	47.	Sliedrecht		
9.	Kaag en Bussum	22.	Lansingerland	35.	Vlaardingen	48.	KieveldGiessendam		
10.	Wassenaar	23.	Zuidplas	36.	Westhoerne	49.	Gorinchem		
11.	Voorschoten	24.	Gouda	37.	Brielle	50.	Oud Bijerland		
12.	Zoeterwoude	25.	Westland	38.	Hellevoetsluis	51.	Dordrecht		
13.	Alphen aan de Rijn	26.	Delft	39.	Spijkenisse	52.	Goeree Overvlakkee		

Fig. 28: The 52 municipalities in the province of South Holland, the former brownfield locations and the universities. Source: (PZH, n.d.) (PZH (n.d), (De Zwarte Hond &CO-URB, 2017) p. 55, (Nationaalgeoregister, 2020)

The Rotterdam Port

The port of Rotterdam is the largest European sea harbour. Therefore, its importance is related to activities of the Netherlands as well as to the transportation of goods from all over the world towards other European lands. The harbour is 42 km long and grew from the inner-city area (Bet, van Meijel, & Hinterhur, 2008)towards the recent artificial outer land expansion of the Tweede Maasvlakte. A lot of oil refineries are located here as well as dry bulk storage (Port of Rotterdam, 2021). Due to enlargement of ships over the past decade, inner city harbour areas are becoming vacant for urban redevelopment. In Rotterdam, such areas are Merwehavens in Delfshaven and RDM (De Zwarte Hond &CO-URB, 2017).

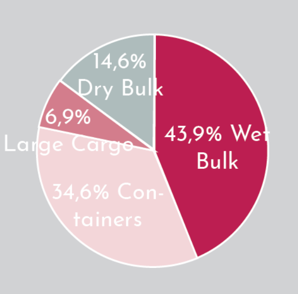


Fig. 29: Percentage of type cargo stored in the Port of Rotterdam (Port of Rotterdam, 2021)

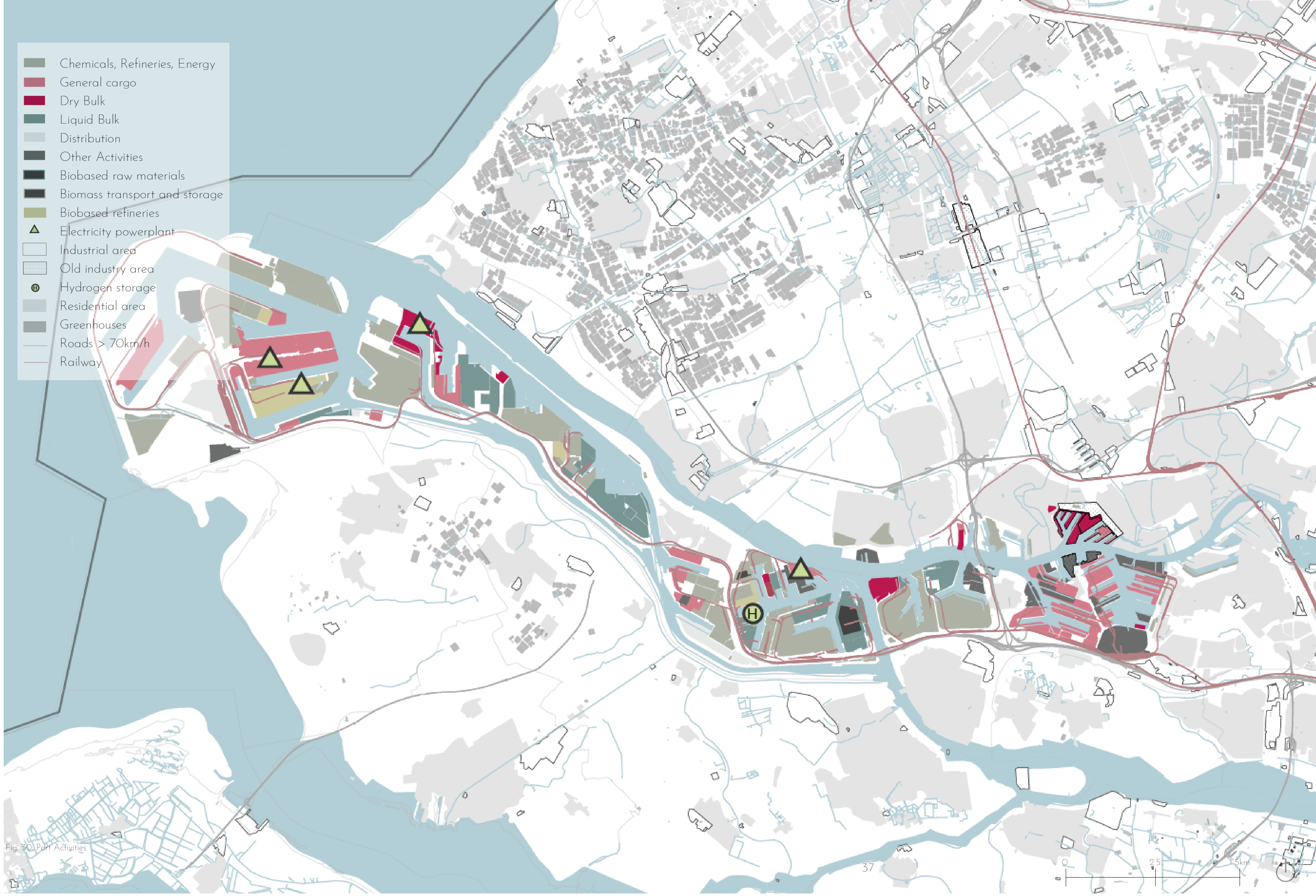


Fig. 30: Port Activities

3.1 Current Material Status

In order to build new dwellings more materials are needed. To have a sustainable material flow that ensures distributive justice, an understanding of the existing material flow is needed. Now 74% of the building products are extracted from Dutch soil. 26% of the building products is imported from neighbouring countries like Germany, Belgium and United Kingdom (Ministerie Van Infrastructuur en Waterstaat, 2016). Main resources which are being used in the buildings are steel and sand to create glass and concrete. As already stated in chapter 1.2, these materials are getting scarce. Alternative options in the construction sector are needed.

In order to build new dwellings more materials are needed. To have a sustainable material flow that ensures distributive justice, an understanding of the existing material flow is needed. Now 74% of the building products are extracted from Dutch soil. 28% of the building products is imported from neighbouring countries like Germany, Belgium and United Kingdom (Ministerie Van Infrastructuur en Waterstaat, 2016). Main resources which are being used in the buildings are steel and sand to create glass and concrete. As already stated in chapter 1.2, these materials are getting scarce. Alternative options in the construction sector are needed. Most of the imported building materials are delivered by freight train and freight ships and stored in the port of Rotterdam. After that, the dry bulk is transported by smaller ships or train wagons to the cities in the Netherlands. In the province of South Holland, the round waterway encloses the transportation route between the cities. The transhipments places nearby the water provide the hinterland and the several manufacturing companies with building materials (Waal, 2019). The linear diagram (fig33) shows that there is a decreasing value of building materials flow as a big amount is being degraded in value or burnt (Metabolic, Drift , 2018). This is an alarming remark that calls for action. Potential resources and material flows.

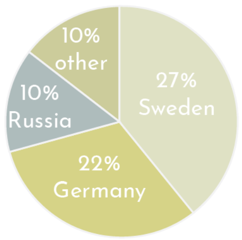


Fig. 31: Imported Sawn Wood (Probos, 2019)

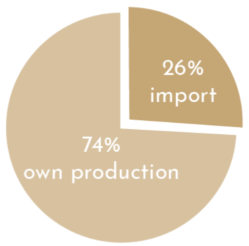


Fig. 32: Percentages of where building materials are extracted. (Ministerie Van Infrastructuur en Waterstaat, 2016)

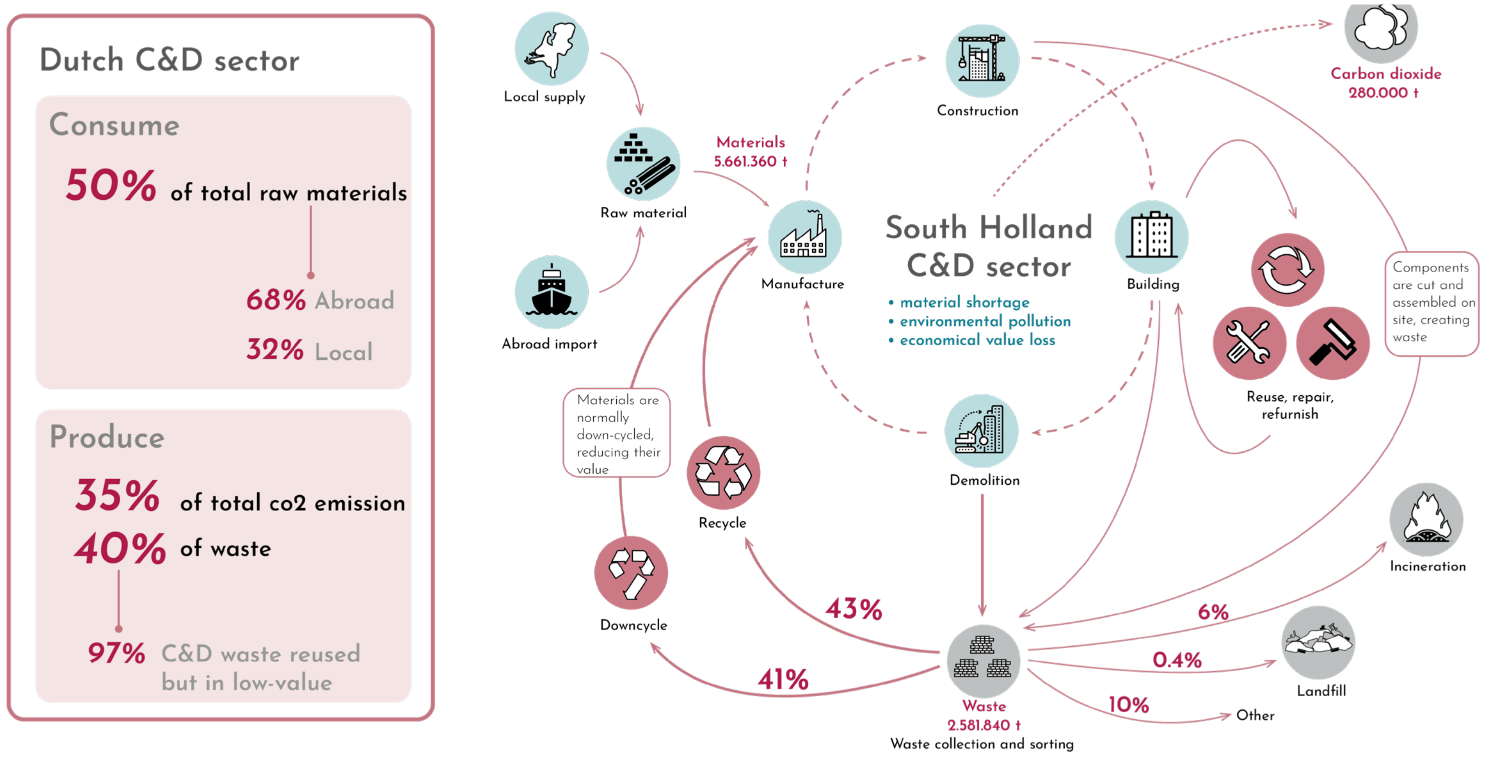


Fig. 33: Linear Material Flow Diagram. Based on: (Netherlands circularly 2050, 2016; Province Zuid Holland, 2019; Drift, 2020)

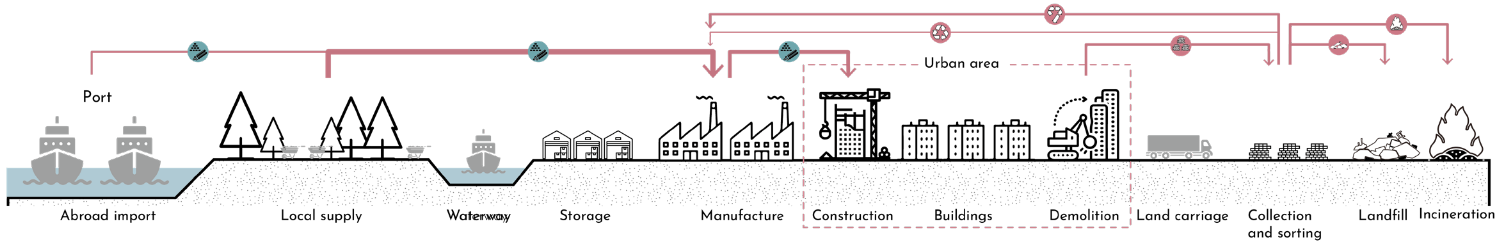


Fig. 34: Linear Material Systemic Section

Initiatives local upcycling

Some initiatives of recycling buildings are also present in the area. Buurtman in Rotterdam (Buurtman, n.d.), Groeneregentes in The Hague (Groeneregentes, 2020) are example initiatives for local reusing of building materials. Some larger material recycling locations are arising in nearby cities in the Netherlands. Volkerswessels (Volkerswessels, n.d.) have created a Bouwhub to regulate more the material flow in the city Utrecht. South of Holland has the potential to facilitate such hubs. There are some recycling companies of heavy materials already present in the area which can have a bigger role in the future (Rotterdam, Schroot, 2021). (see appendix)

Innovative ways of building

TU Delft (SUM-TUDelft, 2021) has some trial projects of innovative ways of building. Modular buildings are one of them. This has a high potential since prefabricated parts can be manufactured at one location and eventually been distributed at the location, minimising emissions of production and transportation. Also, these modular buildings are easily assembled and disassembled when unneeded. This innovative way of construction should be further explored and used for densifying the current housing stock.

Renewable materials

Biobased materials are planned to be used extensively from now on in the area as they seem one of the very few solutions that combine neutral or even negative emissions when produced and have a positive footprint on the built environment during their whole life cycle of their use. The Netherlands have not yet created a biobased industry therefore wood, the main biobased raw material is imported from abroad, mainly from Germany and Sweden (NIBE, 2019; zaken, n.d. ; Probos, 2019)The expected growth of the biobased industry worldwide in combination with the demand of biobased raw materials in South Holland highlights the need for a strategic and careful planning for the creation of a local biobased industry. An industry that has the potential to combine the imported wood with other available potential biobased raw materials such as locally produced reeds or even with demolition waste. Investing in the biobased materials has the potential close and minimize the loop of the material flow. In order to refine these new ways of building there has to be a job transition to prevent job loss.

Conclusion

The current material flows and resources must be more renewable with flows forming narrowed or closed loops. Local initiatives for upcycling should be strengthened to make the region more circular. The use of biobased materials will assist in providing renewable building materials for future generations. However, to refine these new ways of building, there must be a guided job transition to prevent job loss

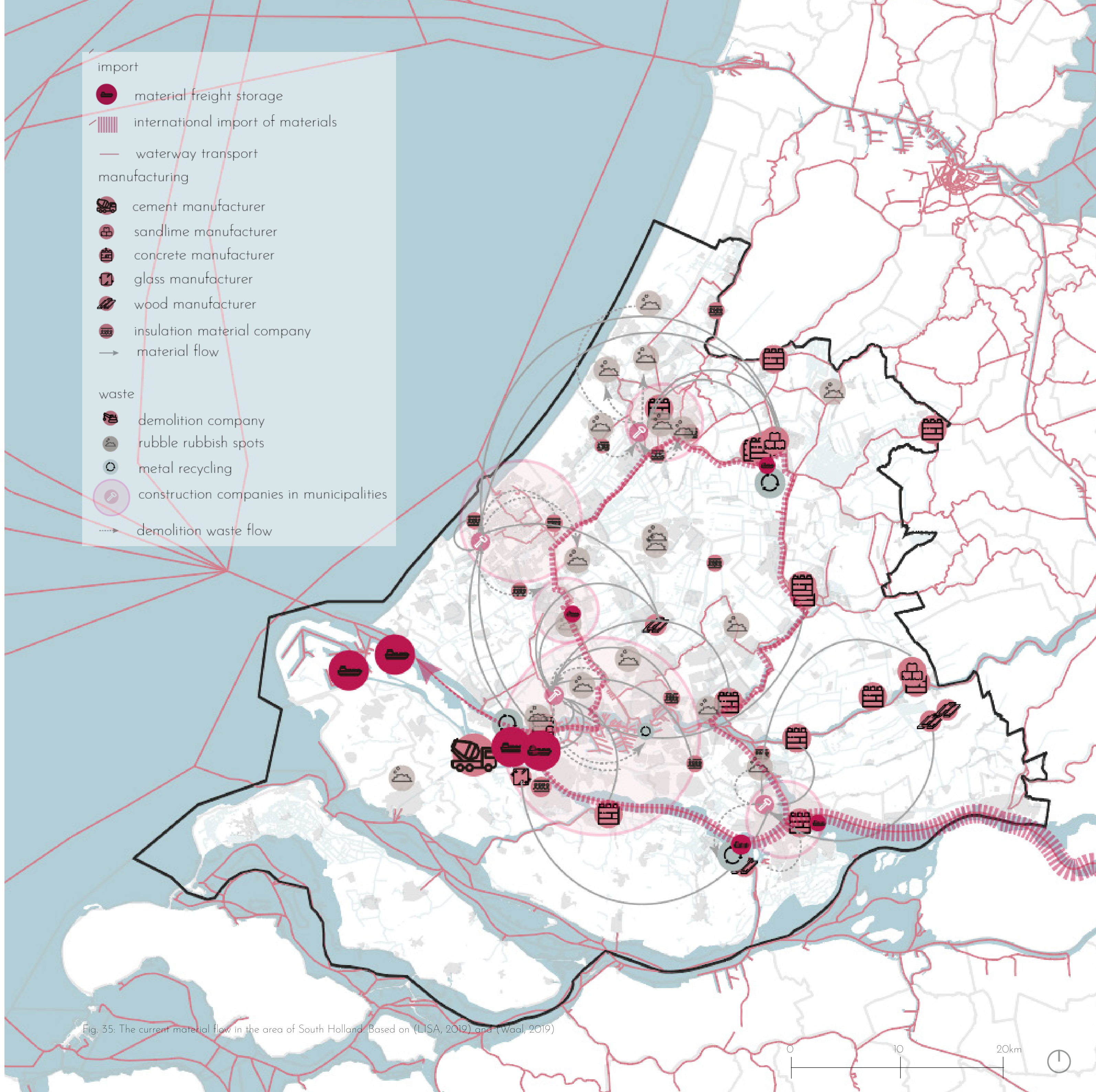


Fig. 35: The current material flow in the area of South Holland. Based on (LISA, 2019) and (Waal, 2019)

3.2 The Energy Status

Current situation of linear electricity and heat

Currently South Holland is depended on non-renewable resources. As the linear energy flow chart shows, it is mostly depending on non-renewable cycles (fig. 39). Heating and electricity are mainly based on fossil fuel combustion. Most of the dwellings are still depending on the natural gas grid. Fossil fuel combustion is happening in refineries in the port of Rotterdam, which provide the whole province with natural gas. The distribution of the energy is now mainly accommodated by a few companies, Stedin and Liander, which regulate the whole system in South of Holland. People are dependent on the scale of the province. These refineries produce a lot of CO_2 emissions due to the fossil fuel combustion. To transit towards low carbon renewable energies, these industries should be downscaled (fig 39).

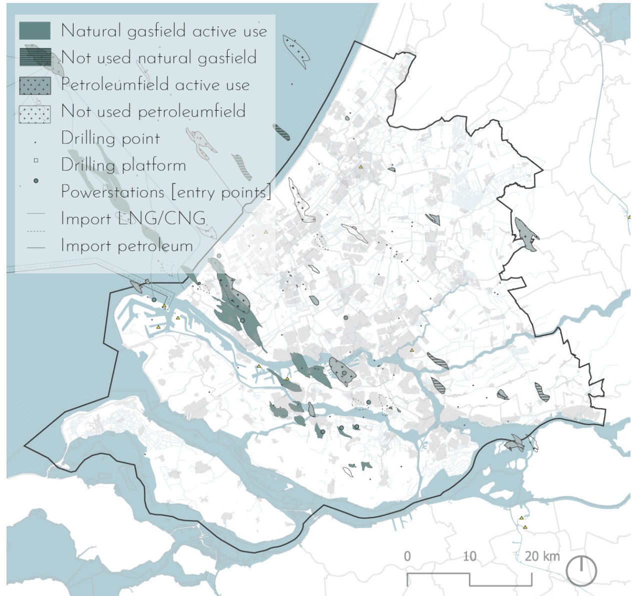


Fig. 37: Fossil extraction. Based on: (CBS, Monitoring warmte, 2017)

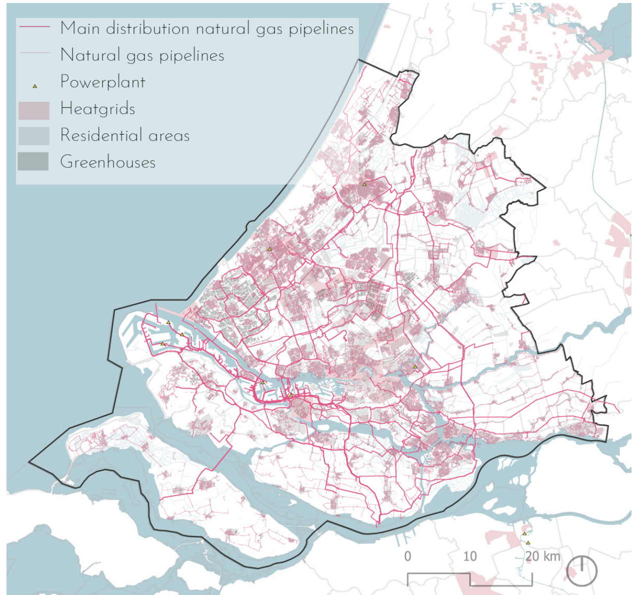


Fig. 36: Current Heat Generation and Distribution. Based on: (CBS, Monitoring warmte, 2017)

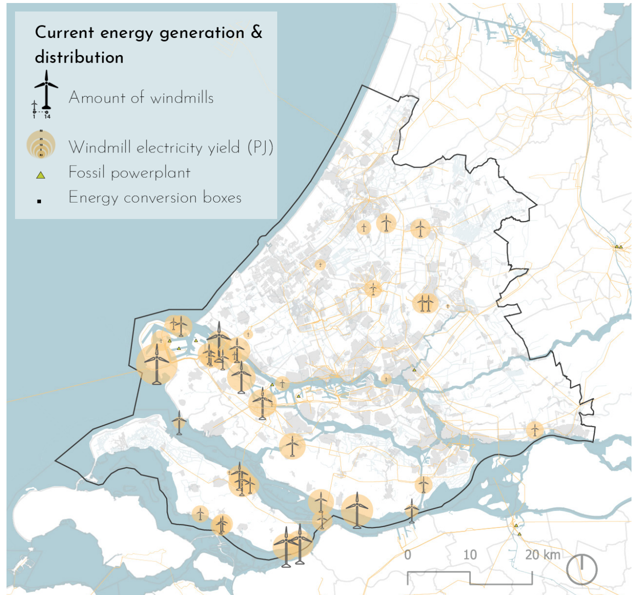


Fig. 38: Current Renewable Energy Generation and Distribution. Based on: (Windstat, 2020)

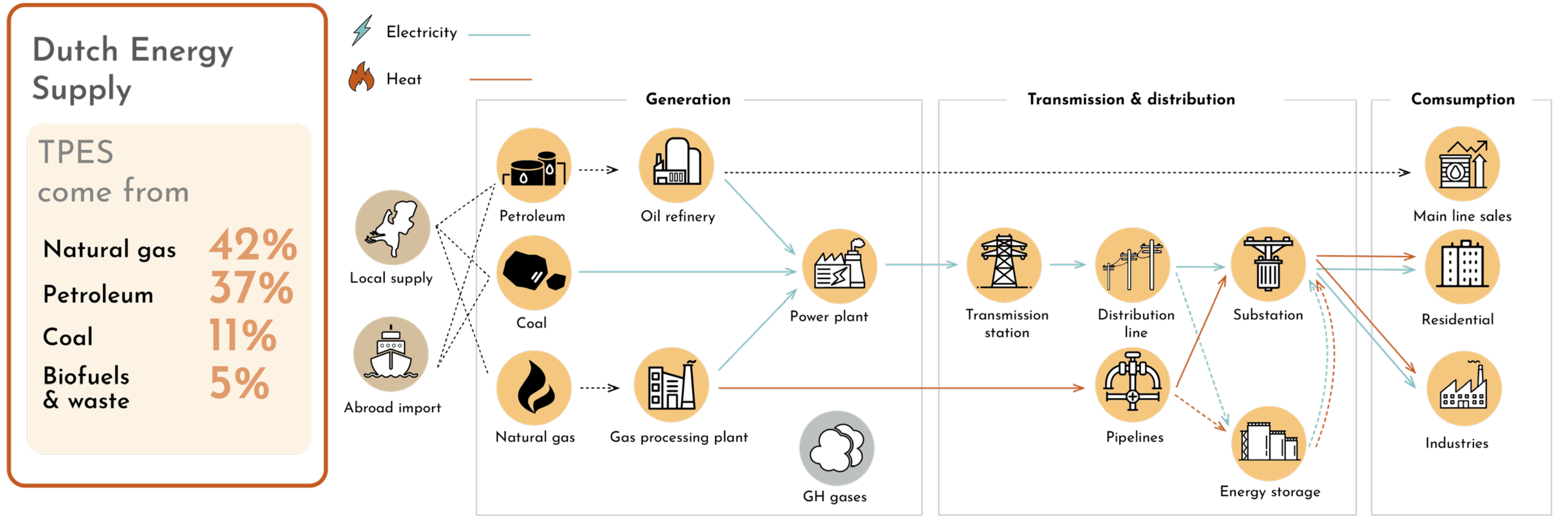


Fig. 39: Linear Energy Flow Diagram. Based on: https://www.iea.org/reports/the-netherlands-2020

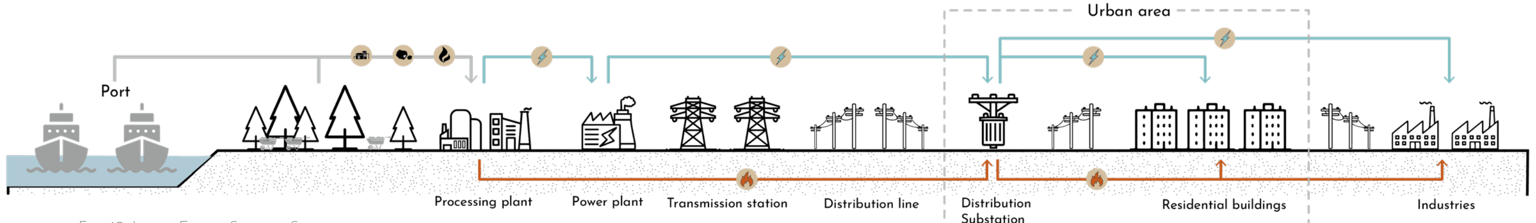


Fig. 40: Linear Energy Systemic Section

Potential low carbon renewable energy

Luckily, there are already some alternatives present in the province. This low carbon renewable energy can be upscaled. An assessment is needed to see which are in line with the distributive justice. Five potential options are being explained. Necessary to mention is the size of storage according to the energy carrier (fig. 41) (FABRICations, Kamangir, 2018). Batteries for example take a lot of space when storing energy for a longer period. The fluctuation offers of energy of some low carbon renewable resources should be considered. A plethora of energy sources should be considered to create a reliable energy system.

1. Residual heat

The producing refineries and industries in the port cause a lot of CO_2 emissions. However, theyalso produce extra heat which is not used. This residual heat is lost while it has the potential to be re-used. Momentarily the province is busy with introducing the project Warmtelinq which will distribute the heat to other municipalities (Gasunie, 2021)(fig. 43). This residual heat can be used on the shorter term, while these industries are transforming to other resources.

(Gasunie, 2021)(fig 43). This residual heat can be used on the shorter term, while these industries are transforming to other resources.

2. Wind Energy

On the Tweede Maasvlakte in the port there are some wind farms already existing (fig 38). They don't degrade the value of nearby housing since they are far away from the residential areas (Koster & Dröes, 2020). Also, wind energy on sea is more beneficial since the windspeed is higher there. Costwise, it is also profitable to build them onshore since the costs on land are 3 times higher than on sea (Ministerie van Economische Zaken, 2018). This highlights a potential of further onshore expansion.

3. Geothermal heat

There are also some experiments going on for geothermal heat resources, as planned in TU Delft Campus. There is potentials for deep and ultradeep geothermal heat extraction. The deep geothermal are in the Krijt Jura earthlayers (2000-3000m), and the ultradeep earth layers (4000m) are in the Trias layers (FABRICations, Kamangir, 2018). (fig 42).

4. Hydrogen

As seen in the exploration of the smart multi commodity grid, hydrogen is stored in the harbour of Rotterdam (fig 30) ((Gasunie, 2021; FABRICations, Kamangir, 2018) To establish a hydrogen powered province, a big change is . This will take a long time since it is still not used in the province. But there is proof that existing natural gas lines can be used for the hydrogen distribution. Therefore, the existing natural gas line infrastructure can be re-used (Waterstofmagazin, n.d.).

5. Solar energy

The use of solar energy is also an option. A lot of rooftops can be used for solar panels (Ministeries van Infrastructuur en Milieu, n.d.) Solar panels can be used in the whole area since the total of days of sun in the Netherlands do not differ that much ((KNMI, 2020) By placing solar panels on rooftops, a decentralised energy system could be achieved.

Local initiatives

There are also some initiatives which focus on the local distribution of energy. Blijstroom (Blijstroom, n.d.) is a corporation which gives tenants the possibility to be in charge of their energy production and consumption.

To conclude from the potential low carbon renewable energy resources there are some site-specific solutions which will help to form a more decentralised and more sustainable system. This can be formed into a circular energy system ensuring distributive justice.

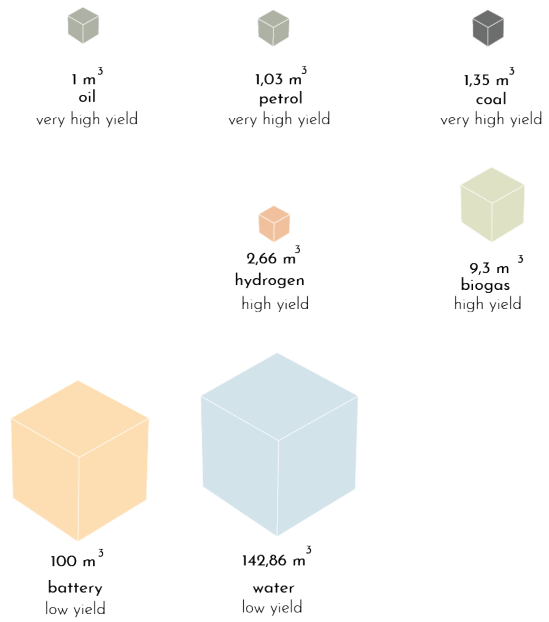


Fig. 41: Storage time and volume of alternative energy carriers in comparison with oil and petroleum based on (FABRICations, Kamangir, 2018)

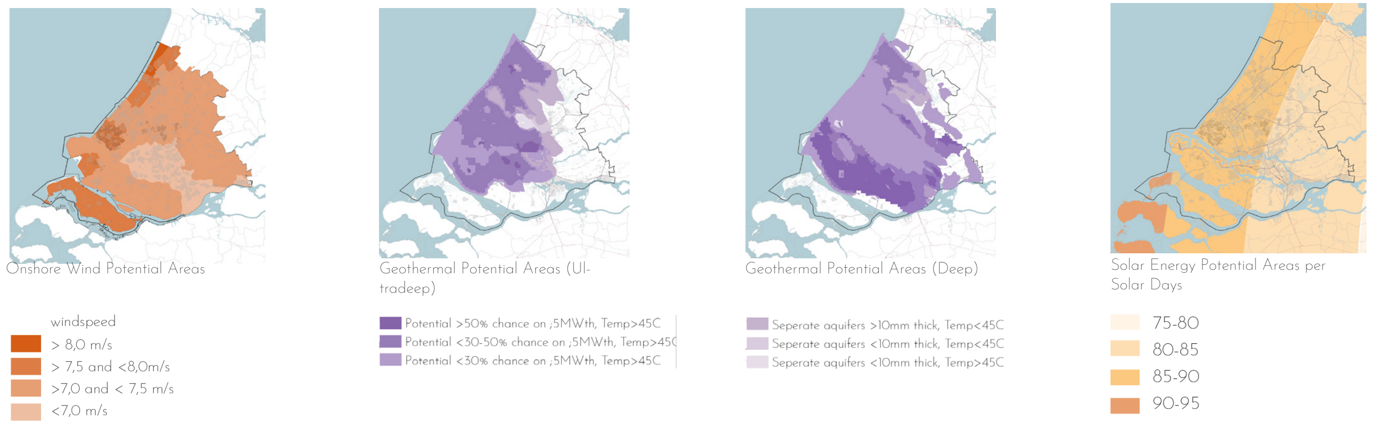


Fig. 42: Windspeed on land at 100m in comparison with the built environment based on (KNMI, Windsnelheid, 2010)
Geothermal heat earthlayer potentials based on (RVO, Warmtenetten, 2020)
Average total of sunny days in combination with built environment options based on (KNMI, 2020) (Atlasleefomgeving, 2016)

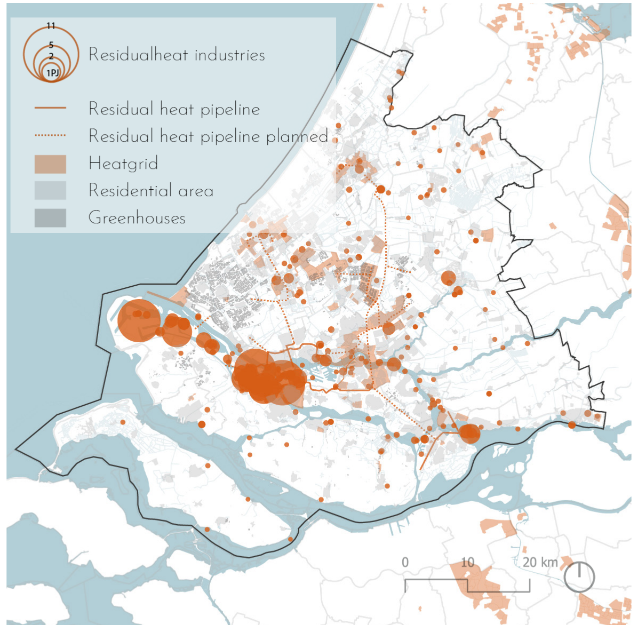


Fig. 43: Residual heat potential and reuse plans based on (RVO, Restwarmte, 2018) (Gasunie, 2021)

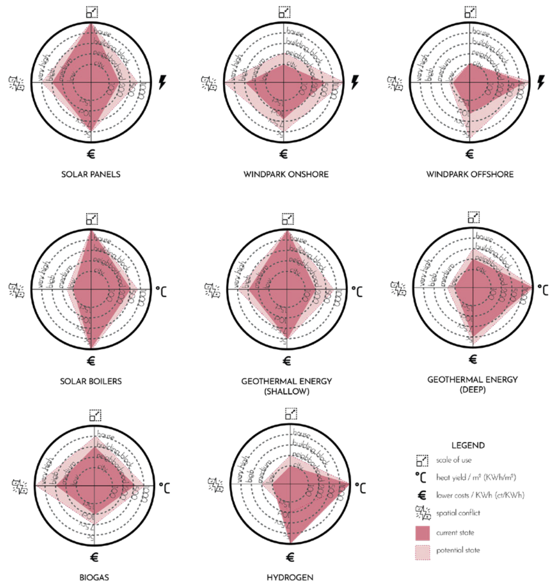


Fig. 44: Renewable Energy Assessment. Based on: Delta Grid 2050 (2019) and (Studio Marcovermeulen, FABRICations, Wolf Pack, Kamangir, 2019)

3.3 Spatial Inequalities

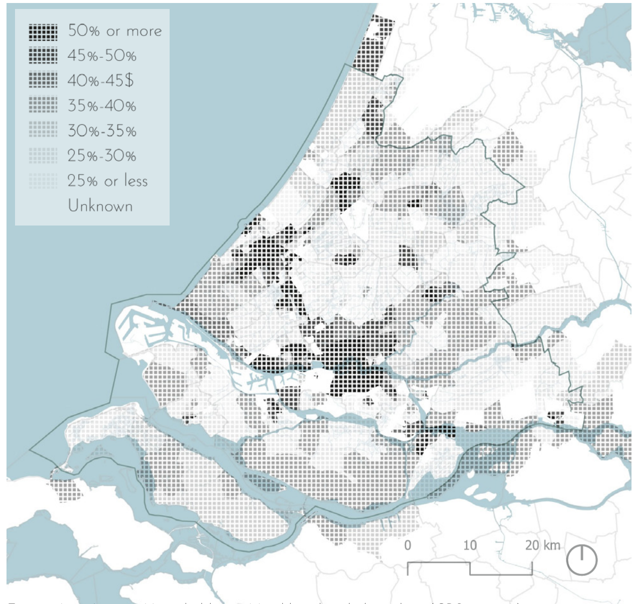


Fig. 45: Low Income Households per Neighbourhood. based on (CBS, 2020a)

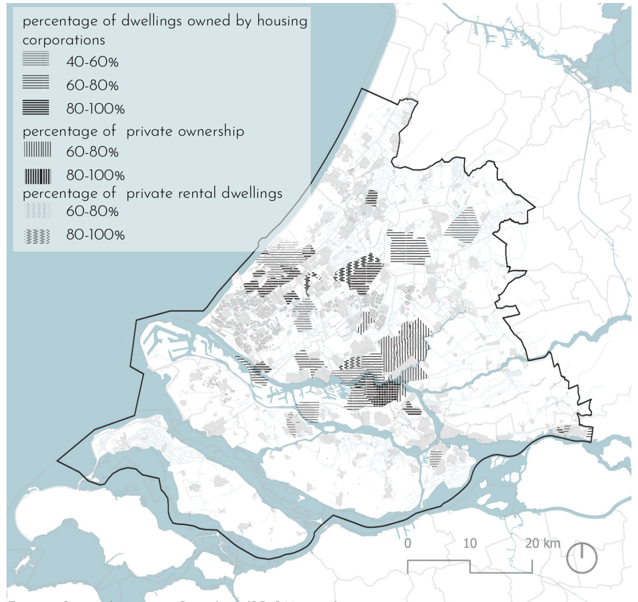


Fig. 46: Ownership status. Based on (PDOK, 2017)

The built environment is not a homogenous space. Homogeneity is not the desirable goal of the built environment, but the elimination of the inequalities in the existing heterogenous environment is. This map series confronts that areas with high percentage of low-income households also combine a low energy label building stock, post-war problematic typology clusters and have a high percentage of rental dwellings. In short, we can assume that these areas will be in the most challenging position during the energy transition. This will occur as the renovation of these dwellings will have a very high cost. This is due to the extensive amount of energy and insulation materials needed to transform this housing stock. This factor, along with other structural problems of the post-war buildings formulate this process extremely costly, that even the housing associations will probably not be able to afford. The housing associations are namely in charge for maintaining and occupying their housing stock. They do not have the abilities to invest in such sustainable upgrades (Vestia, 2019). This is a potential situation that can lead to the demolition of these areas for regeneration purposes. Therefore, these spatial inequalities are alarming to act and prevent phenomena of gentrification.neration purposes.

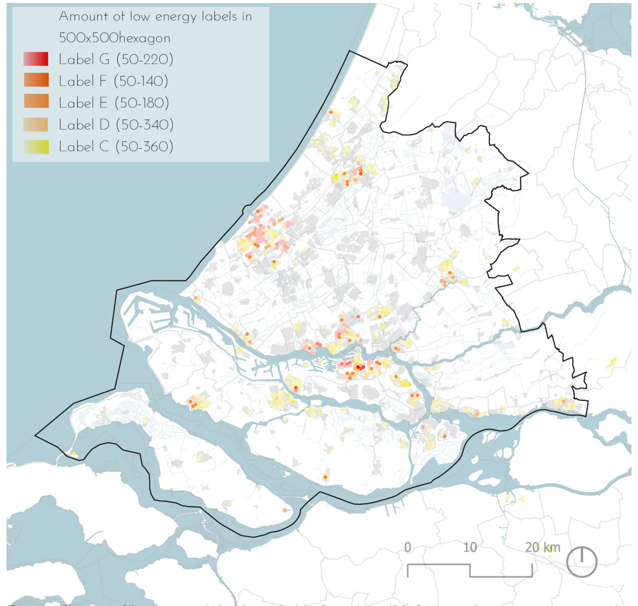


Fig. 47: Clusters of low energy label households. Based on (PDOK, 2017)

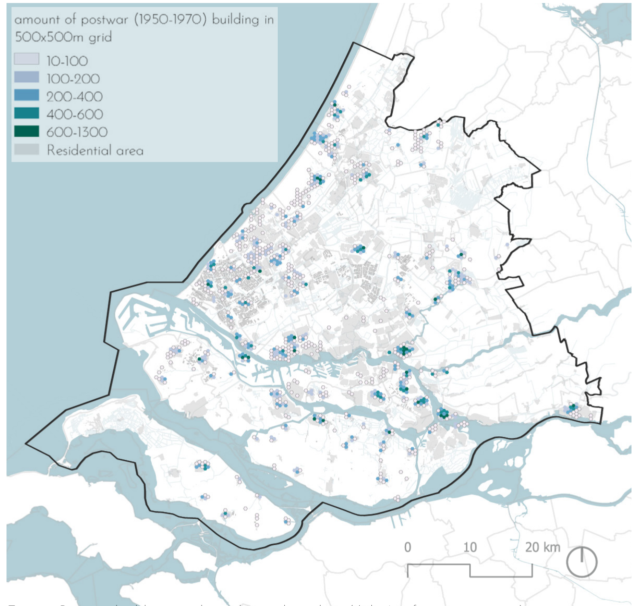
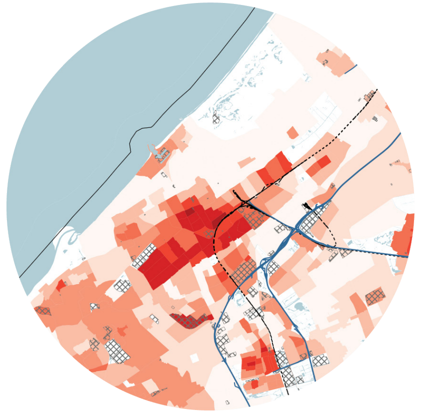


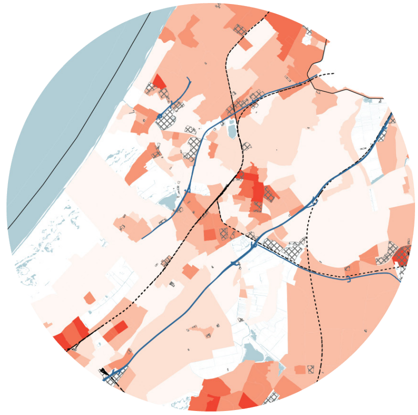
Fig. 48: Postwar building typology clusters based on (AtlasLeefomgeving, 2018)

Liveability

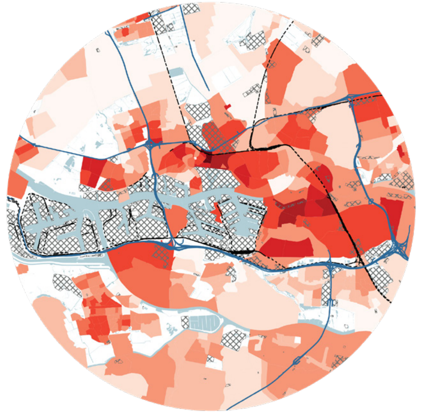
The level of liveability of each neighbourhood in based on the data of 2018 of the Leefbaarometer((MinisterievanBinnenlandseZakenenKoninkrijkrelaties, Leefbarometer dataset, 2018). This instrument measures the liveability of the streets of the Netherlands based on 100 criteria to assess the quality of life in the built environment. Even if this indicator measures liveability based than many criteria which makes the result a bit abstract, it still gives a well-grounded overview of the areas. as Among other criteria, it also includes quality of life, social security, income, leisure, education and most importantly public opinion (Leidelmeijer , et al., 2015). The main conclusion of the spatial intersection of the liveability data and the main infrastructure of the area is that the latter influences the liveability of the existing urbanised areas in a negative way. A concentration of areas with low liveability percentages are observed next to railways and highspeed roadways, aspects that can only worsen the areas' living environment in terms of air and noise pollution. These aspects also have an immediate effect on the quality of life of the residents, especially for those living in city centres.



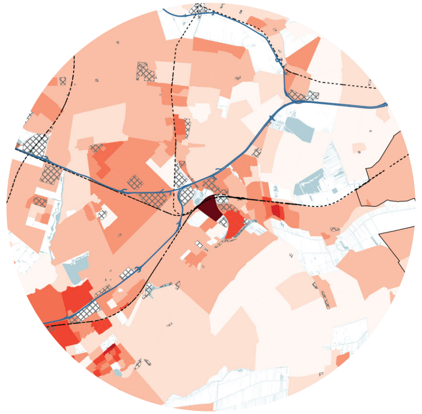
1. The Hague



2. Leiden



3. Rotterdam



4. Gouda

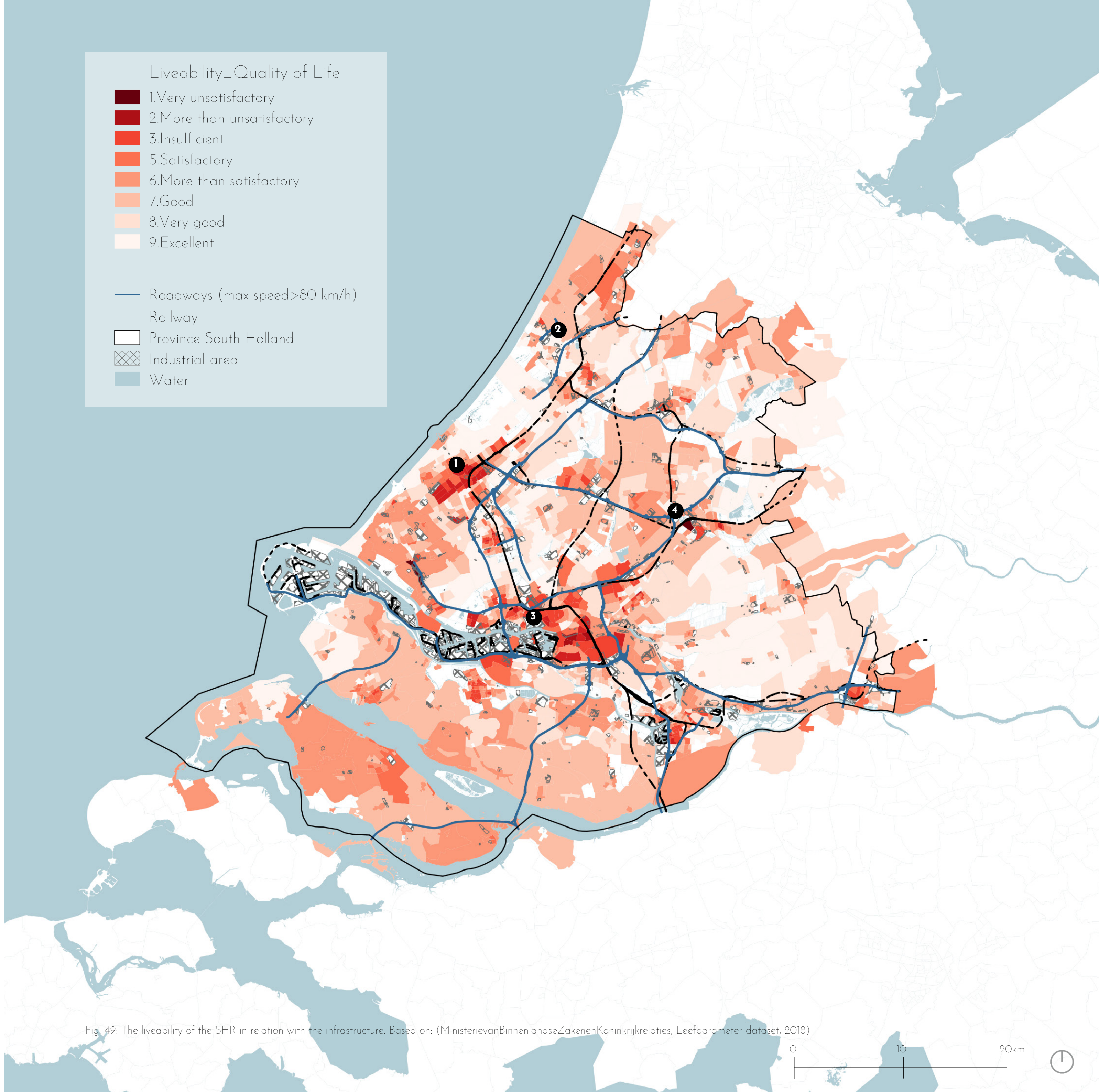


Fig. 49: The liveability of the SHR in relation with the infrastructure. Based on: (MinisterievanBinnenlandseZakenenKoninkrijkrelaties, Leefbarometer dataset, 2018)

3.4 SWOT Analysis

Fig. 50: Strengths of South Holland

Strengths

- Educational Institutions
- TNO
- Railway
- High speed roads (>80km/h)
- High voltage cables
- Existing windfarm locations
- Existing solarfarm locations

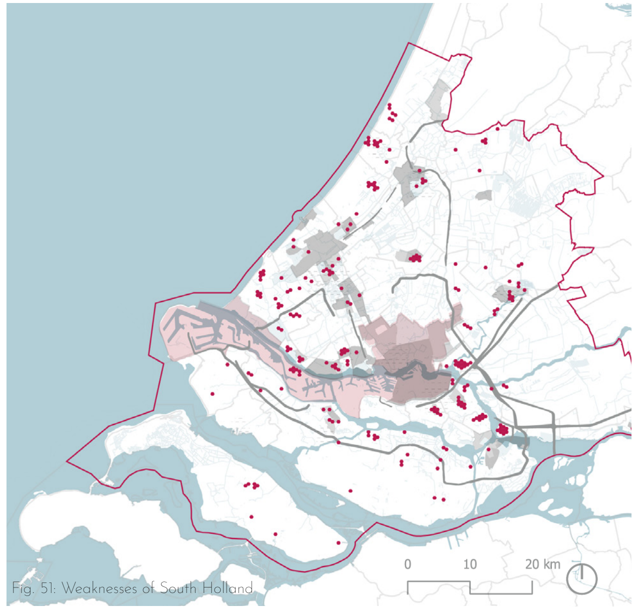


Fig. 51: Weaknesses of South Holland

Weaknesses

- High voltage cables (above ground)
- Low energy label cluster
- Area with low income
- Post-war household concentration (problematic typology)
- Extremely high CO2 emissions

Identifying strengths, weaknesses, opportunities and threats of the area directly summarises and illustrates the main elements that will play a key role in our vision. In terms of infrastructure, the current good accessibility and connectivity among the existing urbanised areas in the region are strong allies of the planned transitions until 2050. Nevertheless, the analysis depicts spatially some problematic clusters where the urgency of their careful and fair transformation during the transition process is extremely high. Furthermore, these sensitive clusters combine characteristics that can also be at stake during a potential transformation and densification that can lead to the undesirable phenomenon of gentrification. Therefore, the careful transition of the identified clusters can serve as a new, fair role model that can be used in similar cases in the future. An overview of the stakeholders of the different aspects are shown in the next table. Conclusion is that the civil society isn't well equipped for making changes in their building environment.

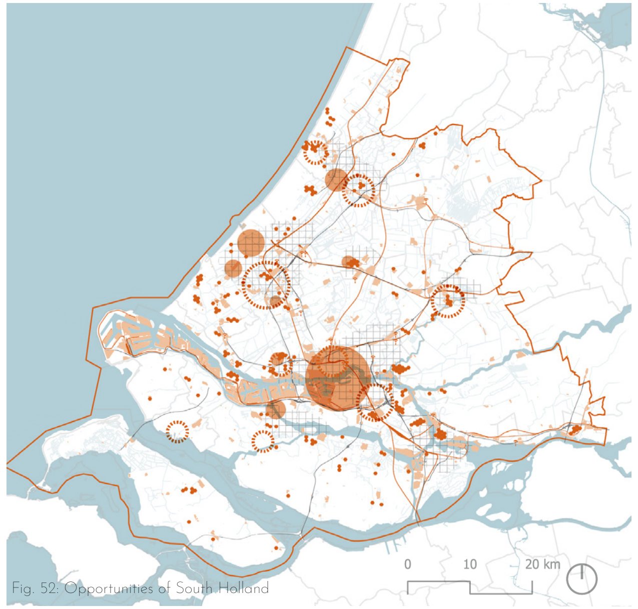


Fig. 52: Opportunities of South Holland

Opportunities

- Data center
- Railway
- High speed roads (>80km/h)
- Low energy label cluster
- Post-war household concentration (problematic typology)
- Rental cluster
- Industrial sites
- Suitable Rooftops for Solar panels

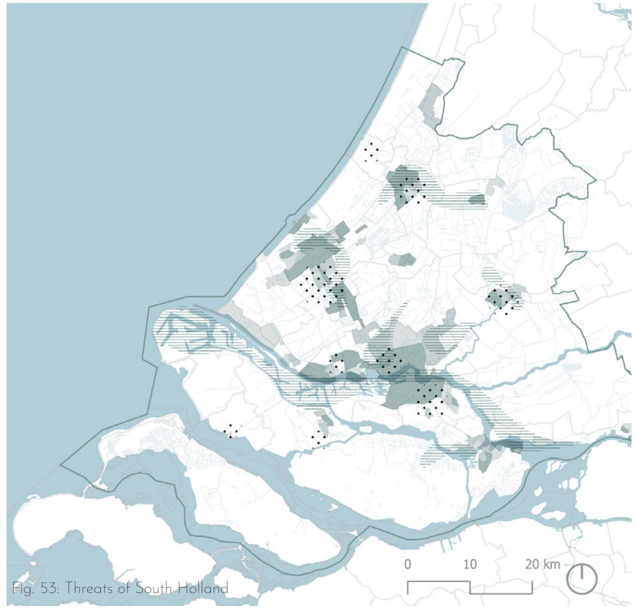


Fig. 53: Threats of South Holland

Threats

- Potential gentrification sites
- Low-income neighbourhoods
- High CO2 emissions
- The transition timeframe until 2050

4. Make it Fair

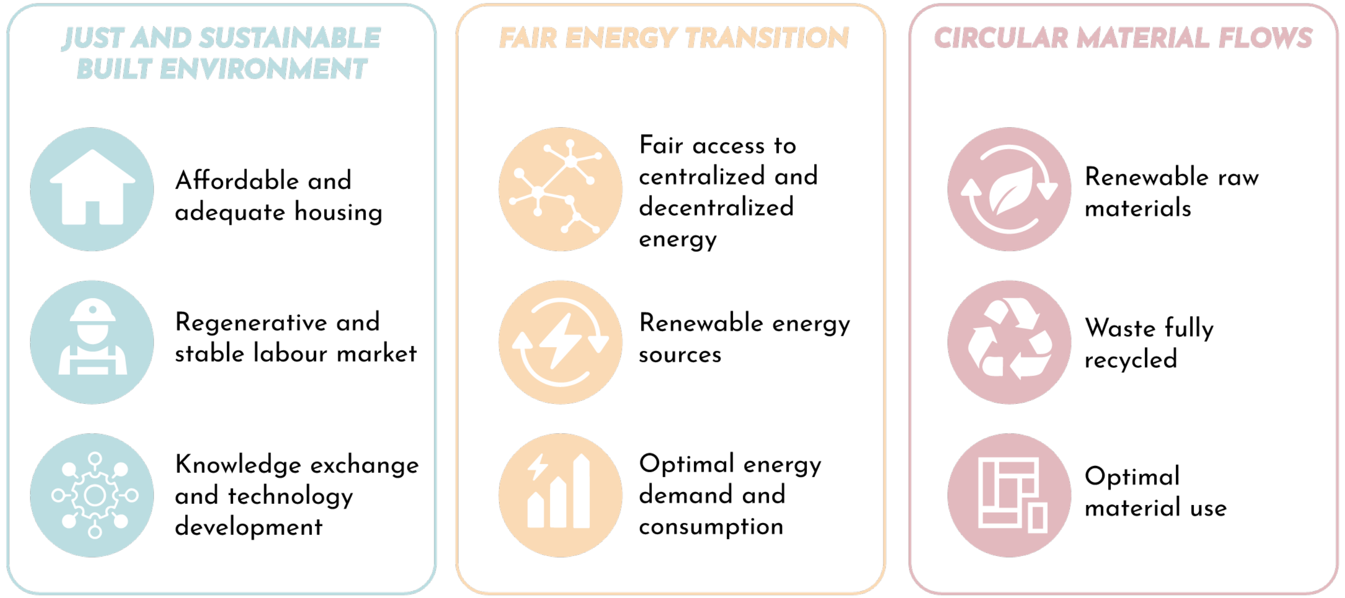


Fig. 54: Goals of *Building a Fair Transition*

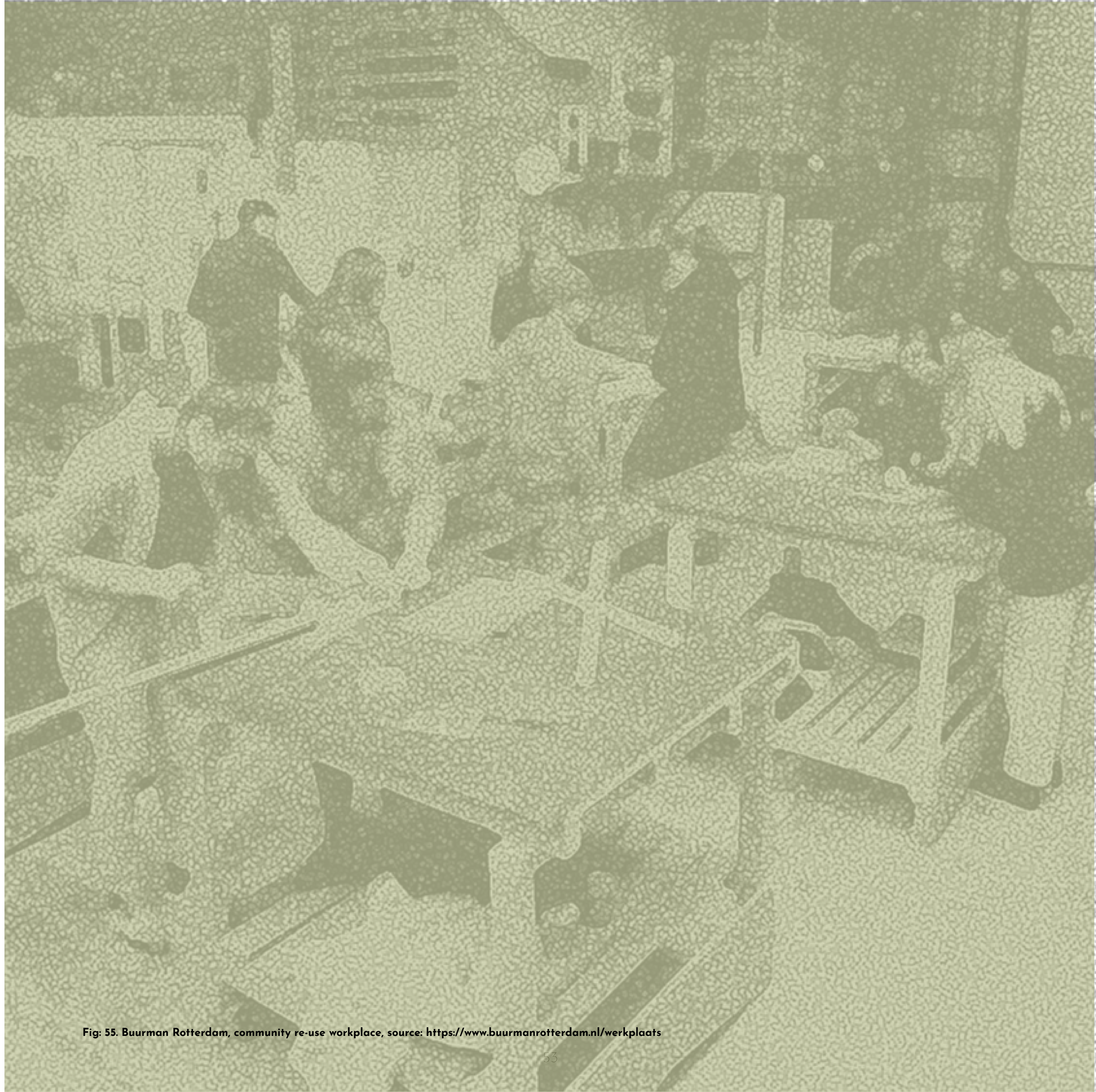


Fig: 55. Buurman Rotterdam, community re-use workplace, source: https://www.buurmanrotterdam.nl/werkplaats

4.1 Vision 2050

In 2050 "Building a Fair Transition" has become reality. Three main pillars will be the driven force to ensure that the new construction and demolition sector in the South of Holland is circular and done in a fair way, namely a just and sustainable built environment, inclusive energy transition and a circular way of material flows.

Firstly, a just and sustainable built environment is created. Affordable and adequate housing will be created in former brownfields and low liveability areas with low energy building performance will be the locations of densification in inner urban areas. These refurbishments of dwellings bring the possibility for change in the current housing stock. The liveability will be increased since these locations are equipped with more meeting places and urban greenery.

Secondly, a fair energy transition will be done through a fair access to centralised as well as decentralised energy. In this way, each energy user can become a prosumer (producer - consumer) and is able to trade their energy. This will lead to an end of energy poverty in South Holland. Due to the fluctuations of certain energy carriers, citizens will still be able to use a regional level of access of local heat and electricity production. Therefore, context specific low carbon renewable resources will be used, by taking into account distributive justice. In this way an optimal energy demand and consumption will be regulated to perform a circular use of energy in the province.

Thirdly, in order to achieve the house demand goals, a circular way of material flows will be generated. Innovative ways of building, like modular building, will be the norm in order to create efficient construction and deconstruction methods. Renewable raw materials like biobased materials will be common while constructing new dwellings. By the upscaling of existing initiatives to reuse materials in the neighbourhood, eventually, building waste will be fully recycled in the whole province. By monitoring the existing buildings through material and energy passports, a regional organisational structure, which regulates the optimal use of materials, is created. With the introduction of hubs as commons of the future on multiple levels the region will exchange knowledge and synergies of material and energy flows. The involvement of bottom-up initiatives will become important for implementation of change. On the neighbourhood level, people get informed and enriched of the changes they can make for their own environment. The material flow will be more circular and the knowledge about circularity will be shared on different scales. Therefore, it is important that there is a regenerative and stable labour market which will guide the people in construction jobs towards the transition in this new circular development. Knowledge exchange is therefore urgent so that pioneers in this field can share their knowledge to transit the technological development. The cities which stand out in this knowledge, like Delft and Rotterdam, will share their knowledge for the job transition.

The vision map shows the synergies of these three themes per city according to their context specific location. In the next chapters the synergies of the cities and the interrelations will be explained.

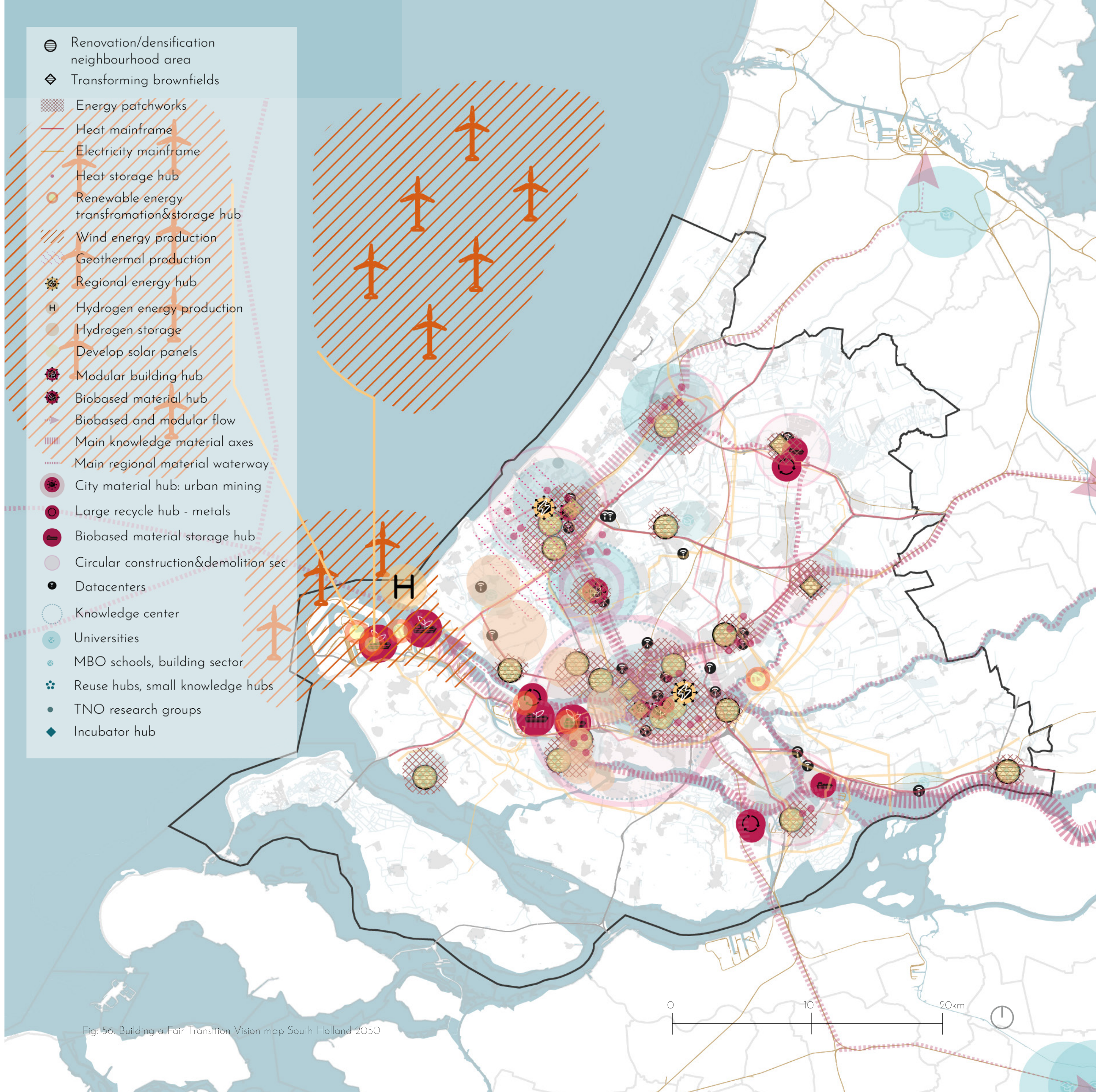


Fig. 56: Building a Fair Transition Vision map South Holland 2050

4.2 Materials for All

By 2050 the way materials are used will have changed drastically. The main changes will lie in the ways of building and the use of different resources. Building waste materials will be re-used and gathered in hubs. Digital and open information from material passports will be gathered and therefore an efficient and controllable flow of material re-use will be applied. Innovative ways, like modular building as in example projects from the TU Delft, will be adapted in the construction and demolition sector. The use of biobased materials as a renewable resource will be largely implemented. As it can be seen in figure 61 there is high potential of replacing traditional building materials with biobased ones.
The lifespan of materials and consequently of building structures will be extended. Smaller hubs will arise to reuse waste building materials. Eventually, on the bigger scale, a whole network of large material hubs will be established to gather information on material passports in order to create circular, sustainable and just material flows in the cities. Each city in the province contains a city hub of building materials for distribution purposes.

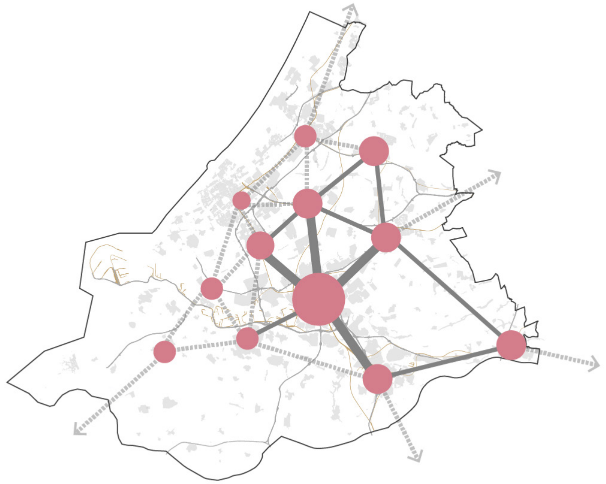


Fig. 57 Diagram Material connections, South Holland 2050

Core function
Least core function

Material

Strong interactions and cooperations
Good interactions and cooperations

Fig. 58 Material Vision Map South Holland 2050

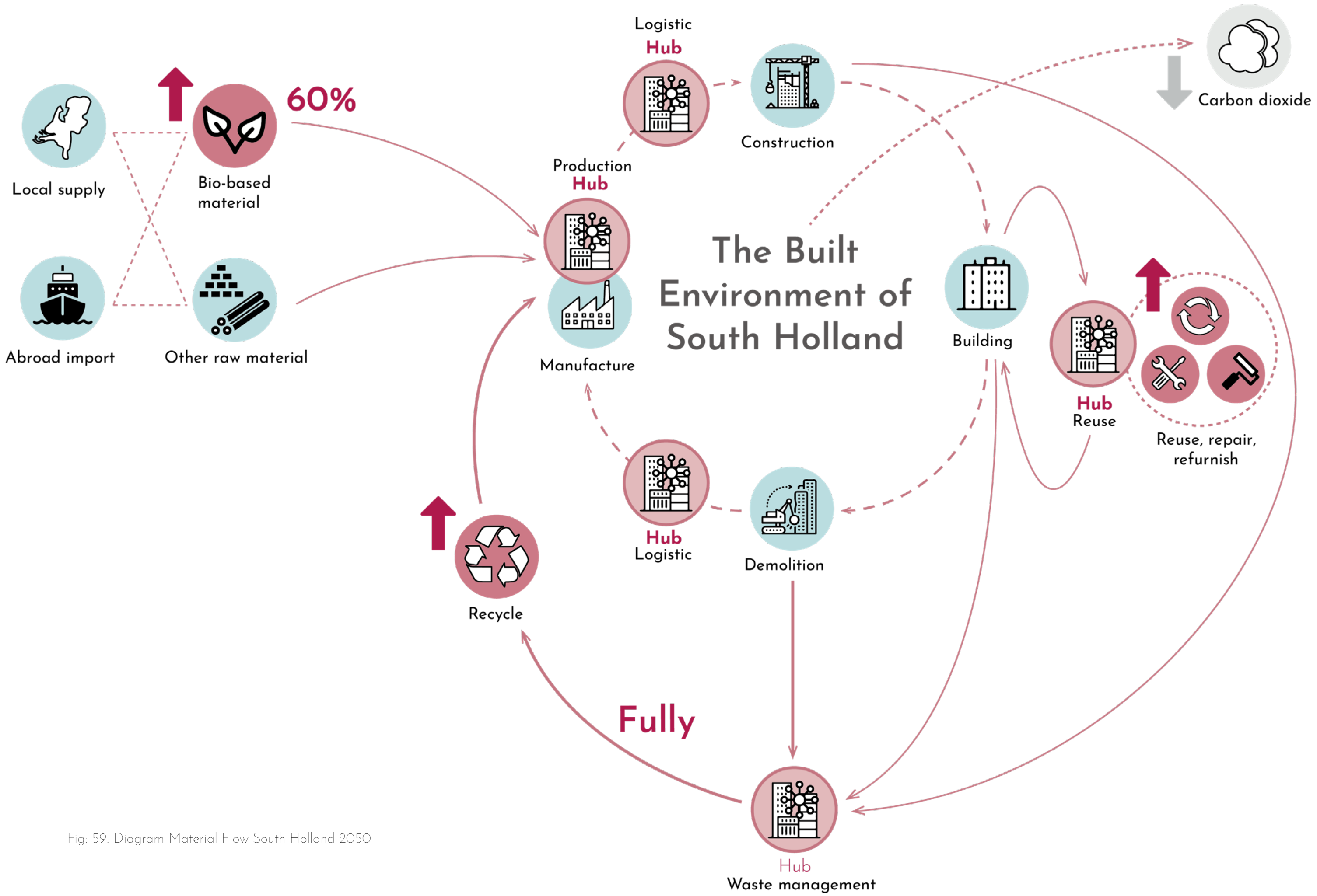


Fig: 59. Diagram Material Flow South Holland 2050

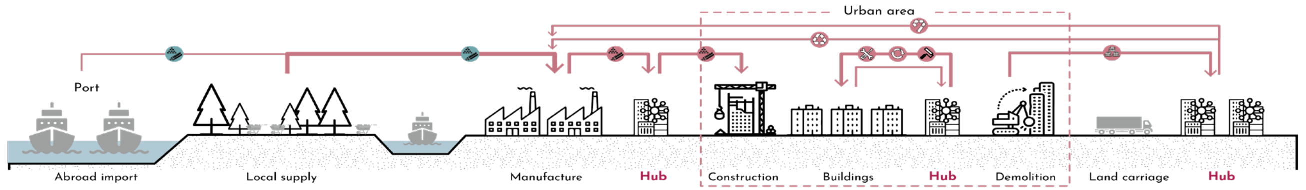


Fig: 60. Systemic section Material Flow South Holland 2050

	Part in reference	Bio-based alternative
Offices	Concrete piles Concrete floors Concrete columns and beams Load- bearing concrete walls Gypsum fiber board system walls Brick façade, sand lime brick Bitumen roofing Roof and ground floor insulation EPS steel Inner frames and concrete stairs Brick pavers	Wooden piles Wooden hollow-core slab floors Laminated wood HSB load-bearing walls HSB Interior walls HSB elements with tropical hardwood cladding and EPS based biopolymers Vegetable roofing Flax insulation Wooden frames and wooden stairs Bamboo terrain pavement
Industry	Concrete piles Concrete ground floor Concrete floor Concrete columns and beams Load bearing concrete walls Plaster block interior walls Lime and sandstone inner leaf and glass wool insulation Steel trim Bitumen roofing Roof and ground floor insulation EPS Steel interior frames and concrete stairs Brick pavers	Wooden piles Not replaced for heavy vehicles and storage Wooden hollow-core slab floors Laminated wood Pine logs walls HBS interior walls HSB elements and EPS based on biopolymers Tropical hardwood trim Vegetable roofing EPS based on biopolymers/ Cellulose Wooden frames and wooden stairs Not replaced for heavy traffic
Residents	Concrete piles Concrete floors house Concrete floors apartment Concrete plaster block walls Brick, façade, sand-lime brick inner leaf and glass wool insulation Concrete roof tiles Bitumen roofing Roof insulation PVC gutter Brick pavers	Wooden piles Wooden hollow-core slab floors Laminated wood HSB load-bearing walls HSB Interior walls HSB elements with tropical hardwood cladding and EPS based biopolymers Vegetable roofing Flax insulation Wooden frames and wooden stairs Bamboo terrain pavement

Fig: 61: Biobased Alternative Materials. Based on: (van der Velde & van Leeuwen, 2019)

4.3 Energy for All

As it has already been stated, the transition to low-carbon energy supply puts enormous pressure in existing electricity systems. Increasing electrification of the built environment calls for more flexible solutions. Smart grids are already envisioned as the solution to this challenge. Especially in the Dutch context of energy transition, smart grid is seriously considered as an alternative to electricity network expansion (Milchram, Künneke, Doorn, van de Kaa, & Hillerbrand, 2020). For the province of South Holland, this has already been extensively researched in the reports of Smart Multi Commodity Grid (FABRICations, Kamangir, 2018) and Deltagrid 2050 (Studio Marcovermeulen, FABRICations, Wolf Pack, Kamangir, 2019). The revolutionary aspect of these systems lies in the fact that temporal gaps between supply and demand of electricity can be bridged through application of advanced information technologies (IT). The production of energy becomes context-specific taking advantage of the potential of each area. Because of the excessive dependance on real-time household energy production and consumption data, digital technologies are needed. All these imply that consumer participation is a prerequisite for the success of the smart grid. Each energy user can become a prosumer (producer - consumer) and is able to trade their energy. This will lead to an end of energy poverty in South Holland. The smart grid adds a lot to the efficiency of energy use by giving multiple producers insight into their consumption and production. This guarantees minimum loss of energy thus minimising residual flows and lowering its cost. Energy production capacity is thus democratised. These different patches of almost self-efficient neighbourhoods are all connected to the bigger main frame. With this main frame neighbourhoods can also exchange residual heat and energy with each other.

Because of the growing demand of energy, the mainframe should also have its own supply of low carbon emissions renewable energy. This is done by scaling up the windfarms which are far away from big residential areas and by adding hydrogen as a source. These hydrogen powerplants will be located at the location of the current fossil fuel ones, taking over these pollutive industries. Geothermal spots will be dug to extend the Warmteling to create one big heating network. Depended to the location, each city has their way of energy production and consumption as seen in the map (fig 63).

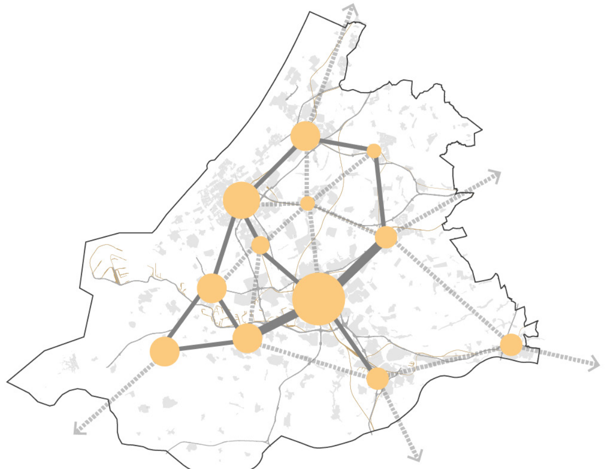


Fig: 62. Diagram Energy connections, South Holland 2050

Core function
Least core function

Energy
Strong interactions and cooperations
Good interactions and cooperations

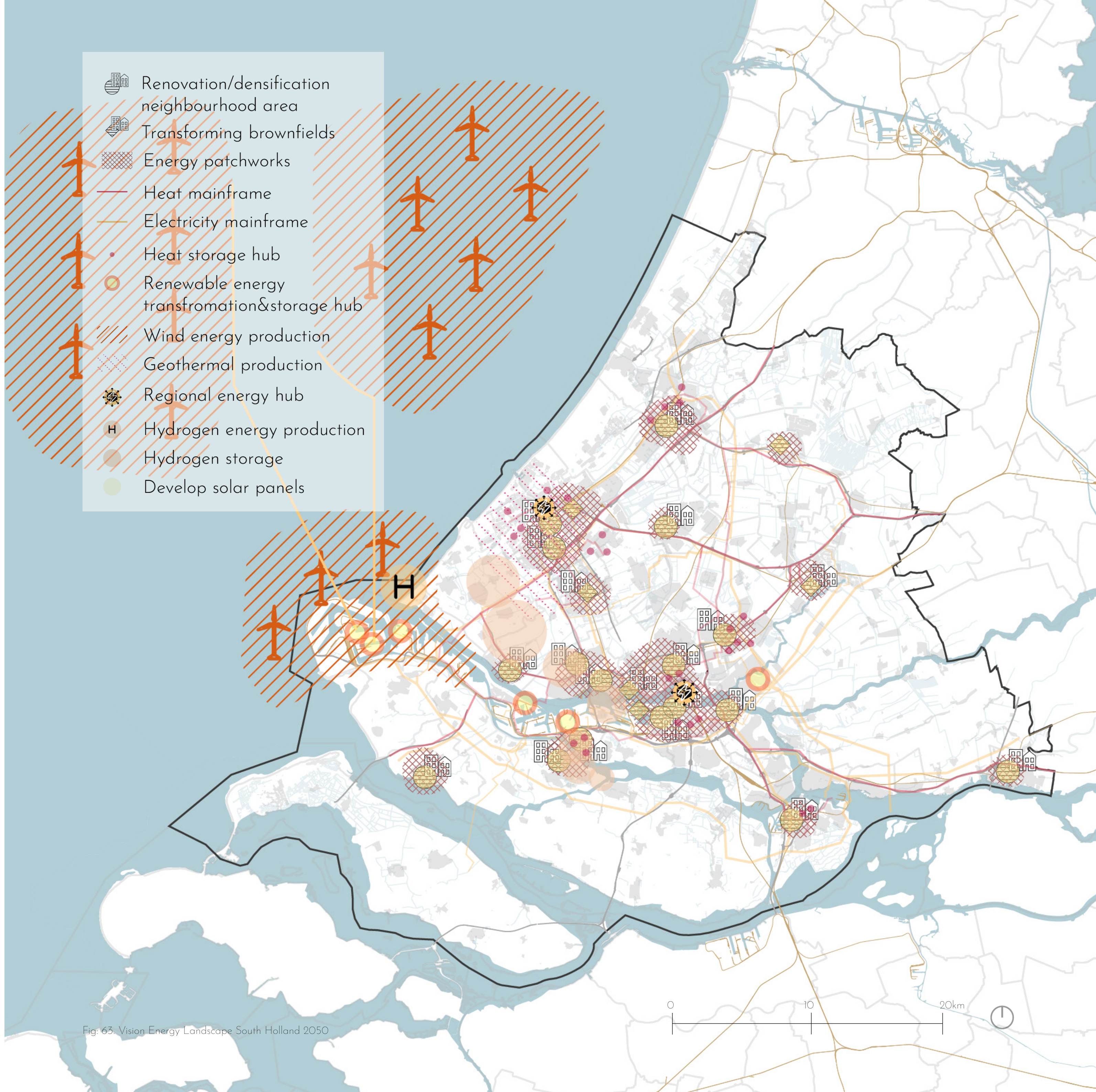


Fig: 63. Vision Energy Landscape South Holland 2050

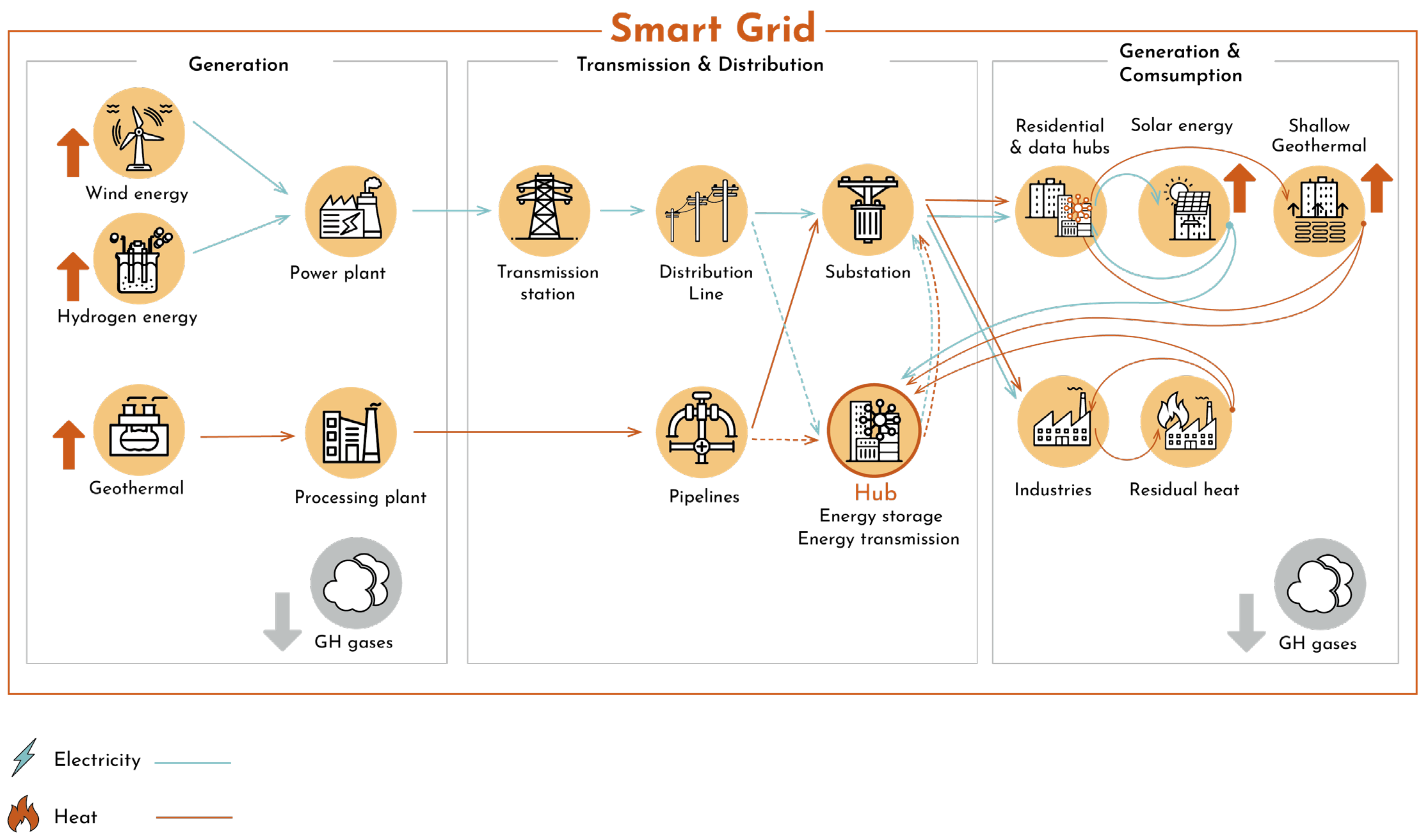


Fig: 64. Diagram explaining the Energy Landscape of South Holland in 2050

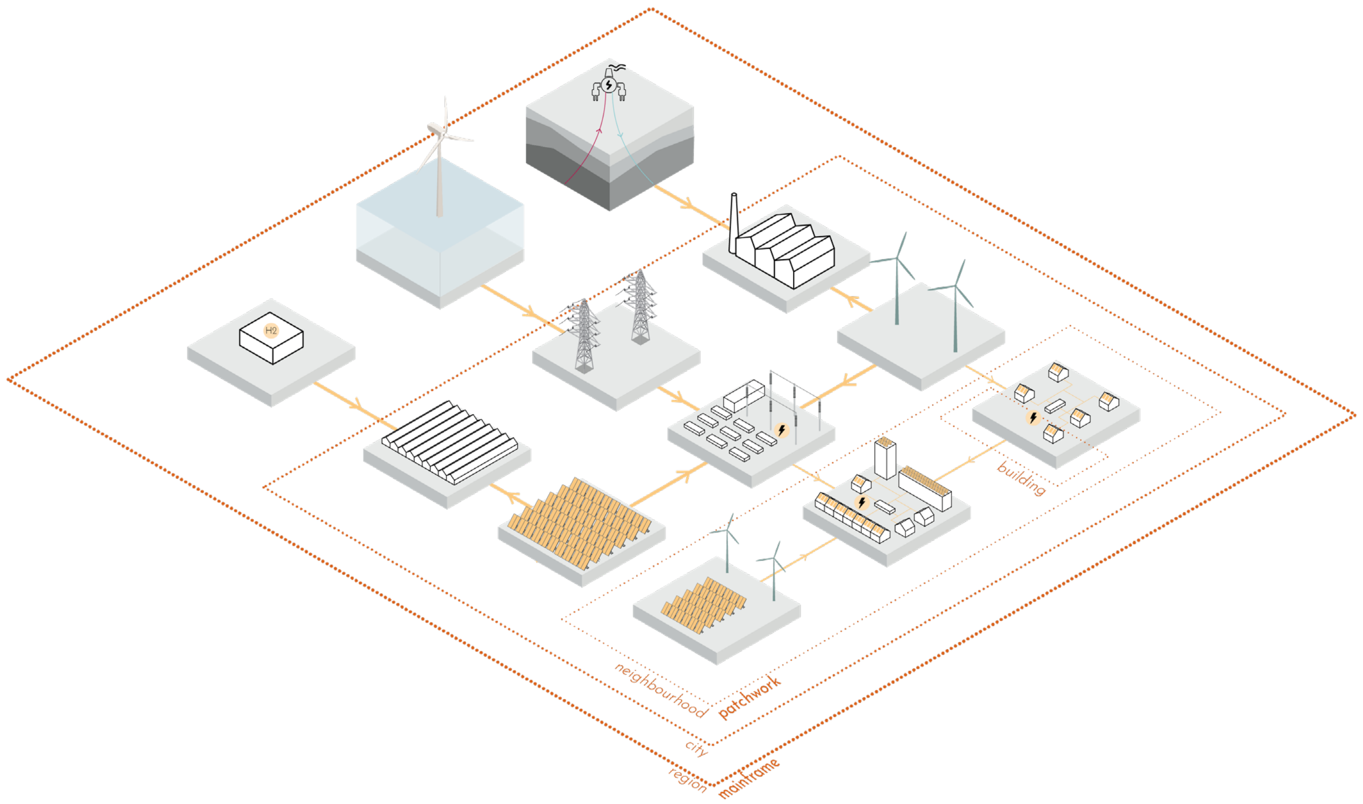


Fig: 65. 3D Diagram explaining the Smart Grid Energy Landscape of South Holland in 2050. Based on: (Studio Marcovermeulen, FABRICations, Wolf Pack, Kamangir, 2019)

4.4 Knowledge for All

All the changes about material and energy use won't succeed without the last pillar: Knowledge. To make use of the smart-grid or to build modular. Everyone should be educated in how these new ways of using goods are working. You can only become a prosumer when you know how to sell your energy. Companies could go bankrupt because they don't know how to build with bio-based materials. But through the gathering of builders, professionals, companies and residents in knowledge hubs everyone can learn how to contribute to the circular economy.

Bigger research centres and universities will do a lot of research on how to collect and use data, materials and renewable energy. This way the circular economy will only improve over time.

The sharing of knowledge will cause this big transition South Holland is going to experience.

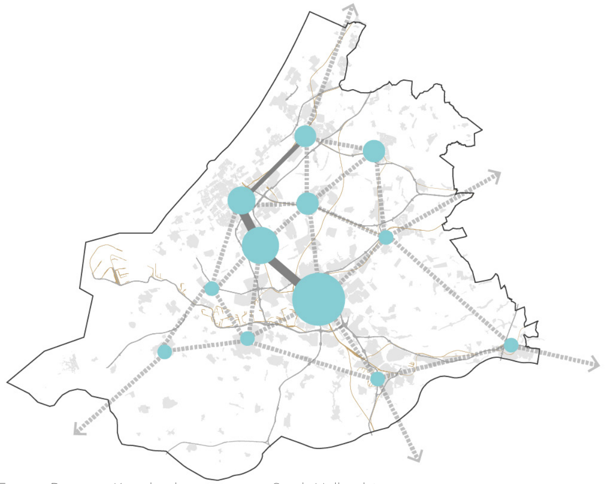


Fig: 66. Diagram Knowlegde connections, South Holland 2050

Core function
Least core function

Knowledge

Strong interactions and cooperations
Good interactions and cooperations

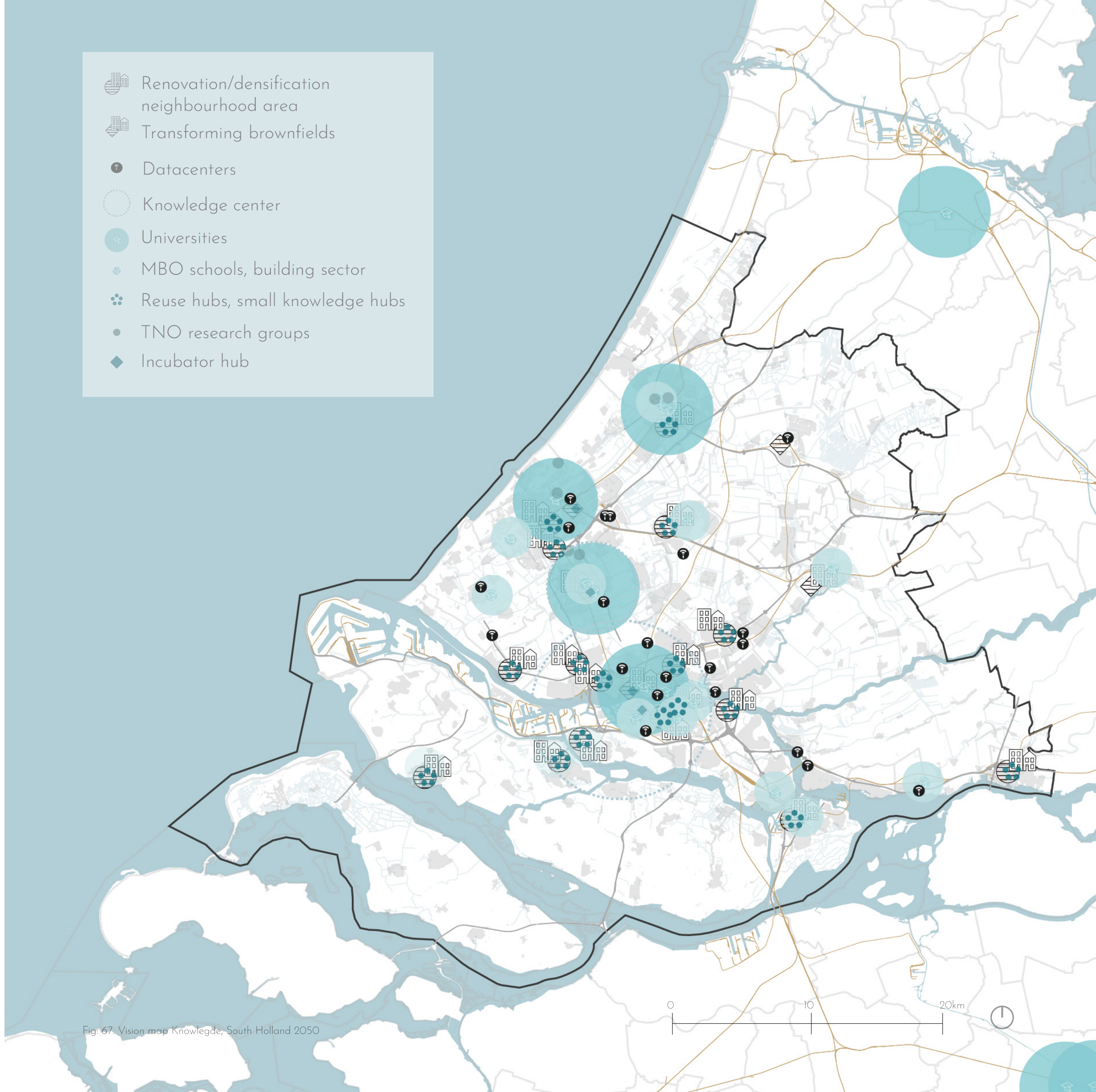


Fig: 67. Vision map Knowlegde, South Holland 2050

4.5 Hubs as Commons of the Future

As turn out of the vision these hubs, mentioned before, will house a lot of functional functions. They will be the logistics centre for material use and be the distributive centre of knowledge. But these hubs will come with one major bonus. They will be used as a tool to enhance relations of people and will be catalysator of neighbourhood initiatives. Through leaving space, the inhabitants can create a space for them own.

There are different scales of hubs. On the neighbourhood scale small hubs will arise. They will be the gather place for all the inhabitants adding programs to follow and activities to do. The bigger hubs, which will operate on a municipality or regional scale, will add value to their surroundings by blending into the landscape and accommodating hiking and biking routes. All these hubs will be connected to each other. This way all data about energy and materials can be spread through the hubs and be explained to inhabitants.

This way hubs won't only add to the transition to a circular economy but will also enhance somebody's life.

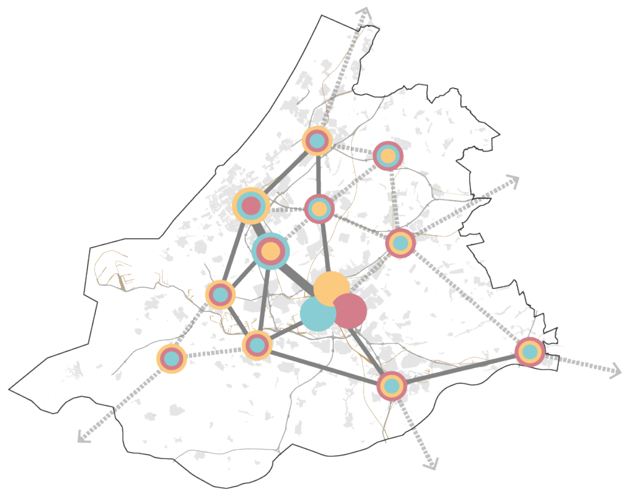


Fig: 68. Diagram Material, Knowledge and Energy connections, South Holland 2050

Core function
Least core function

Energy
Material
Knowledge

Strong interactions and cooperations
Good interactions and cooperations

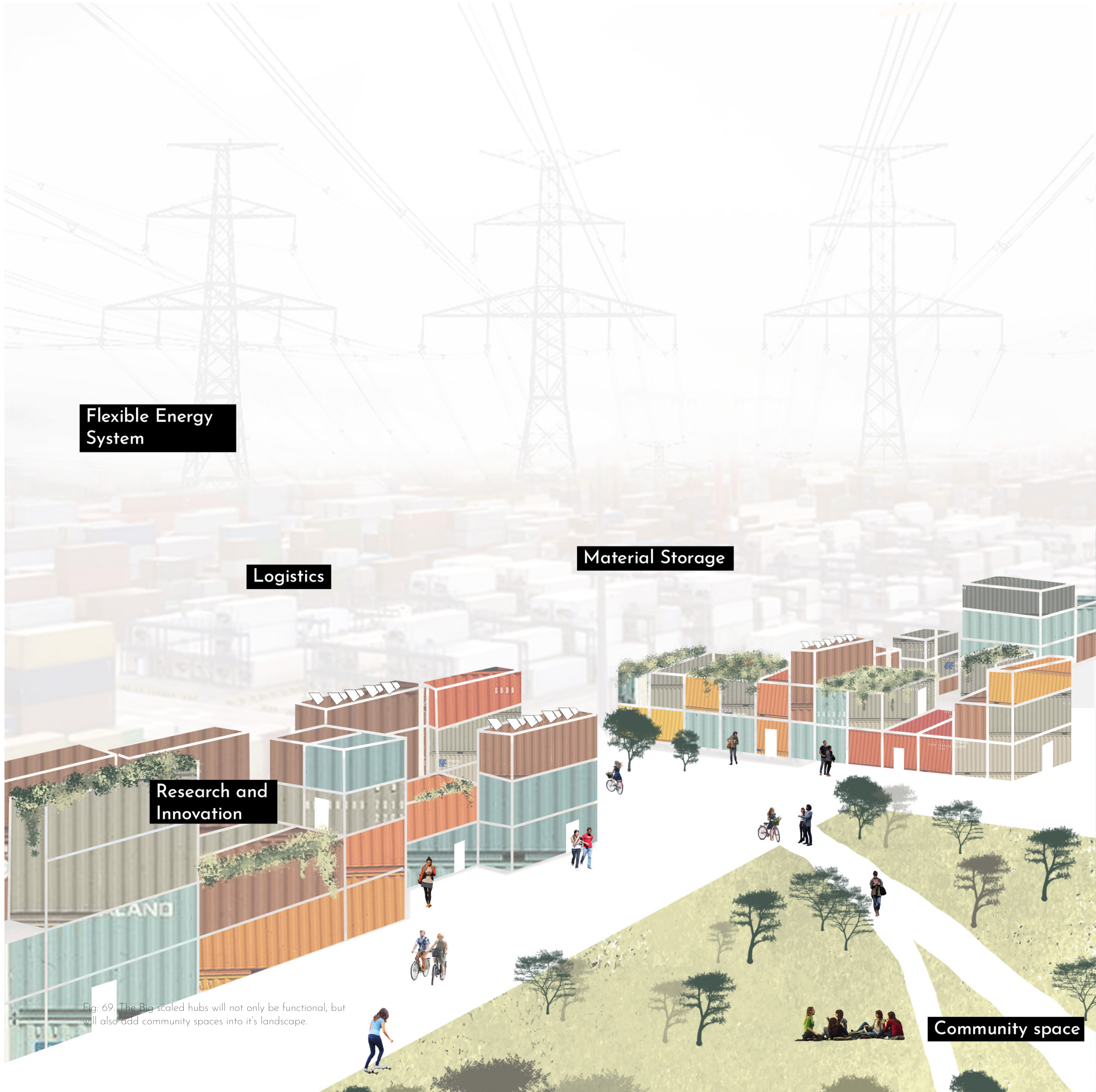


Fig: 69. The Big scaled hubs will not only be functional, but will also add community spaces into it's landscape.

Fig: 70. Envisioning a community hub, where the areas residents have become energy procumers through the collective way of producing, using and storing energy

Fig: 71. Neighbourhood hubs, spaces where people are enabled to repair and reuse and create anything under the scope of circularity, where people are informed about the transitions in order for them to have an active role and say and where people can rent a space to test their innovative ideas.

5. Make it Real

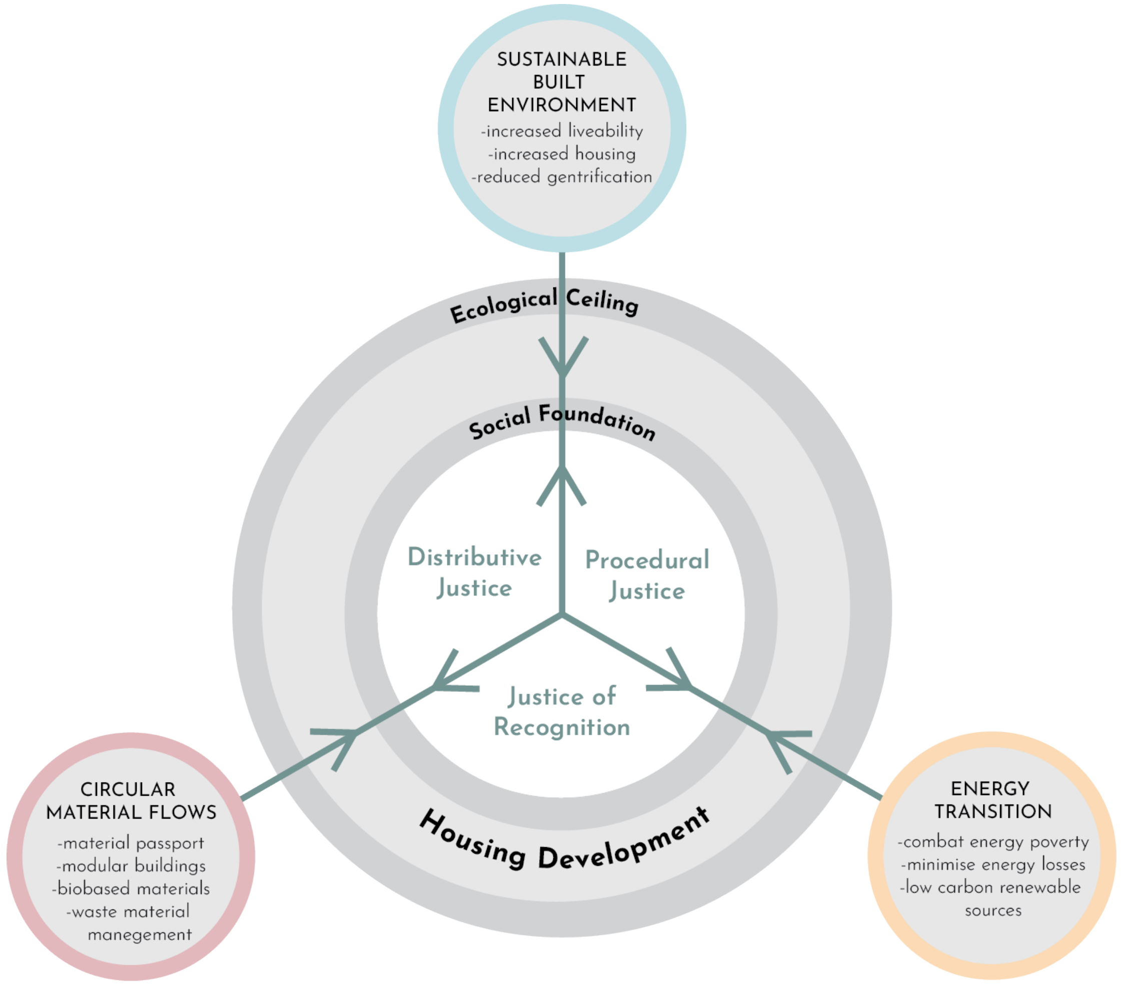


Fig. 72. Strategy Framework

Photo by Science in HD on Unsplash

5.1 Location Choosing Principles

The strategy of the urban redevelopment is based on our analysis. As seen in the former vision map each city has its own characteristics in terms of material, energy and knowledge exchange, which is based on the following table (figure 74 & figure A, B and C, appendix) In order to create a fair urban redevelopment everyone should get along in the transition; even the social vulnerable areas of the province. The prioritisation is therefore based on locations where multiple aspects come together; low liveability, low energy performance of dwellings and community initiatives. This first type of renovation and densification is called "inner city" redevelopment. The second type is existing of large "former brownfields" in the province. The two figures to the right (figure 73 A & B) show the renovation and densification methods applied to these locations. Since they consist of former brownfield grounds the phasing will be gradually throughout the whole phasing process. Some of these two types co-exist next to each other and show a good symbiosis between local qualities in terms of energy, material and knowledge, and their regional relations. Therefore key locations are chosen to test the "Building a Fair transition" These are Binckhorst with Laakkwartier and Heijplaat with its surrounding neighbourhoods. An in-depth phasing will be explained in 5.4.

Former Brownfield transformation

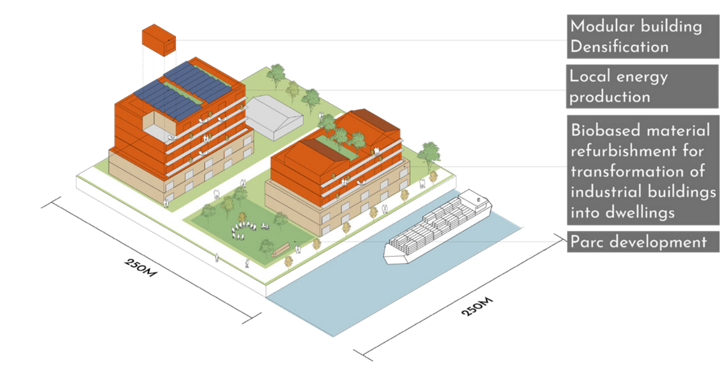


Fig: 73 A. Neighbourhood renovation and densification methods.

Neighbourhood transformation

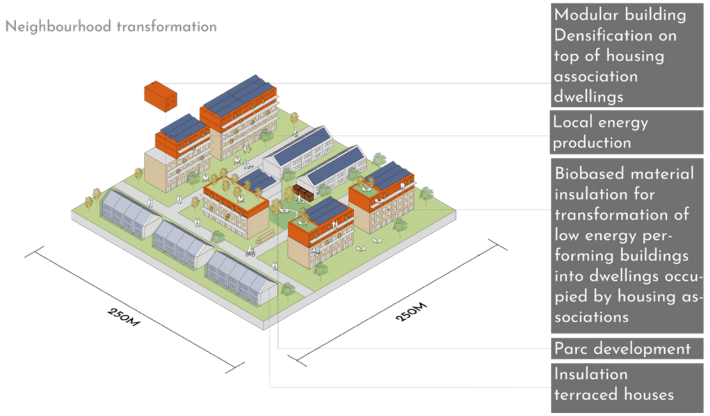


Fig: 73 B. Brownfield renovation and densification methods.

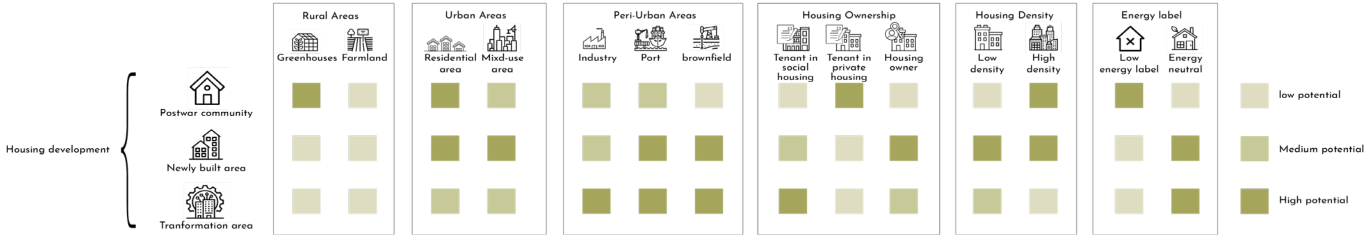


Fig: 74. Location Choosing principles for densification and renovation areas. Based on Analysis in Chapter 3.

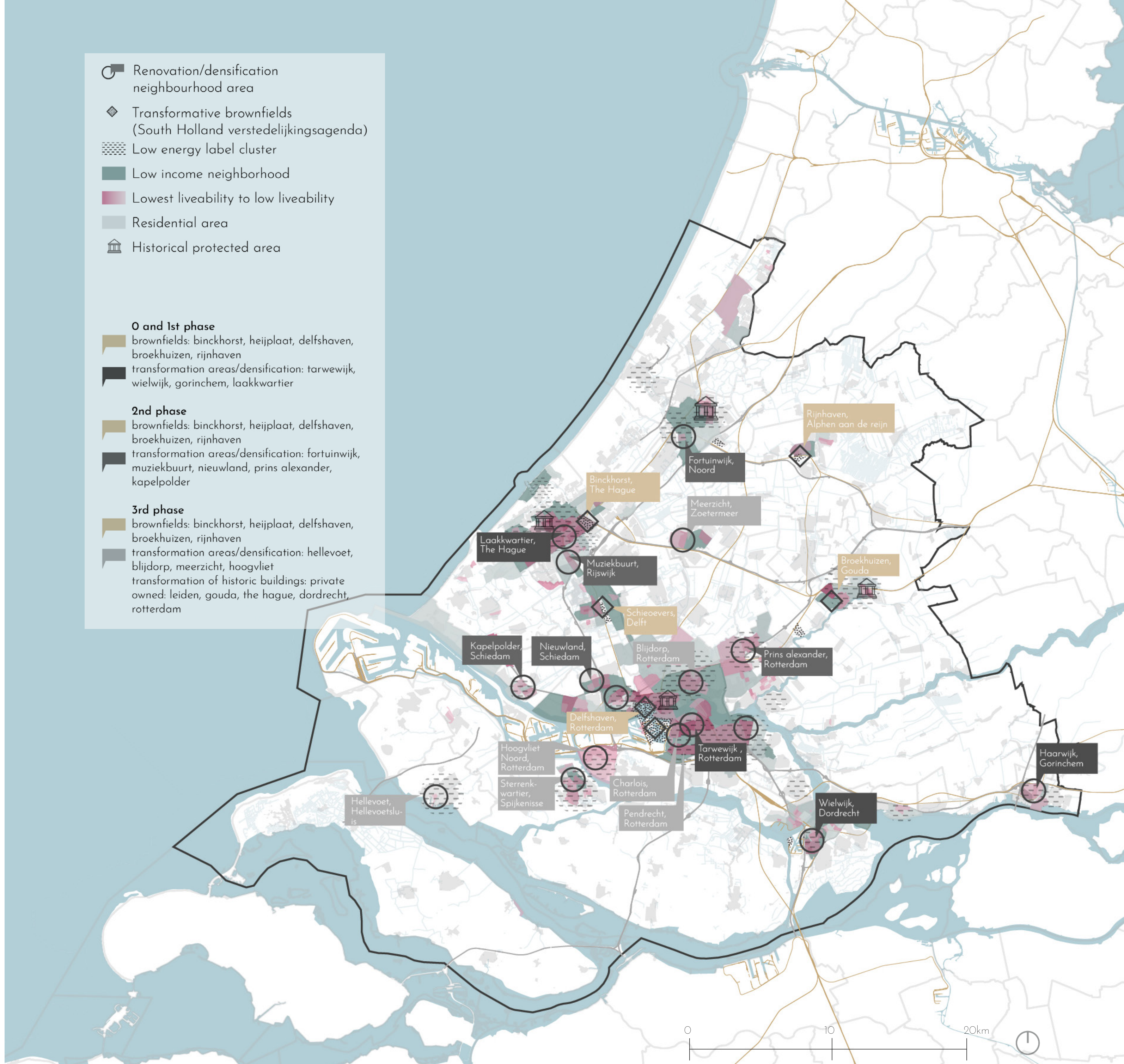


Fig: 75. Densification and Renovation Areas South Holland

Hubs Strategy

Scale \ Type	Material Hub	Energy Hub	Knowledge Hub
Neighborhood	**Reuse hub** Recycling, repairing, refurnishing workshop Second-hand goods market	**Energy transmission/ storage hub** Collect, store and distribute small scale energy	**Circularity hub** exhibition and education in circular knowledge and policies **Job training hub** education and training of circular jobs during the transition
Municipality	**City logistic hub** Small scale storage & distribution Trading Market **Recycle hub** Sort and recycle waste (Urban mining)	**Energy transmission/ storage hub** Collect, store and distribute big scale energy	**Innovation & technology hub** Research and innovation of acedemic institutions and high-tech companies **Incubator hub** Innovation and cooperation of start-ups
Region	**Production hub** Process materials & storage (Bio-base material processing& Prefab design) **Region logistic hub** Small scale storage & distribution Trading market Material passport	**Energy generation hub** For energy generated from wind, geothermal, aquathermia, residual heat, hygrogen	**Circular planning hub** Regulation making and consultacy **Circular database hub** Resource information system Circular strategy database

Fig: 76. Table with Hub catagorization.

To achieve our three main goals which are a just and sustainable built environment, fair energy transition, and circular material flows, we introduce hubs as a strategy to improve the commons of the public. Concerning the service scope of multi-scale hubs, we combine the hierarchy of our three main focus points, subdividing hubs into nine categories of spatial development and functions. Special concern is given in increasing the liveability of their surrounding area by adding ample greenery space and leisure facilities.

Hub of neighbourhood scale

Neighbourhood-scale hubs become a part of the daily life of individuals .

Category: Reuse hub gives materials a new life through recycling workshops and relevant market, like the example of open workshop called BUURMAN ROTTERDAM. Energy storage and transition hub is part of the patchwork of smart grid, which increases accessibility to residual energy for every inhabitant. Circularity hub aims at raising public consciousness of circularity by holding exhibitions and lectures for community members. Job training hub serves to help the unemployed workers in the transition process by equipping them with requisite knowledge and skills needed for jobs that follow circular principles.

Phase: Those small-scale hubs are built up upon the existing community centers and HBO and MBO schools. Therefore, it is quick to implement this type of hubs, facilitating widespread knowledge and sharing of skills. Almost all of them could be fully established by the end of phase 0.

Responsibility: Those hubs could be organized by local community initiatives, worker unions, HBO and MBO.

Hub of municipality scale

For companies and institutions, the hubs of municipality scale provide physical space for them to share, cooperate and innovate.

Category: City logistic hub is responsible for cargo storage and distribution, which also provides a trading market, making material flows more systematic and with less loss. Recycle hub is designed to achieve 100% recycling of waste, especially utilising the high value of electronic waste like urban mining plants. Energy storage and transition hub of city-scale is also a part of the patchwork of smart grid, which has a larger capacity than the neighbourhood ones. Innovation and technology hub is going to encourage scientific and technological innovation by gathering knowledge clusters. Incubator hub is specifically for start-ups to promote the maker industry's prosperity.

Phase: Those middle-scale hubs could be developed mainly in phase 1 and the earlier stage of phase 2.
Responsibility: Those hubs could be run by municipalities or similar administrations, while they are rented to knowledge institutions or relevant material and energy companies.

Hub of region scale

As the development centre of South Holland, the hubs of region scale have the widest range of service.

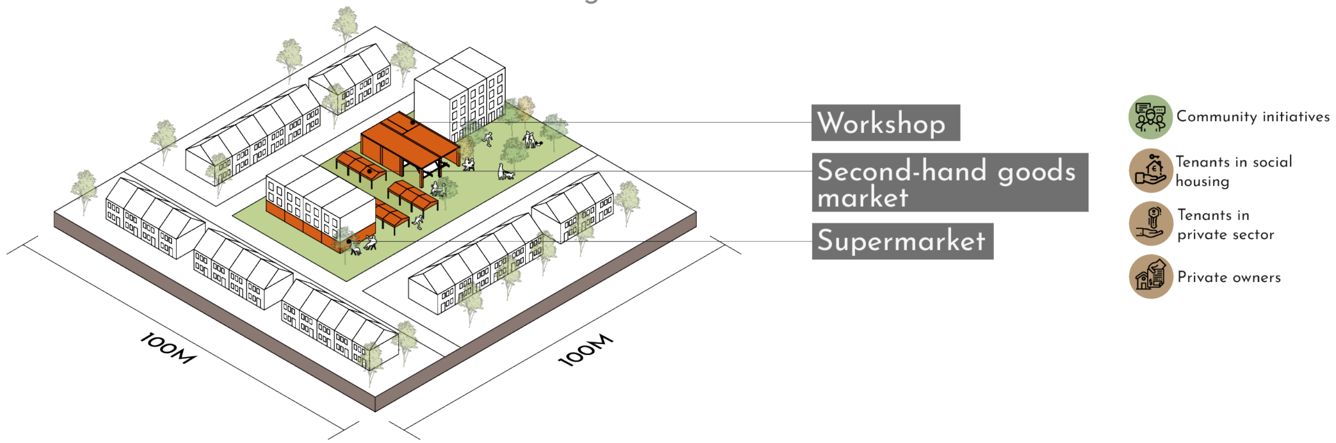
Category: Production hub is created for processing bio-based materials and prefabricated parts, which facilitates renewable material use and optimizes material use. Region logistic hub is built for material storage and distribution of large scale, together with the large trading market, material passport registration, and database. Energy storage and transition hub of city-scale is a part of the mainframe of smart grid, which creates and stores huge amounts of energy. Circular planning hub and database hub are open for the society to enjoy circular knowledge and corresponding consultation service, like the Zero Carbon Park in Hongkong.

Phase: Those regional hubs could either be strengthened where a similar function already exists or be newly built. It will take much time to see the growth of regional hubs, so they will continue to build up until phase 3.

Responsibility: Province of South Holland or similar administrations could be in charge of those hubs, supporting knowledge institutions or relevant material and energy companies to gather and develop.

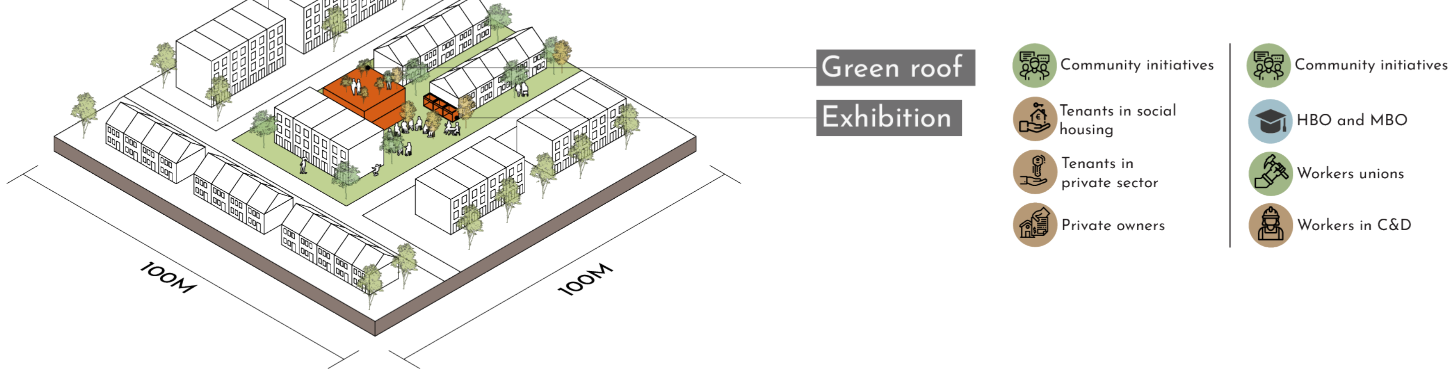
Reuse hub

Neighborhood



Circularity hub or Job training hub

Neighborhood



Incubator hub

Municipality

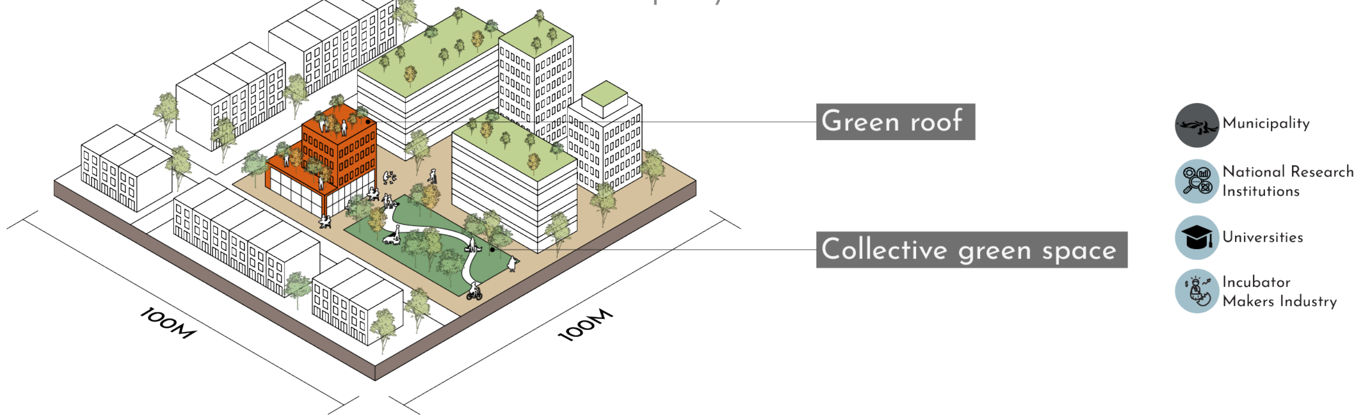
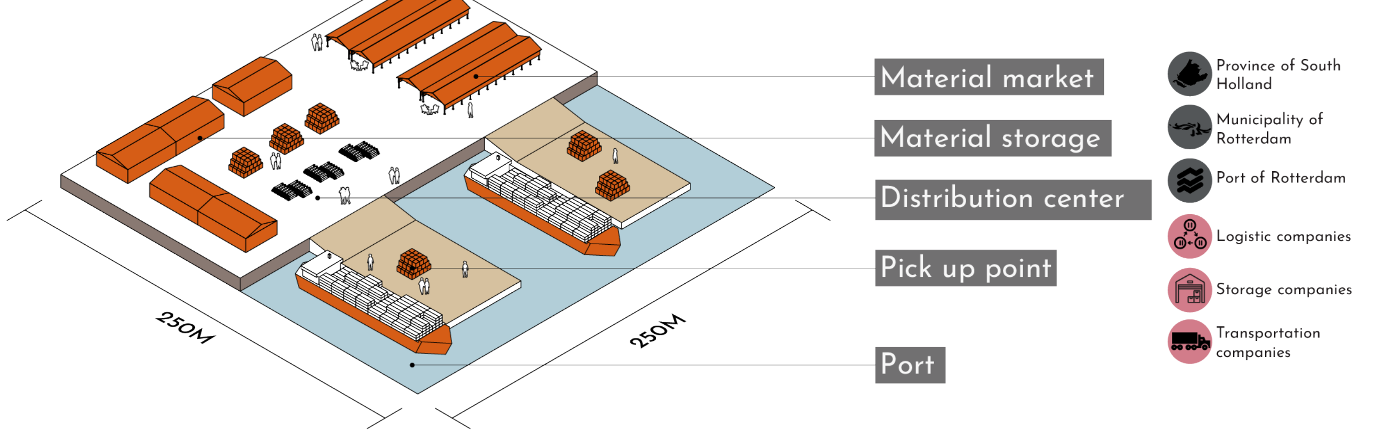


Fig. 77. Hub typologies imbedded into their surroundings.

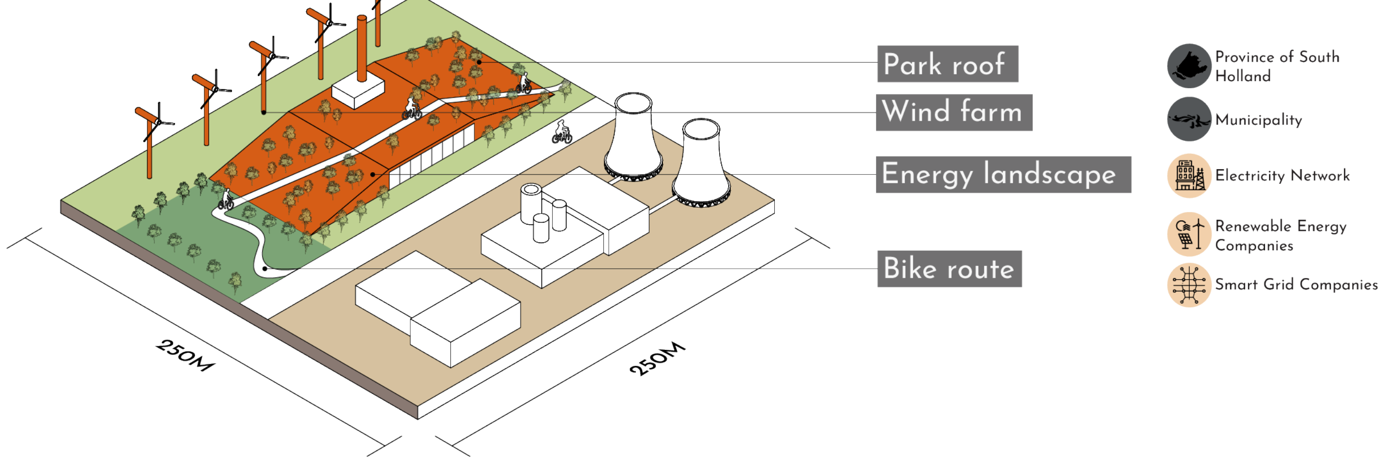
Logistic hub

Region



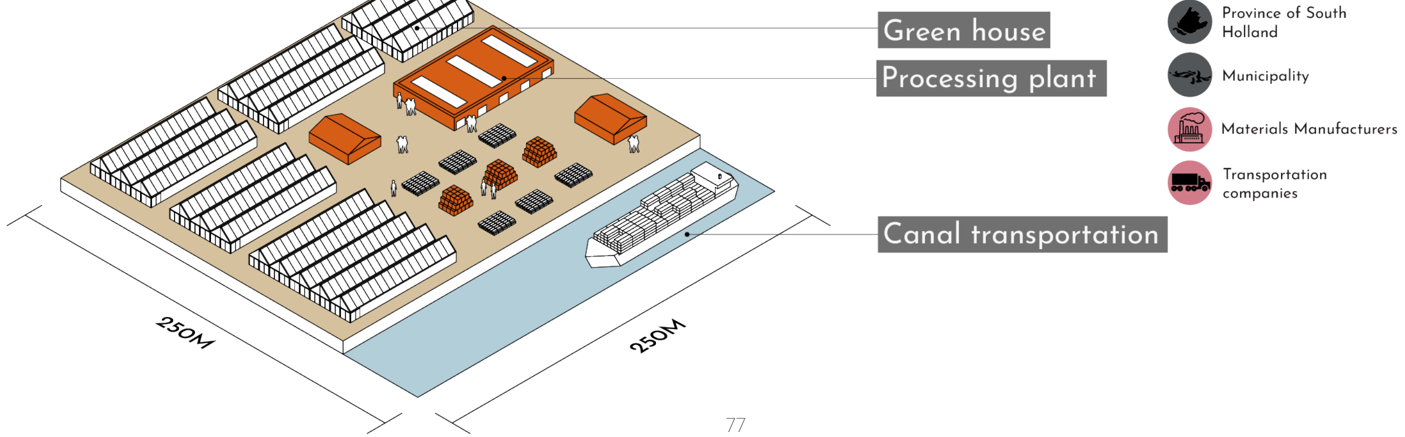
Energy generation hub

Region



Production hub

Region



5.2 Stakeholder Transition

A big organisational structure is needed to make circular and a just change. According to their power and interest ,different governing tools can be used to create short and long term effects.

The crucial stakeholder changes are highlighted in the table (figure 78).

Structural inequalities in civil society have to change. For the phasing it is important that these civil society gets more empowered in the urban redevelopment process.

In this project, housing associations are one of the most important stakeholders since the locations redevelopment are mostly owned by them. Since they do not have the power, due to the "Woningwet" of 2015 (Ministerie van Binnenlandse zaken en koninkrijkrelaties, 2015), just yet to make their housing stock more sustainable or redeveloped, they need new regulating tools to create a just sustainable built environment with affordable and adequate housing for all. In order to create a fair transition the involvement and thus the empowerment of tenants and inhabitants of the private sector are crucial. Existing incubators, makers industries and community initiatives which are present in the province have the chance to gather these inhabitants and construction workers to inform them of changes in their area. In order to get a good foundation of the transition, on the short term it is necessary that this step is taken first.

Meanwhile, next to the upscaling of the civil society some major energy companies, like Stedin and Liander, and material storage companies, like van der Waal, have to be persuaded by the administration institutes to transit to these circular and renewable flows. This will be a long term process. For the fair energy there is already a good network laid out which can be reused for low carbon renewable resources. Certain energy powerplants in the harbour of Rotterdam have to be adapted to renewable resources. Since the circular material hub is not well formulated in the area small initiatives will start while large firms will be transformed to large biobased material hubs.

Administration
European union
National government
Province of South Holland
Municipalities
Port of Rotterdam

Knowledge
Universities
HBO and MBO
Research institutions
Urban planners, developers, architects,
Incubator/Maker industry

Material
Material manufacturers
Construction and demolition companies
Recycling companies
Logistic/Storage/Transportation companies

Energy
Electricity network
Heat network
Renewable energy companies
Fossil fuel companies

Civil society
Housing associations
Housing developers
Community initiatives
Worker unions
Environmental organizations

Individuals
Tenants in social housing
Tenants in private sector
Private owners
Workers in construction and demolition sector

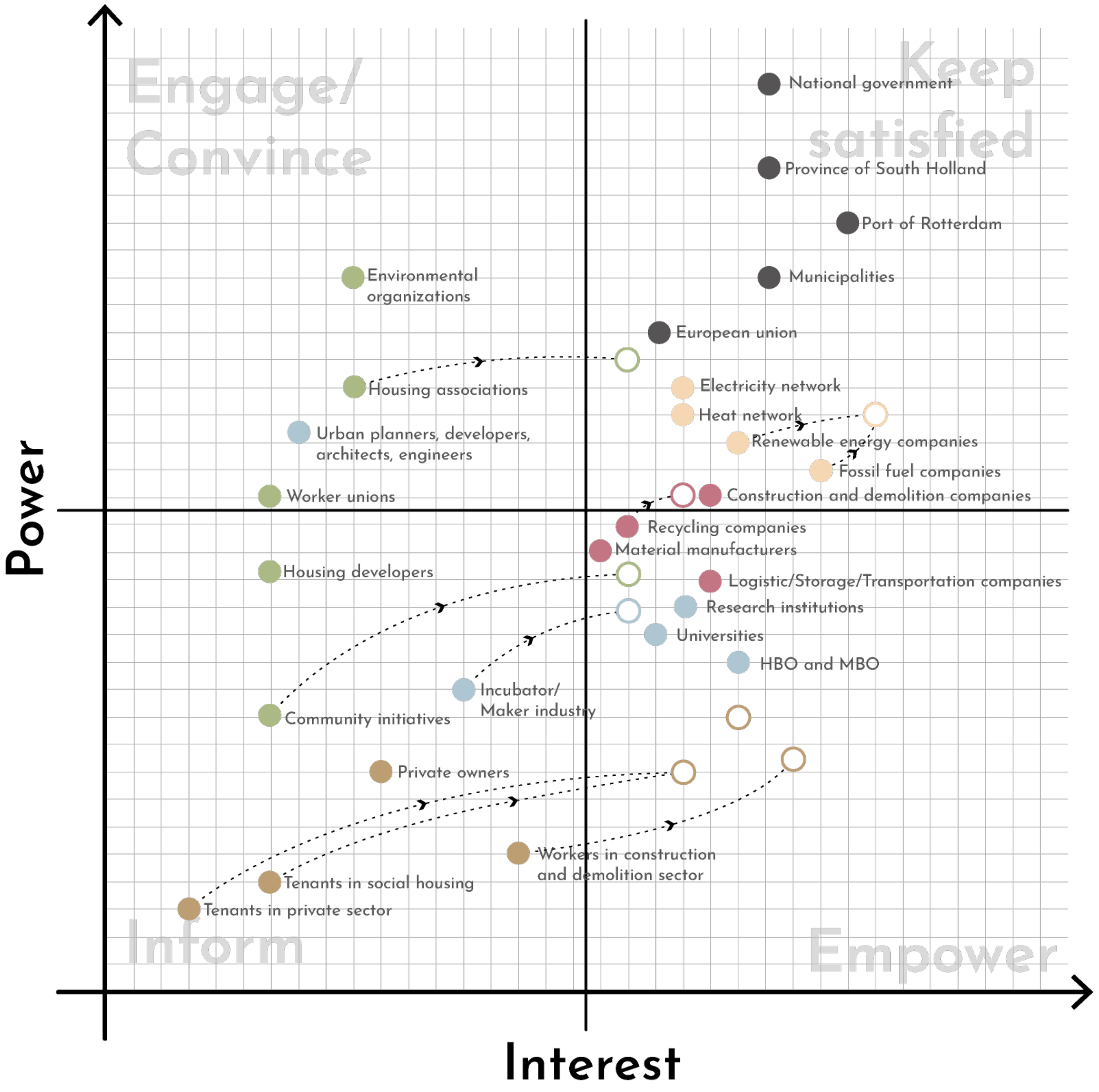


Fig: 78. Stakeholder transformation table

5.3 Strategy Phasing

Phase 0: 2021-2025

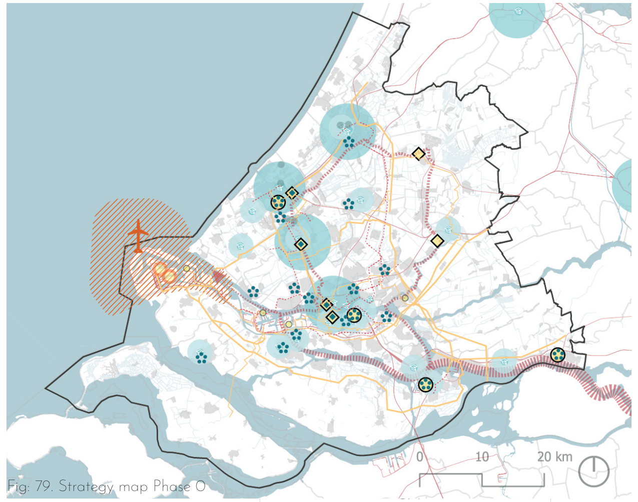


Fig: 79. Strategy map Phase 0

Phase 1: 2025-2030

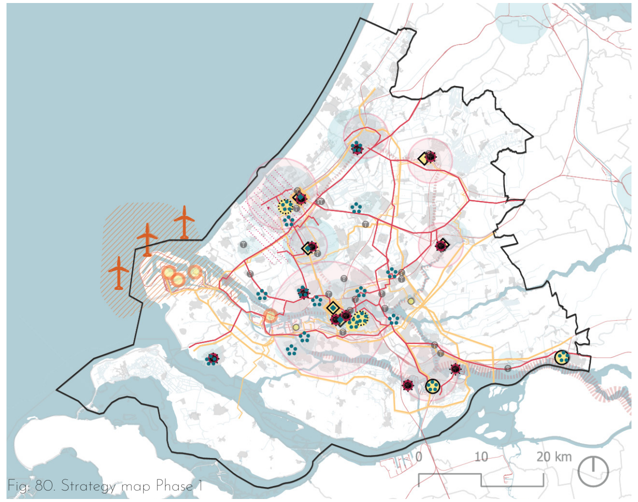


Fig: 80. Strategy map Phase 1

On the following page the phasing table is visible to show which actions and policies are needed for these stakeholders' power and interest transitions. For instance, regulating and stimulating government actions are needed for companies. Whereas for civil society capacity building and shaping governing actions are implemented. The phasing is ordered in four timeframes. The first phase is phase 0 refers to what can be done today till 2025. Phase 0 and phase 1 till 2030, include the same transformation areas. Phase 2 is from 2030 till 2040, whereas phase 3 is from 2040 till 2050.

The first two phases; phase 0 and phase 1 are starting the transformation processes. On the small scale citizens in inner redevelopment areas will get informed and empowered to get along in this urban redevelopment transition. Monitoring these redevelopment areas very urgent. Small initiatives in local hubs are the catalyst for knowledge and engagement of citizens. On the larger scale research is done about new building techniques and low carbon, renewable energy flows for the mainframe. In these phases the key projects are developed since they contain the ideal location for synergy of local and regional importance.

In phase 1, the upscaling of transformation processes is happening. The first generation of renovation/ densification areas will transform to become energy neutral. The key projects showcase tested new ways of material gathering and energy consumption and

Phase 2: 2030-2040

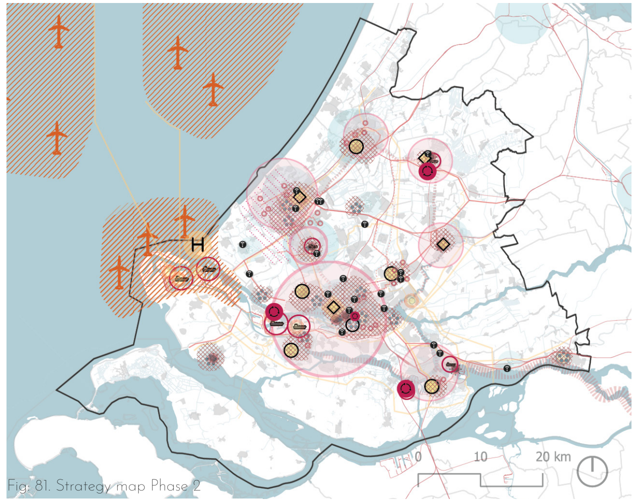


Fig: 81. Strategy map Phase 2

Phase 3: 2040-2050

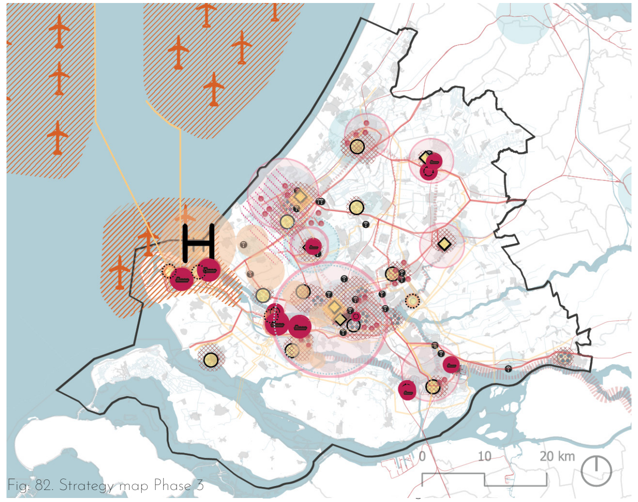


Fig: 82. Strategy map Phase 3

production. Because the mainframe is already there these areas can connect to it and already start trading their energy. The mainframe for reusing industrial heat is established. Other low carbon, renewable energies options are explored further. In former brownfields small initiatives are expanded to become locations for city hubs due to their location specialities.

In phase 2, throughout the whole province more of the second generation renovation and densification neighbourhoods are making the change to an energy neutral environment and a self-sufficient way of energy flows. Because more areas connect to the mainframe the renewable energy sources are upscaled and more storage areas are implied. The construction and demolition is on a regional scale more circular . Big material city hubs are working with data regulating the flows of the materials.

In phase 3, the third generation of renovation/ densification neighbourhoods will start their transformation. A lot of the already transformed areas are already sharing their energy production with each other. The newly used low carbon, renewable energy sources are used in the main frame, to keep meeting the energy demand. Through policies the biobased material, building passports and modular building are imbedded into our way of building. Through big hubs the materials are monitored, stored and shared.

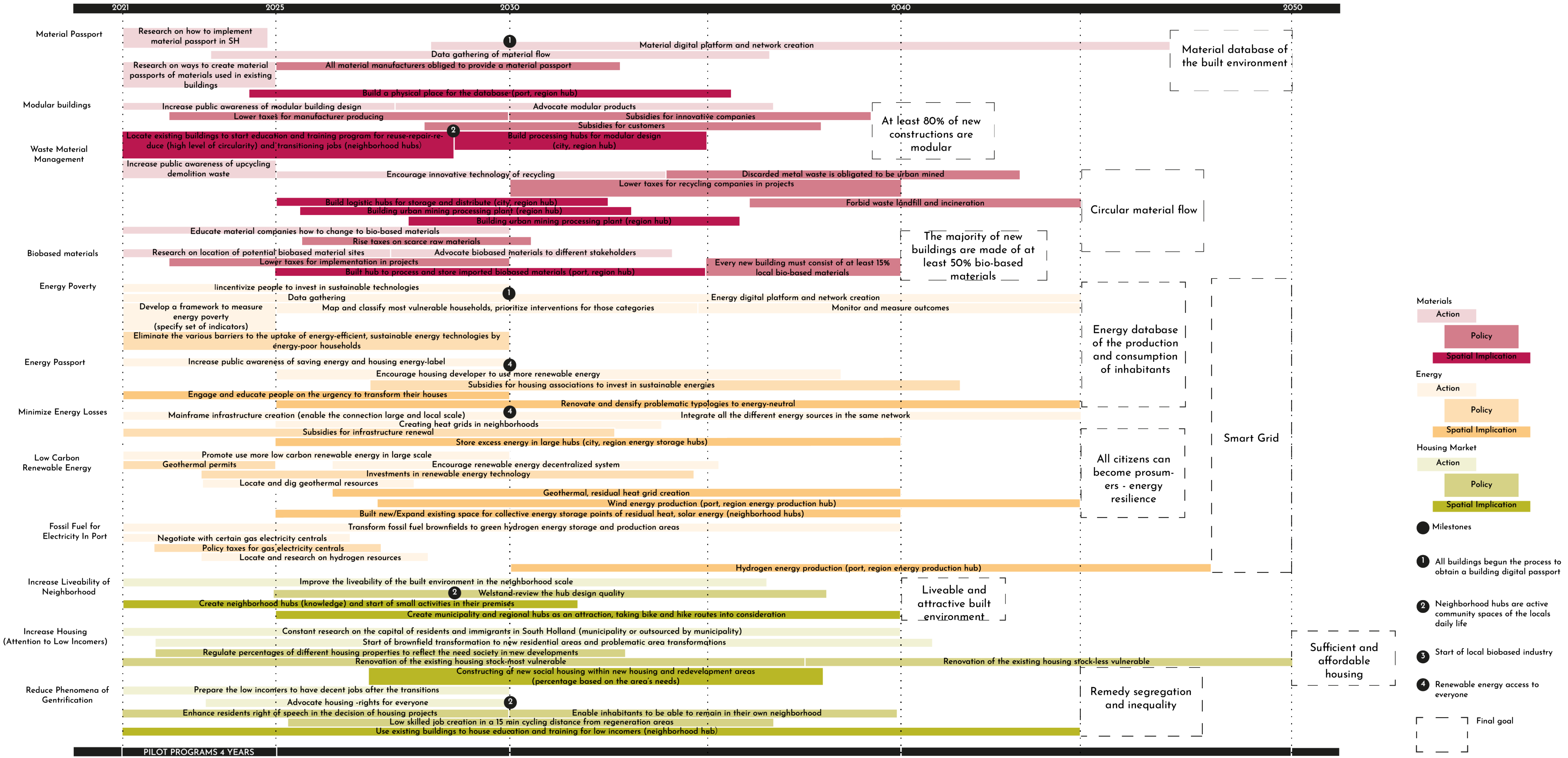


Fig: 83. Phasing Table of the transition of South Holland

5.3.1 Phase 0: 2021-2025

In this research phase a lot of investigations are happening. On the smaller scale the appointed redevelopment areas will have their own small hubs in the area nearby. This will happen in commodity centres and vacant buildings. In this way people will get informed about the sustainable measures needed to have adequate building quality in their dwellings. These locations will serve as local commons from the beginning. They contain small material re-use hubs with existing incubators and initiatives which are already working in these fields. These hubs are used to give people right of speech to discuss the renovation and densification plans and the beneficial liveability prospects for them.

Housing Market

To make sure that the housing supply meets the demand and the capital of the people who are looking for housing, the municipalities should start research on what the exact demand is. When new development projects start, these numbers should be reflected in the diffrent typologies of dwellings which will be built. Therefore this urban redevelopment is responsive towards the potential needs.

Material

The material transformation starts with gaining a lot of knowledge. These first four years should be used to establish the material passport when materials are imported and to get an overview of the materials which are already here in the existing building stock. To increase the use of biobased materials for small companies, taxes will be lowered, when these are implemented in projects or manufactured. Big innovation and educational institutions like the TU Delft and Erasmus university combine forces with MBO Built sector schools to educate the current material companies on how to change to innovative ways of building. This way companies can learn how to change with the transformation to a circular economy and maintain their working forces.

Energy

The regional scale plays considerable importance in this phase. The mainframe should be expanded so it is ready for the neighbourhoods to be connected to. The taxes for the fossil fuel companies will rise, making the need for them to change more necessary.
So the province in collaboration with municipalities. should build a framework on how to measure energy poverty. This information can be used to choose which areas need to be transformed earlier. On a smaller scale people will learn the urgency of transforming their houses through the first small knowledge hubs.

For a more detailed overview of the maps, see appendix.

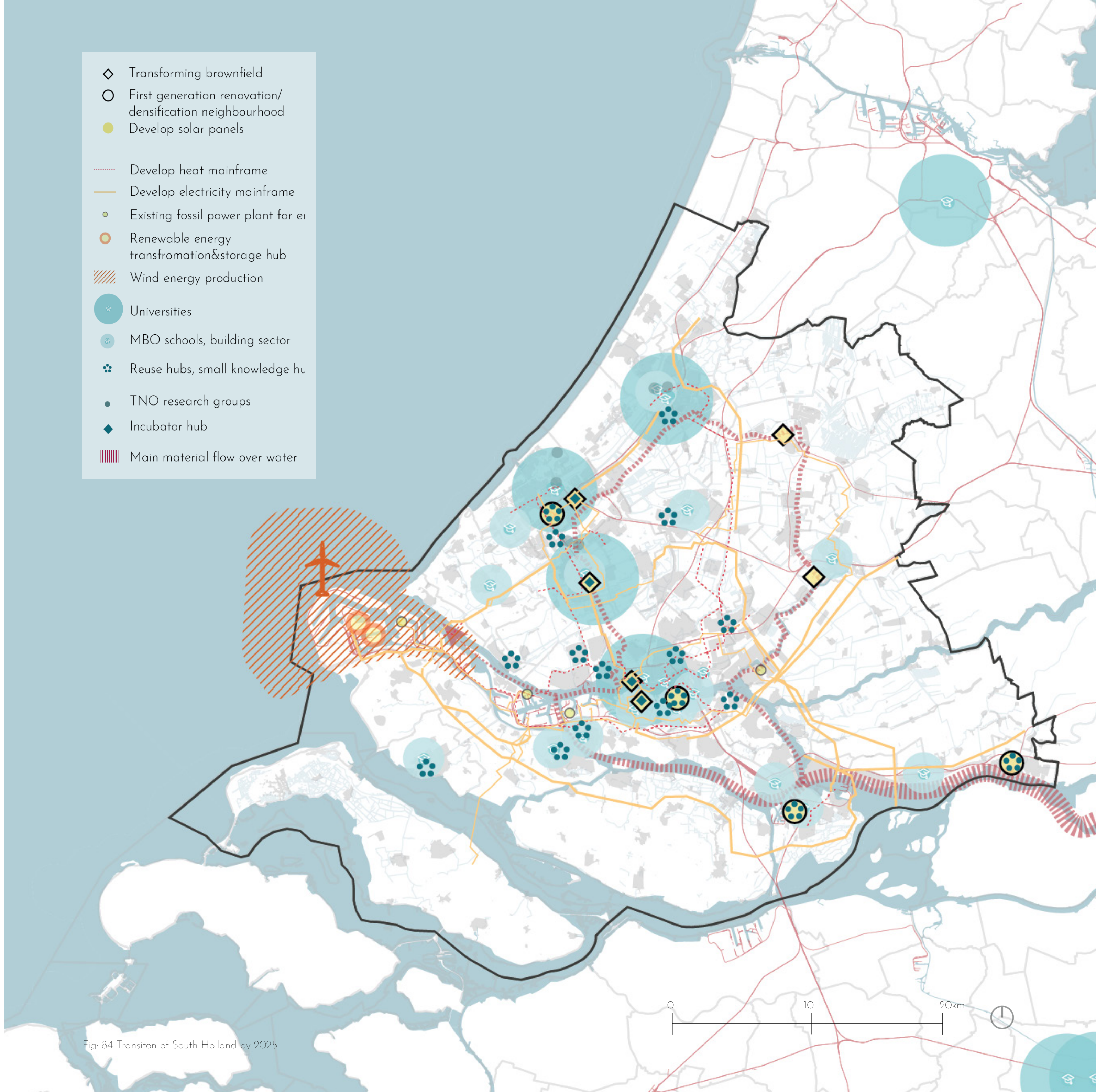


Fig: 84 Transiton of South Holland by 2025

5.3.2 Phase 1: 2025-2030

Housing Market

The transformation of the first-generation renovation areas will really start in this phase. Through the continuous research on the capital of residents and immigrants, the added dwellings are reflecting the inhabitants' needs. To make sure gentrification does not take place residents will get the right to stay in their current neighbourhood. This needs to be ensured by the fact that enough low skill jobs will be maintained in the area. The policy that the newly added building levels on these refurbished municipalities should incline 40% of their redevelopment projects reserved for low income households. Developed neighbourhood hubs outside the renovated and densified inner redevel-opment areas will add to the liveability. To guarantee this, Welstand should always review the plans of the new hubs.

Material

All material manufactures are obliged to have a material passport and most of the buildings will have them by now. This information needs to be communicated to existing datacentres. With the coming manufacturing biobased materials and more "waste" this needs to be stored. The first big city hubs do arise in former brownfield areas to manage the building waste more circularly around the cities. These hubs are built by the province which will rent them out with a lower tax to the circular companies. This way experimenting companies similar to Volker Wessels in Utrecht will create a circular reuse of building materials. According to the specific location of Delft and Rotterdam, they will serve as storage hubs about innovative ways of building and manufacturing of biobased materials. Also, the rise of taxes on scarce raw materials will help the transition to a circular economy.

Energy

In phase 1, more areas are going to be transformed. Because a lot of the buildings in the first-generation areas are from housing associations, they get subsidies to invest in renovation and sustainable measures which will improve the quality of their property. Housing associations are fostered to cooperate with housing developers. For example: the housing developers can build and rent two added levels of a building if they also pay for the renovation or a park outside. For energy sources more geothermal resources are dug and more windfarms are created in the port near the sea. More city energy storage batteries are placed in brownfield areas like Binckhorst and Heijplaat. They qualify themselves for the storage of the experimenting patchworks of Laakkwartier and Rotterdam South in combination with the nearby established mainframe. They catch the energy generated locally and heath fluctuations of the port.

For a more detailed overview of the maps, see appendix.

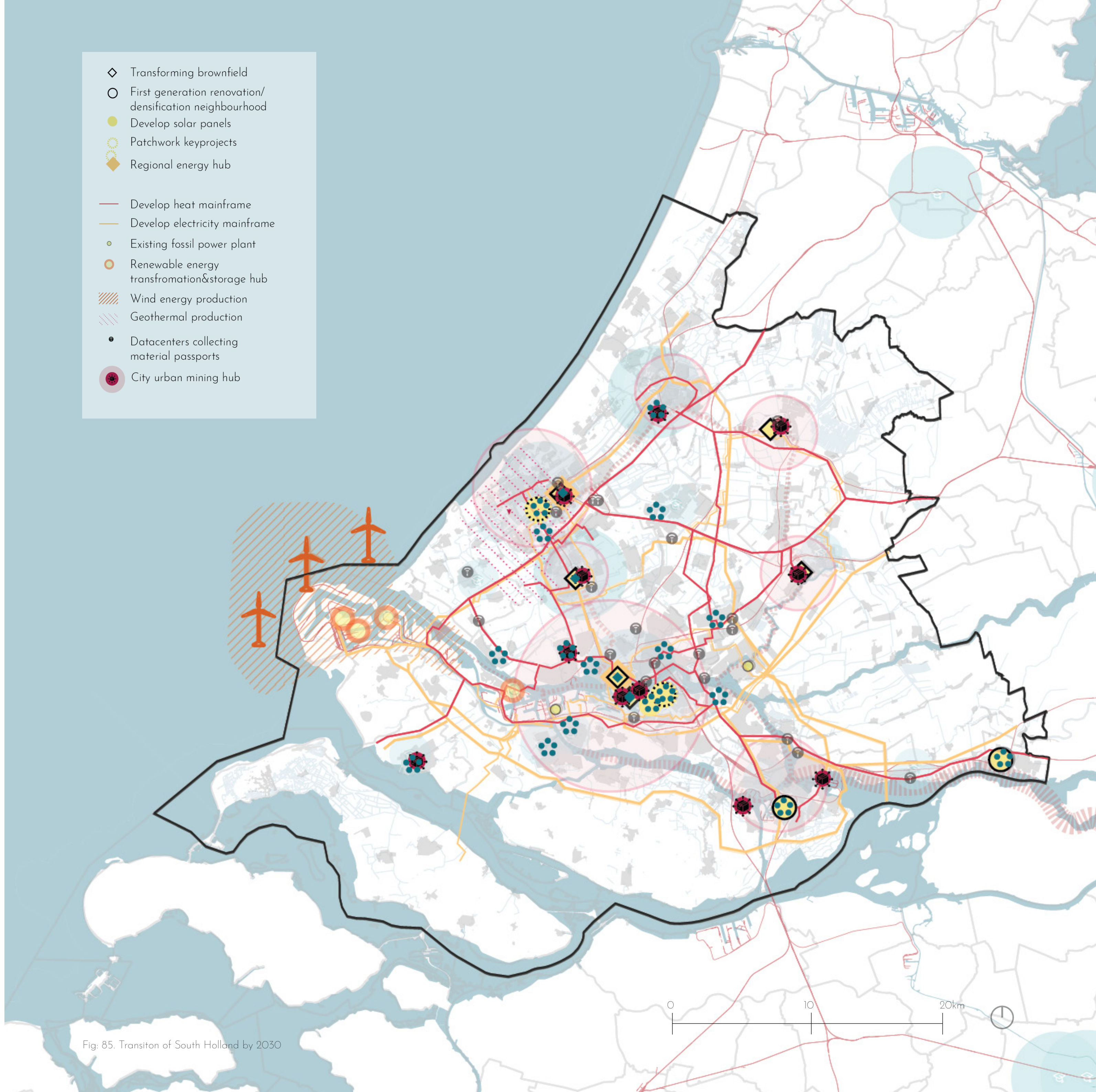


Fig: 85. Transiton of South Holland by 2030

5.3.3 Phase 2: 2030-2040

Housing Market

Second generation renovation and densification locations are going to be redeveloped in this phase. A continuing reflection and conversation between inhabitants and municipalities is needed for capacity building in these neighbourhood hubs.

Material

A big step to a circular economy is taken. Every building must be built with at least 15% bio-based materials. This does not seem like much, but by making it mandatory the market of bio-based materials will grow to a great extent. An added stimulator for closing the material loop is that taxes are lowered when materials are getting recycled in a project. The city hubs will grow even more due to the second generation renovation and densification areas. The relocation of a major part of cargo facilities located in South Roterdam will enable the establishment of bio-based material hubs, that will serve the whole province.

Energy

In this phase, the second-generation areas are being transformed and are added to the mainframe. Because a lot of neighbourhoods already have the infrastructure now, they can be added to the smart grid. This means they can start trading their energy and that the energy flow is monitored to improve its efficiency. On the bigger scale, offshore windfarms are being built.

More energy storage hubs will arise. Also, more windfarms on the sea will be added. Also, the fist hydrogen energy production is planned in the harbour. They will take over some of the current fossil fuel company locations.

For a more detailed overview of the maps, see appendix.

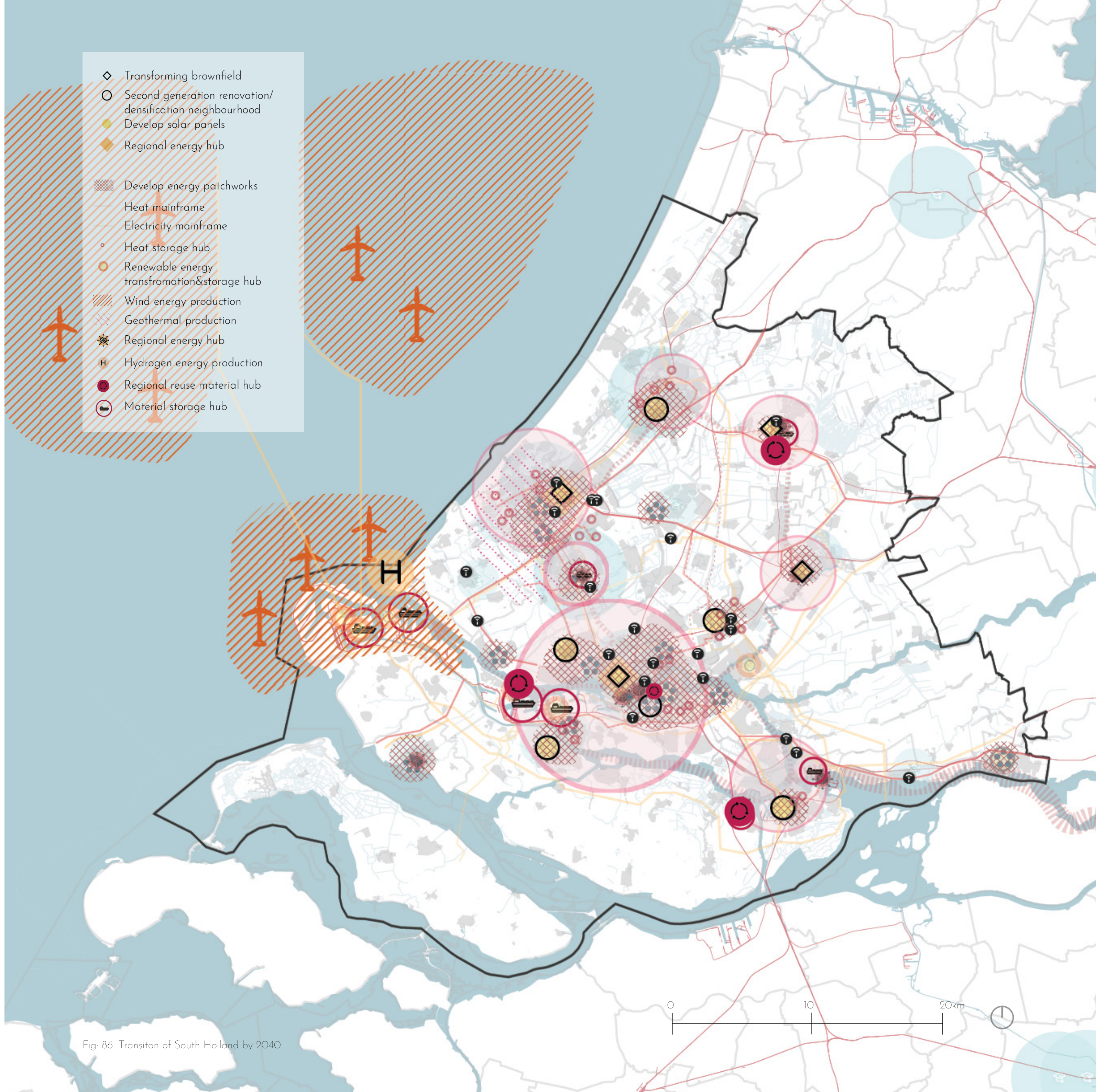


Fig: 86. Transiton of South Holland by 2040

5.3.4 Phase 3: 2040-2050

Housing Market

The third-generation areas will be the last to be transformed. All the previous policies against gentrification that ensure adequate housing based on inhabitants; capital are still in effect.

Material

For the materials, the big change of the transition is really visible. Through investments in education modular design is promoted. Also, the transition to bio-based materials gets its last push to really be imbedded in this industry. 60% of materials used in new constructions should be bio-based. By the end of 2050, the word "waste" should not exist anymore. All materials are monitored and stored to be used when they are needed.

Energy

In this phase the least vulnerable neighbourhoods are enabled to connect to the smart grid. This will mean that a lot of housing with an energy label of C or lower will gradually become energy neutral. Energy poverty is combeted while energy waste is minimised. The biggest transition in this phase is the establishment of the regional hydrogen powerplant. The current natural gaslines can be reused to distribute this electricity towards the dwellings.

Conlusion

In 2050, affordable and adequate housing is established in inner, redevelopment areas and brownfields of South Holland. The prioritisation of urban redevelopment due to social vulnerability and material and energy performance of buildings has led to creating a better living environment. The regenerative and stable construction labour market creates an inclusive job transition. Renewable raw materials like biobased materials are implemented on the regional scale and building waste is monitored and fully recycled. An optimal material use is therefore reached. A fair energy is guaranteed due to the fair access to low carbon renewable resources of the smart grid.

For a more detailed overview of the maps, see appendix.

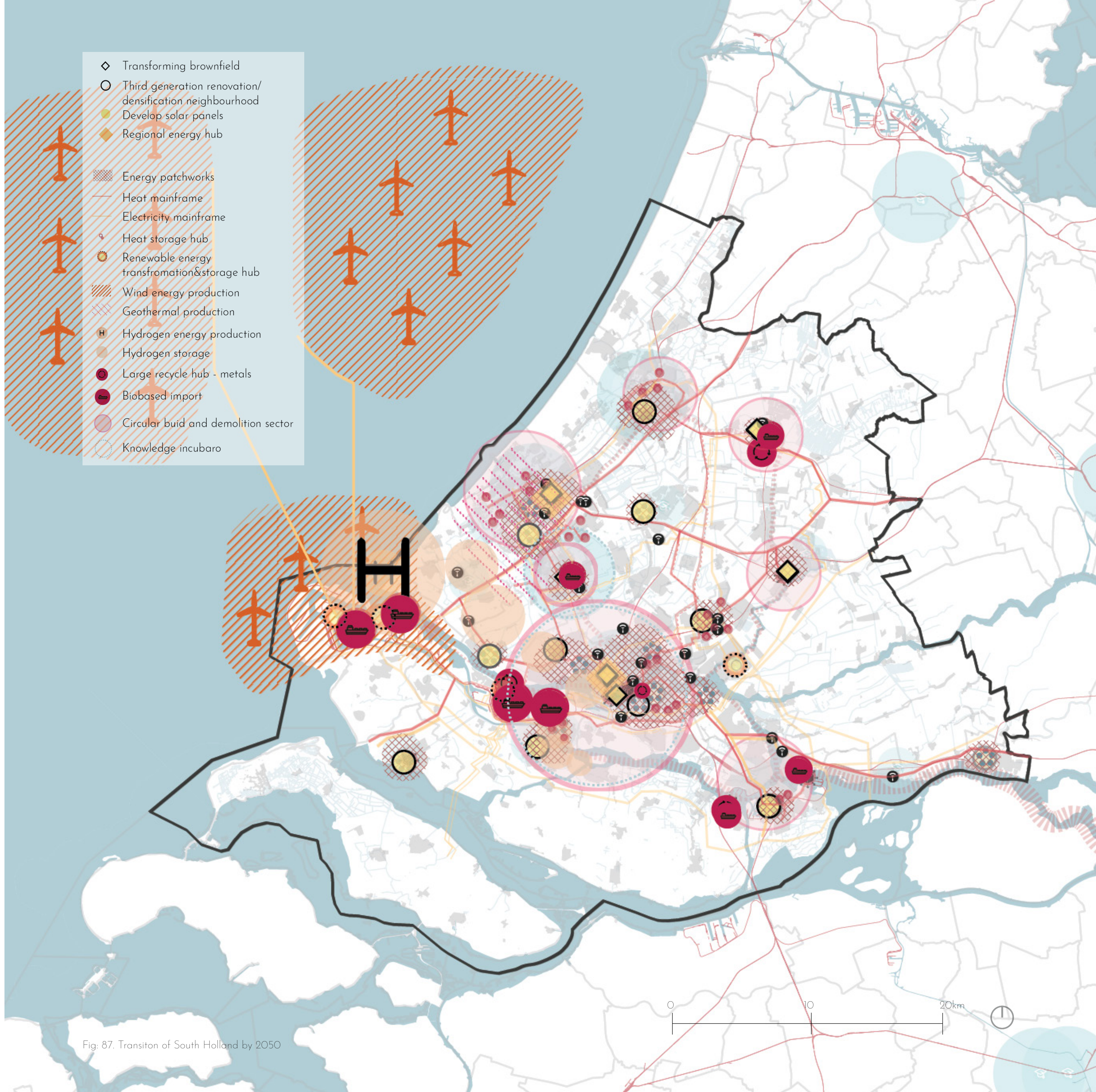


Fig. 87. Transiton of South Holland by 2050

5.4 Key Location: South Rotterdam

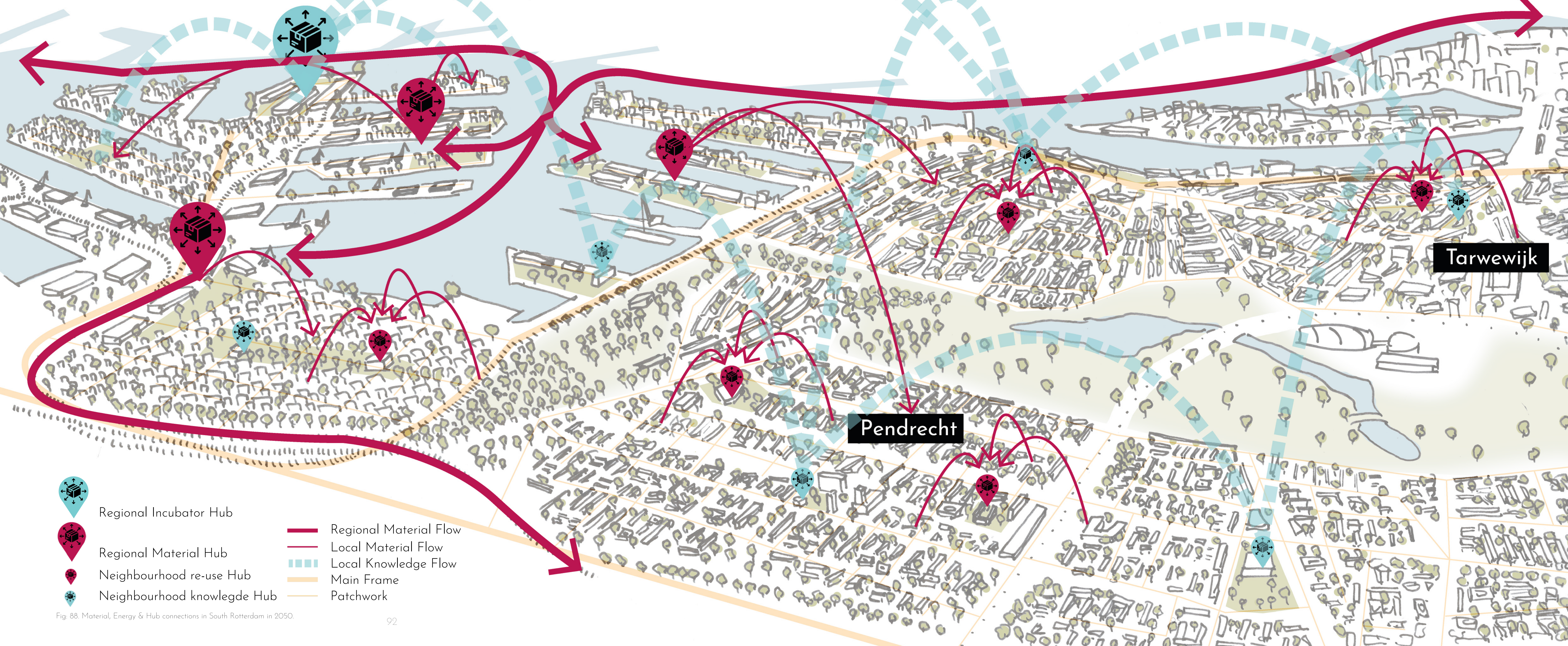


Fig: 88. Material, Energy & Hub connections in South Rotterdam in 2050.

5.4.1 Phasing and Stakeholders

South Rotterdam is a key location of this strategy. It is an area by the port that combines a variety of different urban qualities, malfunctions and potentials, that currently brings out a negative impression to the outsiders. The access to the port, the vulnerable neighbourhoods during the transition, the sufficient space for the regional hubs to evolve as an active part of the city are all strong assets of Rotterdam South.

The creation of the hubs in the port area plays a crucial role in our strategy as they function as the missing link of the urban environment of South Holland Region and the port. This necessary link has the power to be used to increase the liveability of the area, attract more levels of higher education, innovation companies and form a material storage and distribution centre to the renovated areas close by. This variety of actions through scales that can be applied in the area have the potential to create multiple level synergies across the different hubs and urban areas that will be transformed.

Due to the construction of Maasvlakte 2, city harbours such as the RDM site will become vacant creating space for reorganization and renewal. Especially for the area of Heijplaat, this transformation has already started with innovation being the key theme of the redevelopment.

As it can be read in the area's website, in the coming decades, the municipality of Rotterdam and the Port of Rotterdam Authority are expected to 'work with market parties to realize special, innovative living and working areas in the city ports area' (RDM Rotterdam, n.d.). The focus is already visible through the attraction of numerous educational facilities and research companies that focus on new technologies.

This is seen as a great opportunity to strengthen the potential synergies between them. In that sense, different aspects of the transition can be tested and further developed and upscaled in the surrounding area. For instance, the coexistence of the architecture school (Rotterdamse Academie van Bouwkunst) with the technical college that focuses on the practical applications of the built environment calls for a coordination. At the same time, the RAMLab research institute explores material properties which, together with the Innovation Center for Sustainable Building, can accelerate the transition. Also, IoT Academy that specialises on the innovative technology of Internet of Things can lay the groundwork for the advance of smart grid solutions. All these can be applied in the empty plots that have arisen due to the relocation of the port. In that way, the area can act as a case study setting the paradigm for new developments in the future.

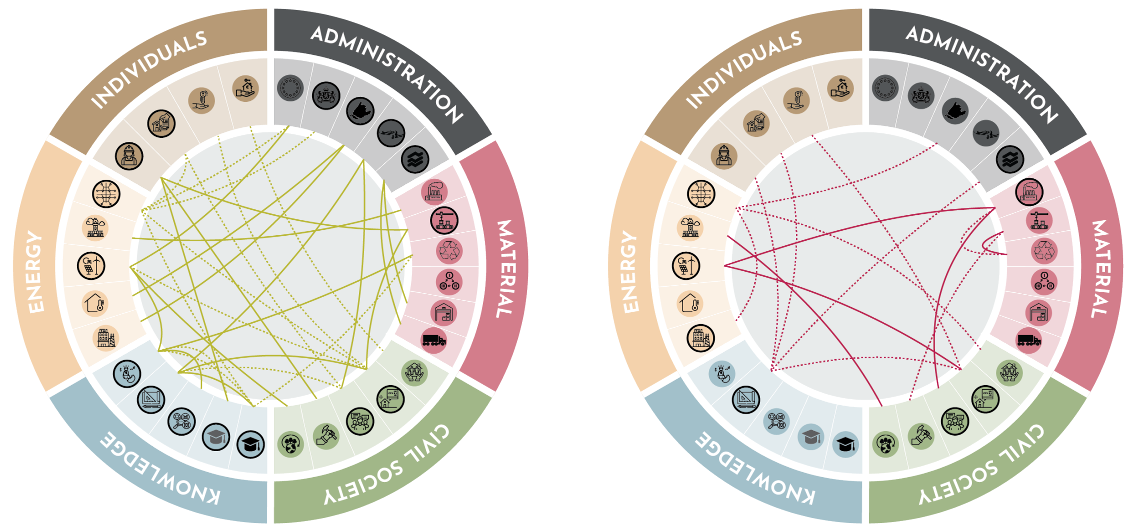


Fig: 90. Stakeholder Analysis diagram South Rotterdam.

- key actors
- current synergy
- potential synergy
- current conflict
- potential conflict

Material
- Materials Manufacturers
- Construction and Demolition companies
- Recycling companies
- Logistic companies
- Storage companies
- Transportation companies

Civil society
- Housing Associations
- Housing Developers
- Community initiatives
- Workers unions
- Environmental Organizations

Knowledge
- Universities
- HBO and MBO
- National Research Institutions
- Urban planners, archi-tects, engineers
- Incubator Makers Industry

Energy
- Electricity Network
- Heat Network Companies
- Renewable Energy Companies
- Fossil Fuel Companies
- Smart Grid Companies

Individuals
- Tenants in social housing
- Tenants in private sector
- Private owners
- Workers in C&D

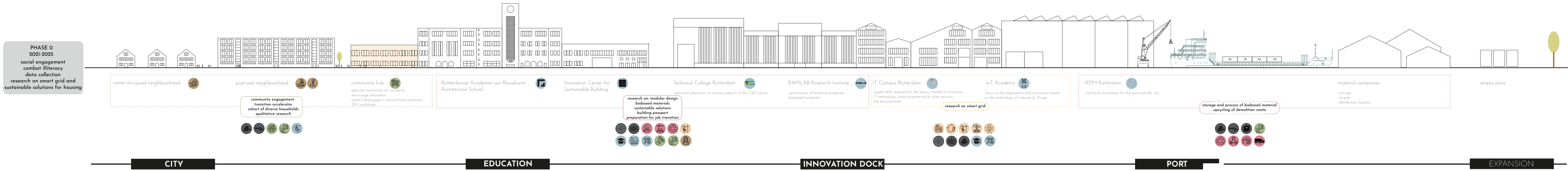


Fig: 89. Systemic Section of South Rotterdam, current situation.

Phase 1: 2025-2030

The first phase of the area is all about transforming the most vulnerable areas during the transition, Tarwewijk, Carnisse and Zuidplein, testing concepts and ideas to apply them in a greater extent during the given timeframe and set the milestones for the crucial infrastructure during the path to circularity and sustainability of the area.

The first neighbourhoods to be transformed are the areas that combine a high concentration of low-income households with low energy label buildings and low liveability environment and therefore form the most vulnerable cluster during the transitions. They are the first and most challenging to transform their building stock to create an energy neutral cluster, through renovation, densification and patchwork creation. These actions will also enable the area to connect to the main frame and thus enable the residents to become prosumers, consumers or producers of renewable energy based on their current needs.

During this phase, the first hubs are created. The neighbourhood hubs of the aforementioned areas that are dedicated to the highest levels of circularity (repair and reuse) on a neighbourhood scale are tested. These hubs combine the material and knowledge essence as they form a new kind of community space where residents are also getting prepared and active during the changes happening around them. Another equally significant role of the larger scale hubs is the pilot program of Heijplaat to test the modular building design with energy neutral materials. This pilot project is strongly connected with the Incubator Hub and the Education Hub, dedicated to ensuring that low education people with vulnerable jobs will be prepared to adapt to the future needs of the housing market.

Existing community center
Existing recycling companies
Neighborhood reuse hub
Neighborhood knowledge hub
Renovation + Densification
Collective energy production and consumption
Patchwork creation
Mainframe expansion
Transformation neighborhoods +Increase of livability
Architecture school students and practical education workers can see in practice the new housing development.
-education on new techniques
-test of new materials and modular design
-research on collective energy production
Large scale hub creation

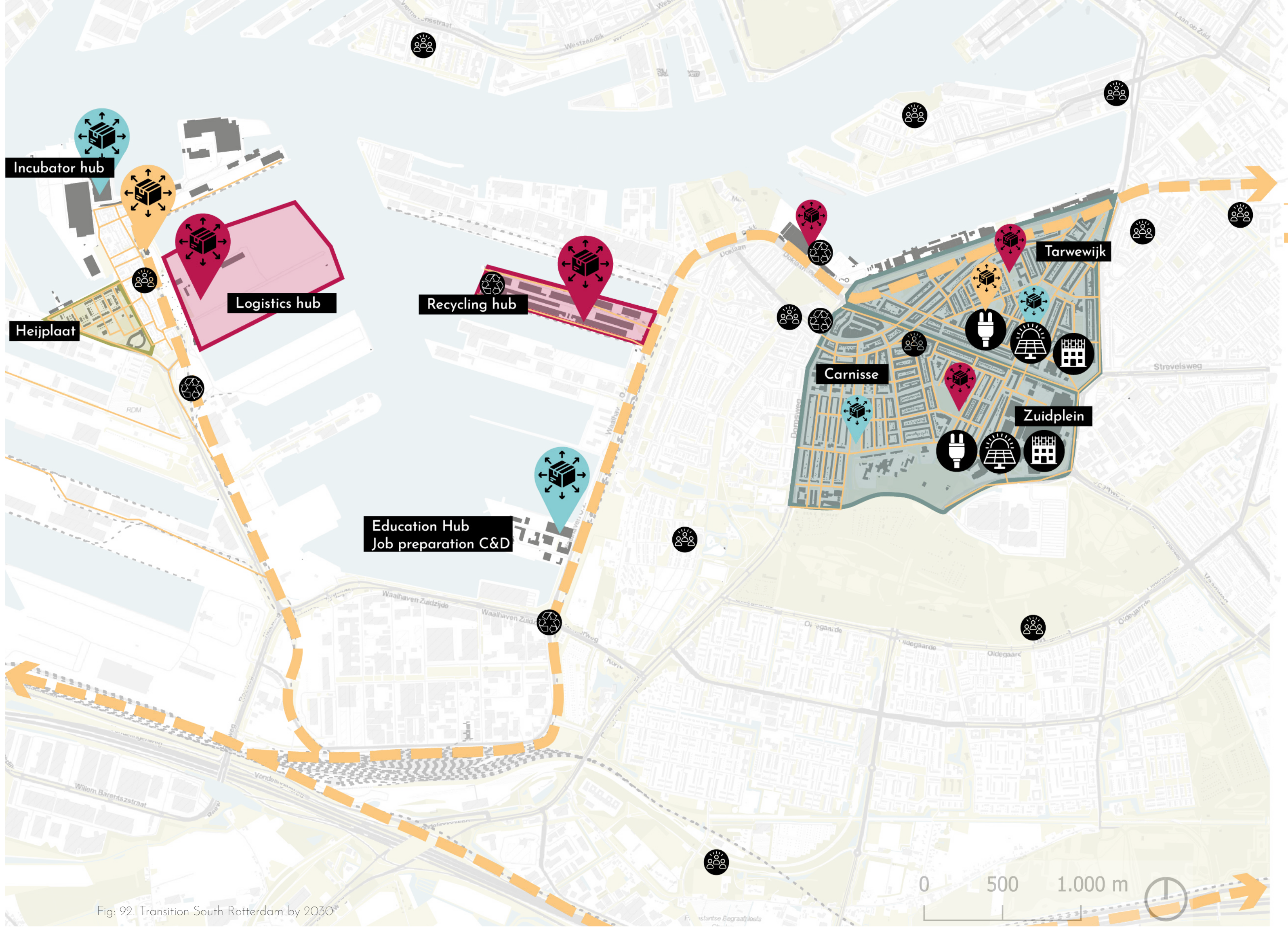


Fig. 92. Transition South Rotterdam by 2030

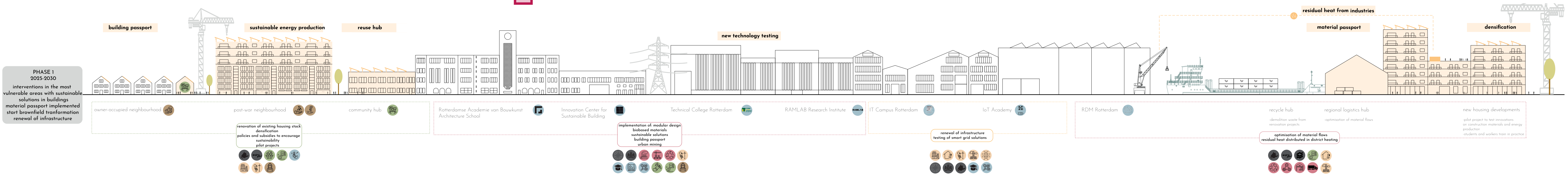


Fig. 91. Systemic Section of South Rotterdam in phase 1.

Phase 2: 2030-2040

Phase two is the time to ensure that everything works efficiently during phase one and adapt to any malfunctions that occurred during the previous period. Now that the transformation principles were applied in the smallest and most vulnerable neighbourhoods during the previous phase, they are now applied to the next in line areas, Pendrecht and Zuidwijk. New neighbourhood hubs are arising in these areas and the regional logistics hub has been created to regulate all the incoming and outcoming flows. As the hubs are growing new residential areas are also built around them based again on sustainable and circular principles that have been tested in Heijplaat.

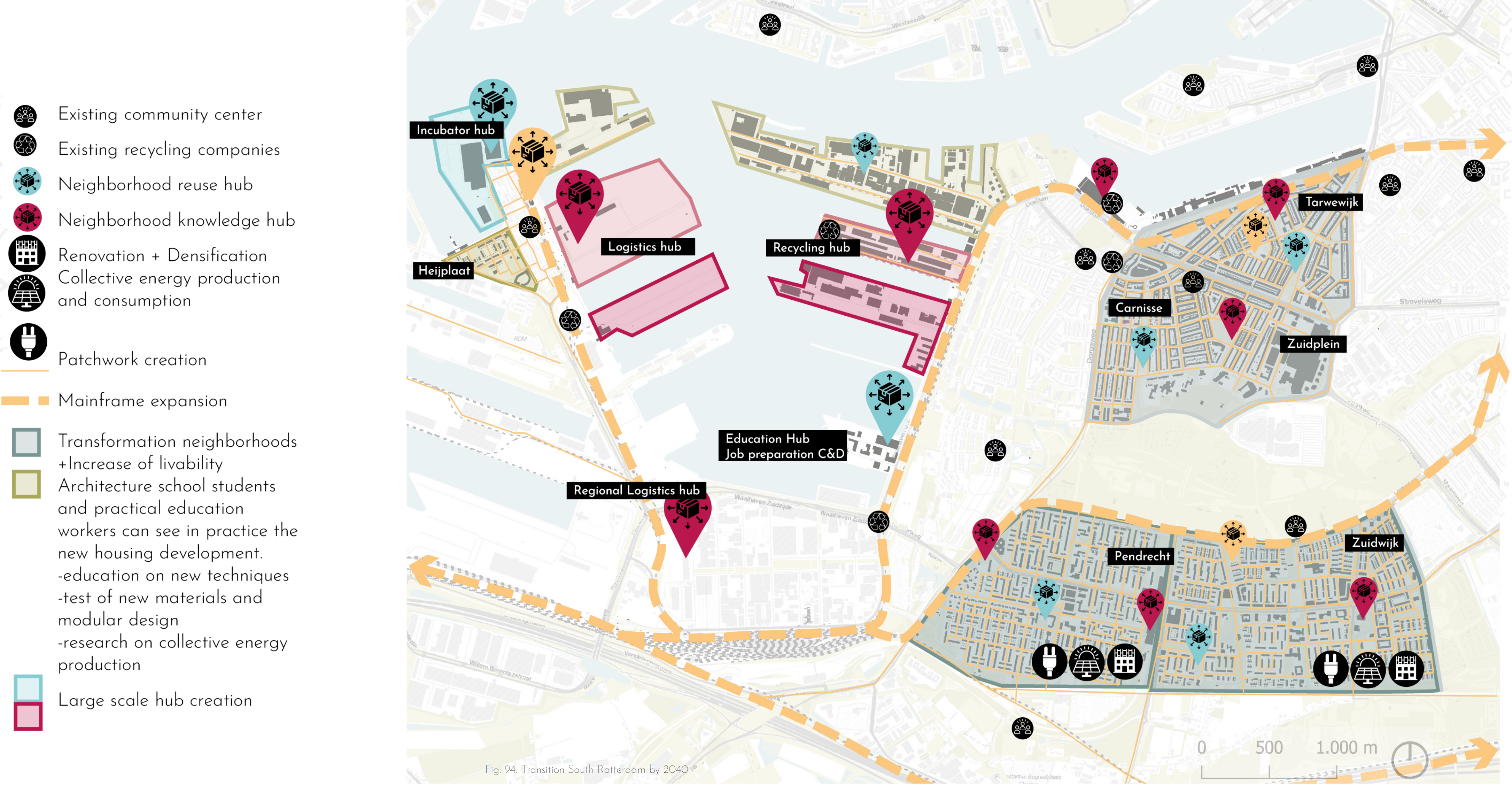


Fig: 94. Transition South Rotterdam by 2040

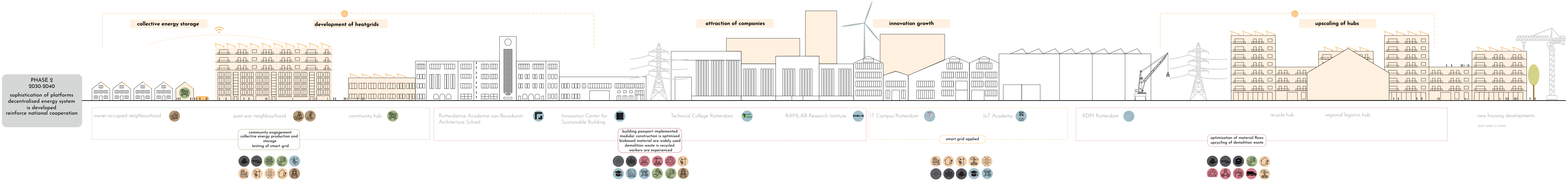


Fig: 93. Systemic Section of South Rotterdam in phase 2

Phase 3: 2040-2050

During this phase, the complexity of the whole area's transformation is visible. The interscalar synergy network among the hubs and the neighbourhoods that was gradually created during the previous phases is now sharpened through the remaining transformed areas and the hubs growth. The neutrality of each area in relation to their connection with the main grid has also created a decentralised, flexible and easily adaptable energy network. All these new characteristics of South Rotterdam have transformed the negative image of the area and created a built environment able to adapt to the constantly changing needs of its society.

Existing community center

Existing recycling companies

Neighborhood reuse hub

Neighborhood knowledge hub

Renovation + Densification

Collective energy production and consumption

Patchwork creation

Mainframe expansion

Transformation neighborhoods +Increase of livability

Architecture school students and practical education workers can see in practice the new housing development.
-education on new techniques
-test of new materials and modular design
-research on collective energy production

Large scale hub creation

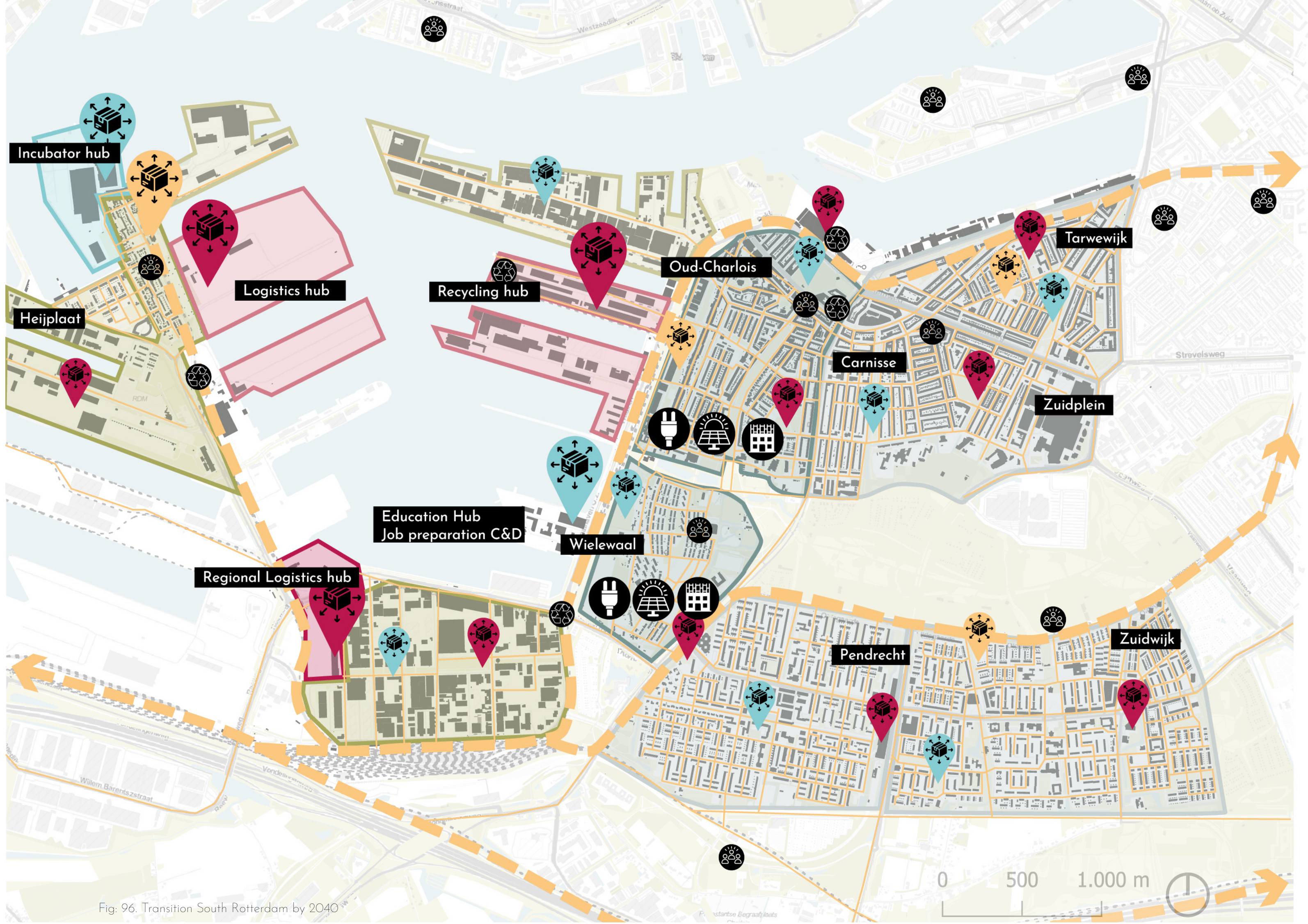


Fig: 96. Transition South Rotterdam by 2040

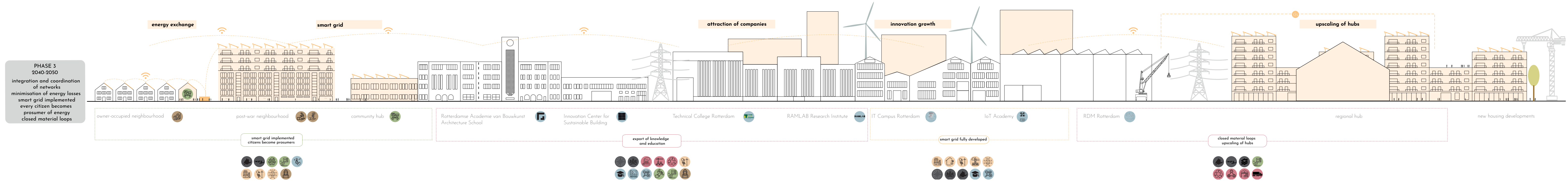


Fig: 95. Systemic Section of South Rotterdam in phase 3

5.4.2 Transformation Principles

Tarwewijk

Tarwewijk is a neighbourhood in South Rotterdam which represents a building typology often ranked as a contributing factor to a low liveability. Other similar places are Laakkwartier and Schilderswijk in the Hague and also Blijdorp in Rotterdam. The renovation and densification principles showed to the right could also be applied over there.
Figure 97 illustrates renovation and densification principles that can be applied in the aforementioned areas. The central role of the neighbourhood hub is also highlighted.

1. Adding Solar Panels
2. Shared Battery
3. Adding additional levels
4. Renovating with bio-based insulation
5. Neighbourhood knowledge hub

Fig: 98. Current situation Tarwewijk, photo from Google Maps.

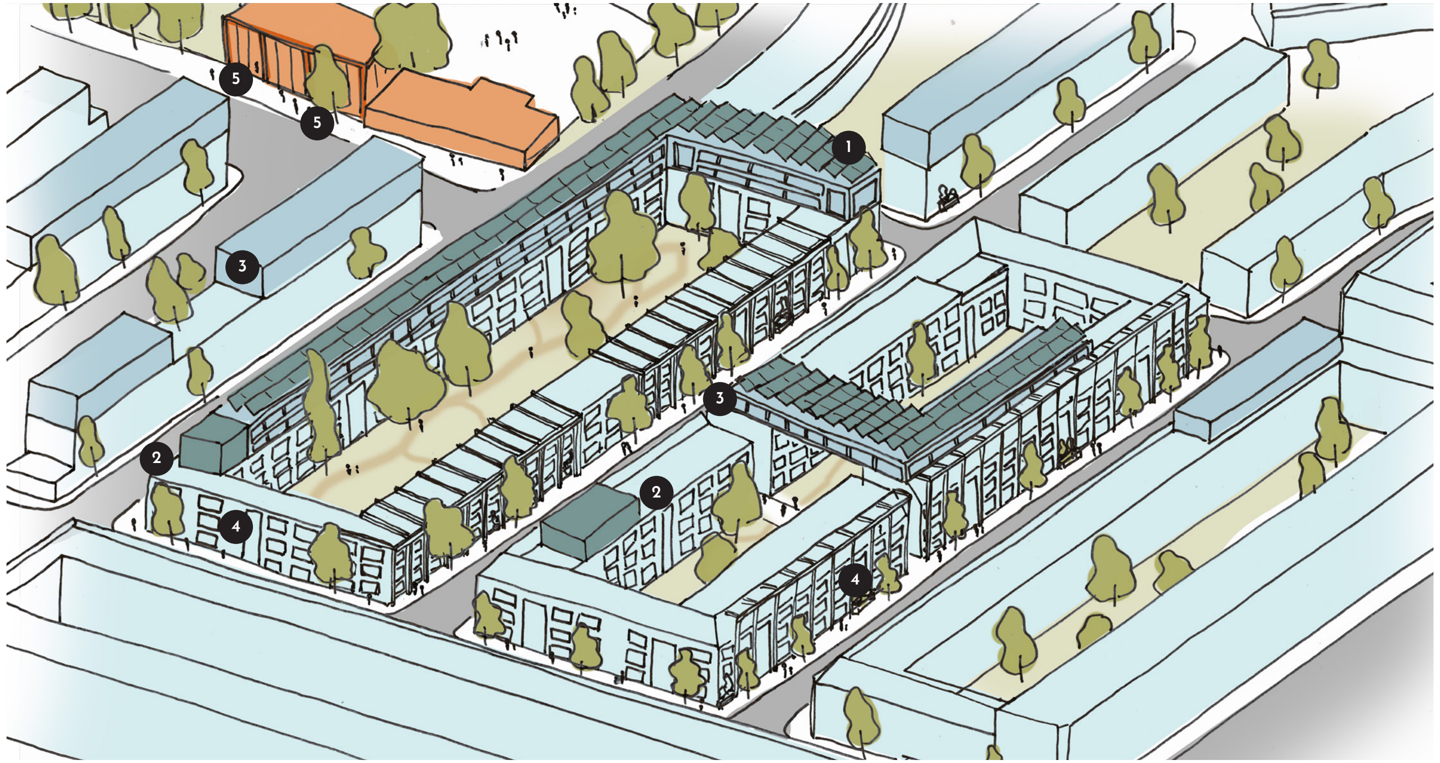


Fig: 97. Renovation Principles Tarwewijk

Fig: 99. Ambiene Image Knowlegde Hub in Tarwewijk 2050, traced from Google Maps.

Pendrecht

Pendrecht also lies in South Rotterdam. Figure 100 showcases the transformation principles of the area. This part of Pendrecht consists of mainly post war buildings. Similar areas which can follow these principles are: Fortuinwijk (Leiden), Muziekbuurt (Rijswijk), Nieuwland (Schiedam), Sterrenkwartier (Spijkenissen) and Wielwijk (Dordrecht).

1. Adding Solar Panels
2. Shared Battery
3. Car park Battery-backup
4. Adding additional levels
5. Renovating with bio-based insulation
6. Activate plinth
7. Adding activities on ground level
8. Newly built building to use space efficiently
9. Neighbourhood re-use hub

Fig: 101. Current situation Pendrecht, photo from Google Maps.

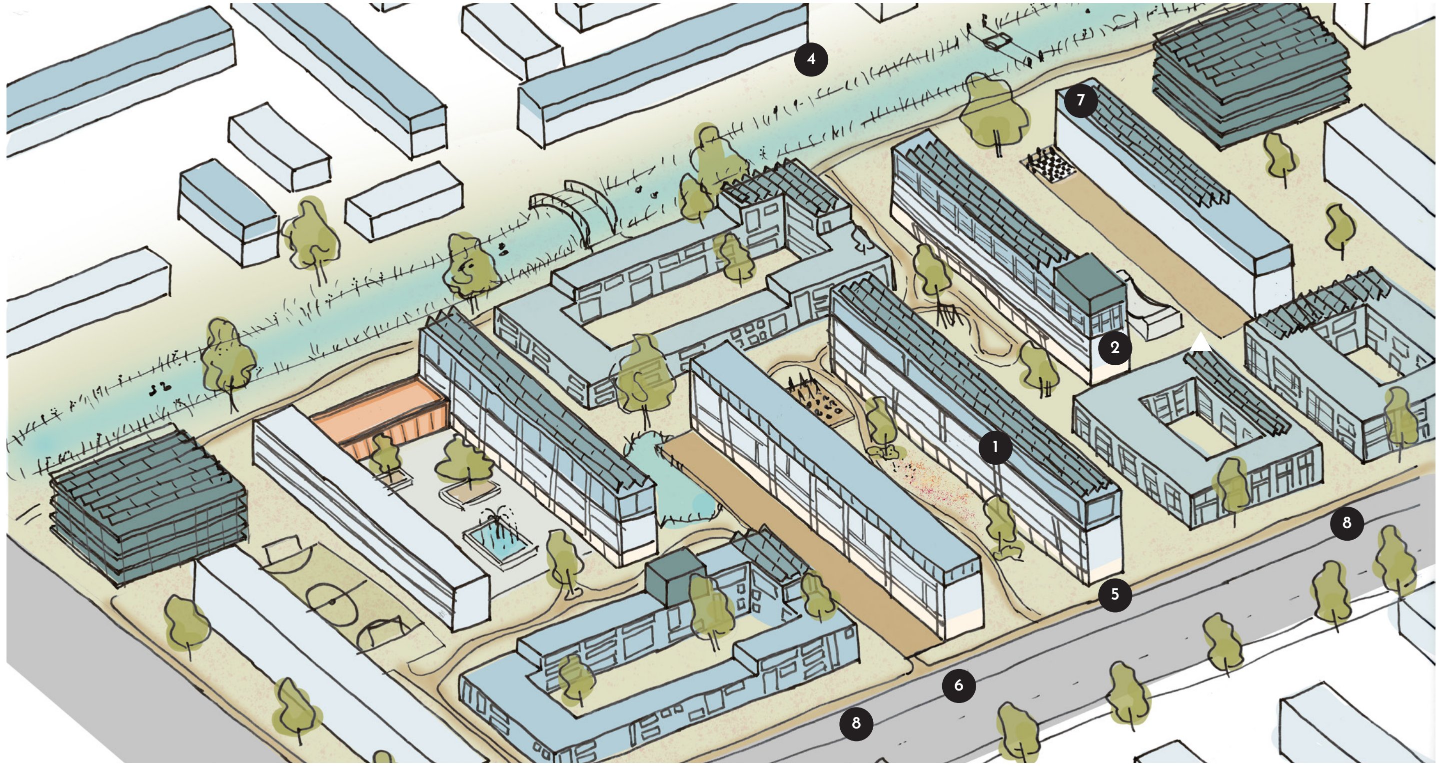


Fig: 100. Renovation Principles Pendrecht

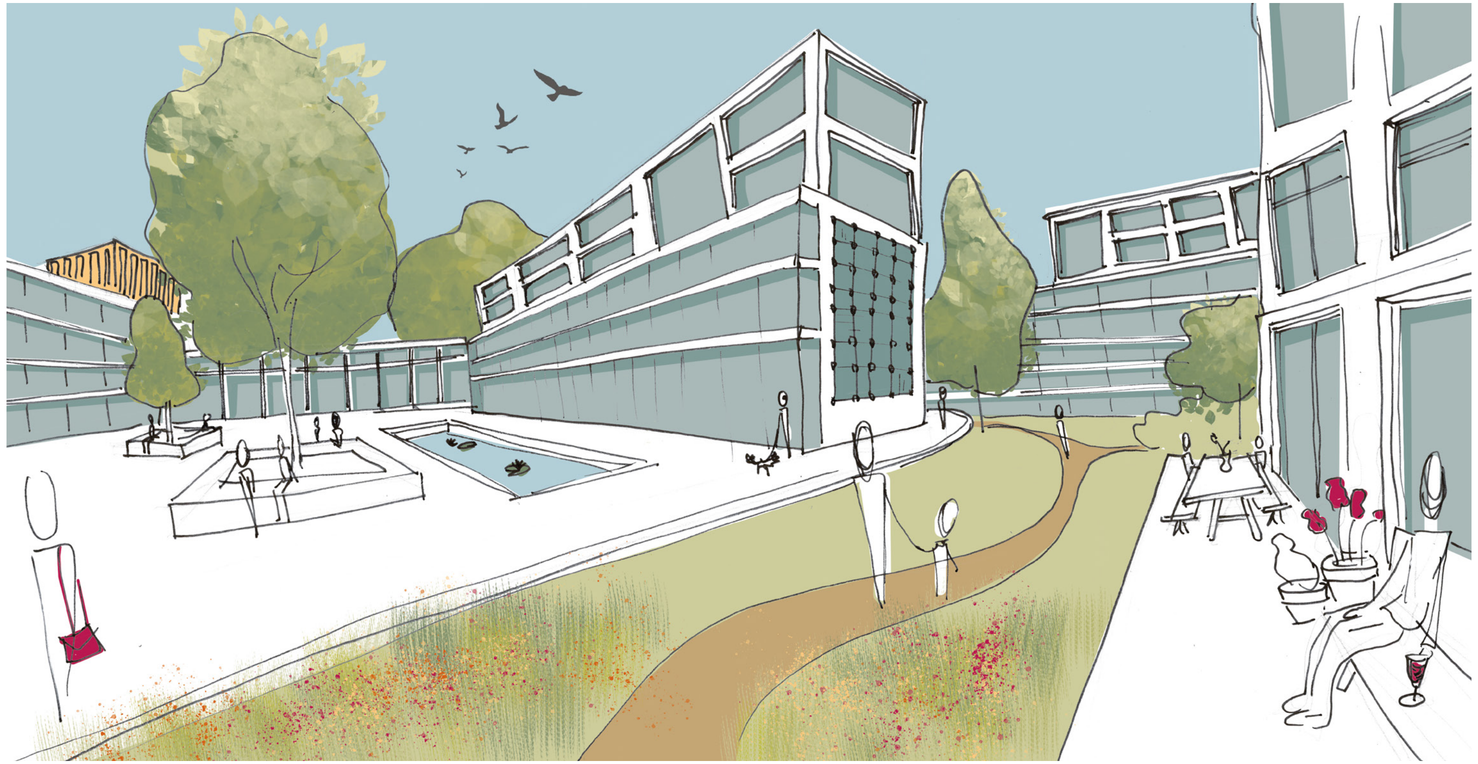


Fig: 102. Ambiene Image Pendrecht 2050, traced from Google Maps.

Heijplaat

Heijplaat could serve as an example on how to make those municipality or regional scale hubs add value to its surroundings. These big scale hubs could also include some new residential buildings so that these areas do not become vacant during the evening. They should also add some recreational routes or other activities for inhabitants should be added. In this way the inhabitants will also get more involved with the circular economy and can contribute to it more.

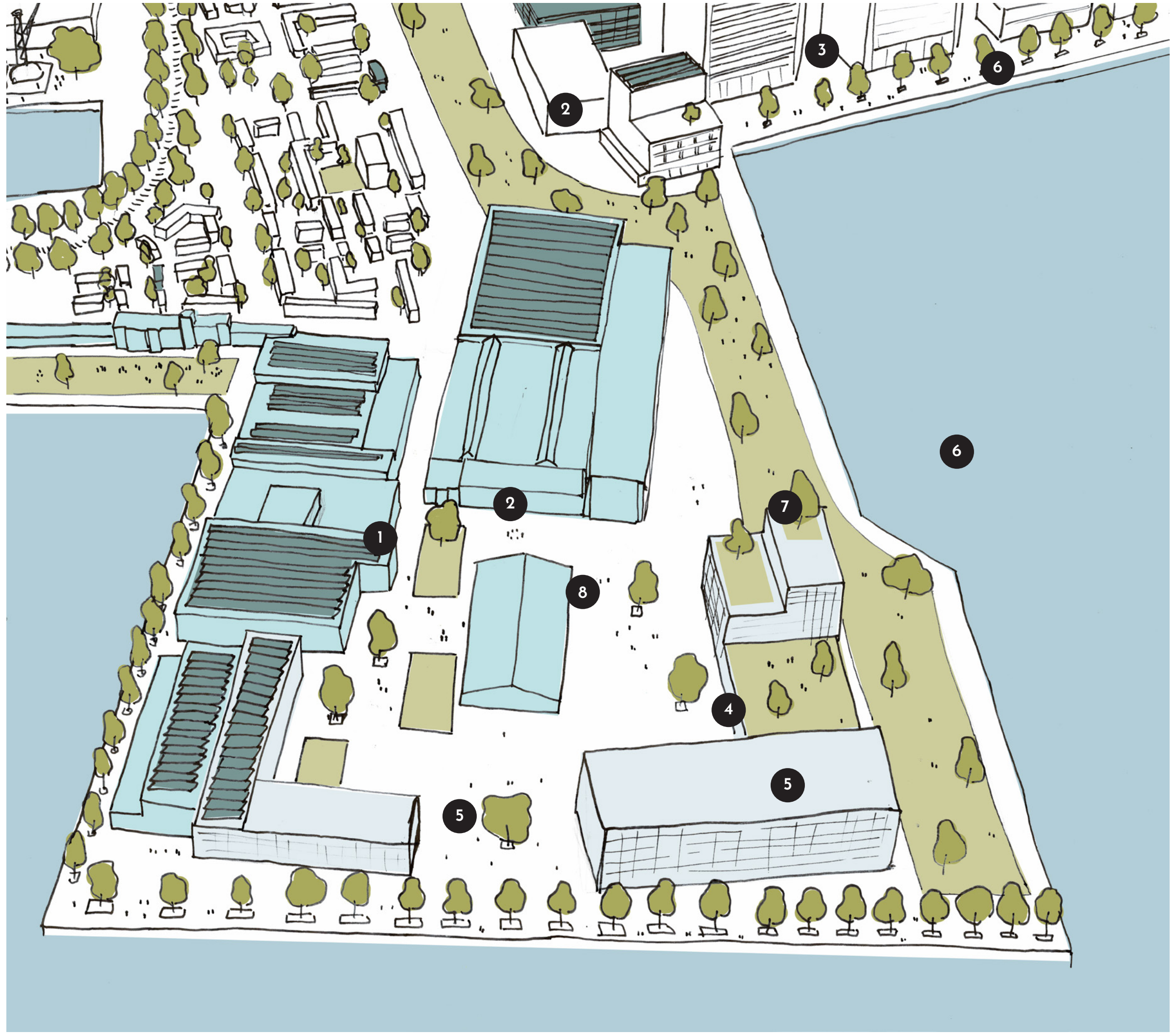


Fig: 103. Transformation Principles Heijplaat

1. Adding Solar Panels
2. Shared Battery
3. Car park Battery-backup
4. Circular exhibiton space
5. New space for circular companies and start-ups
6. Added functions: residential & facilities
7. Lecture rooms
8. Restaurant & Café with terrace

Fig: 104. Current situation Heijplaat, photo from Google Maps.

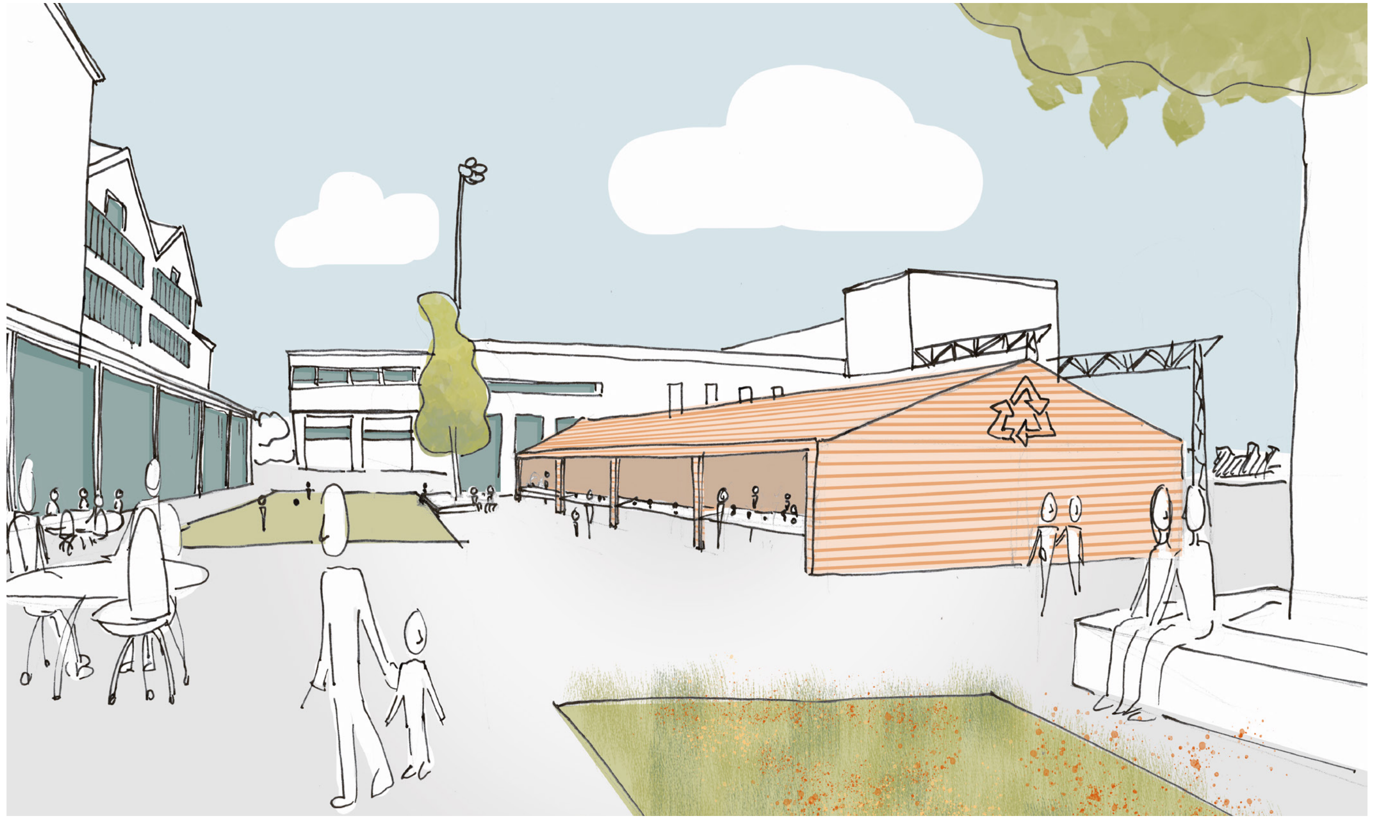


Fig: 105. Ambiene Image Incubator Hub Heijplaat in 2050, traced from Google Maps.

5. Conclusion & Reflection

Fig: 106. Photo by Vyacheslav Koval on Unsplash

6.1 Group Reflection

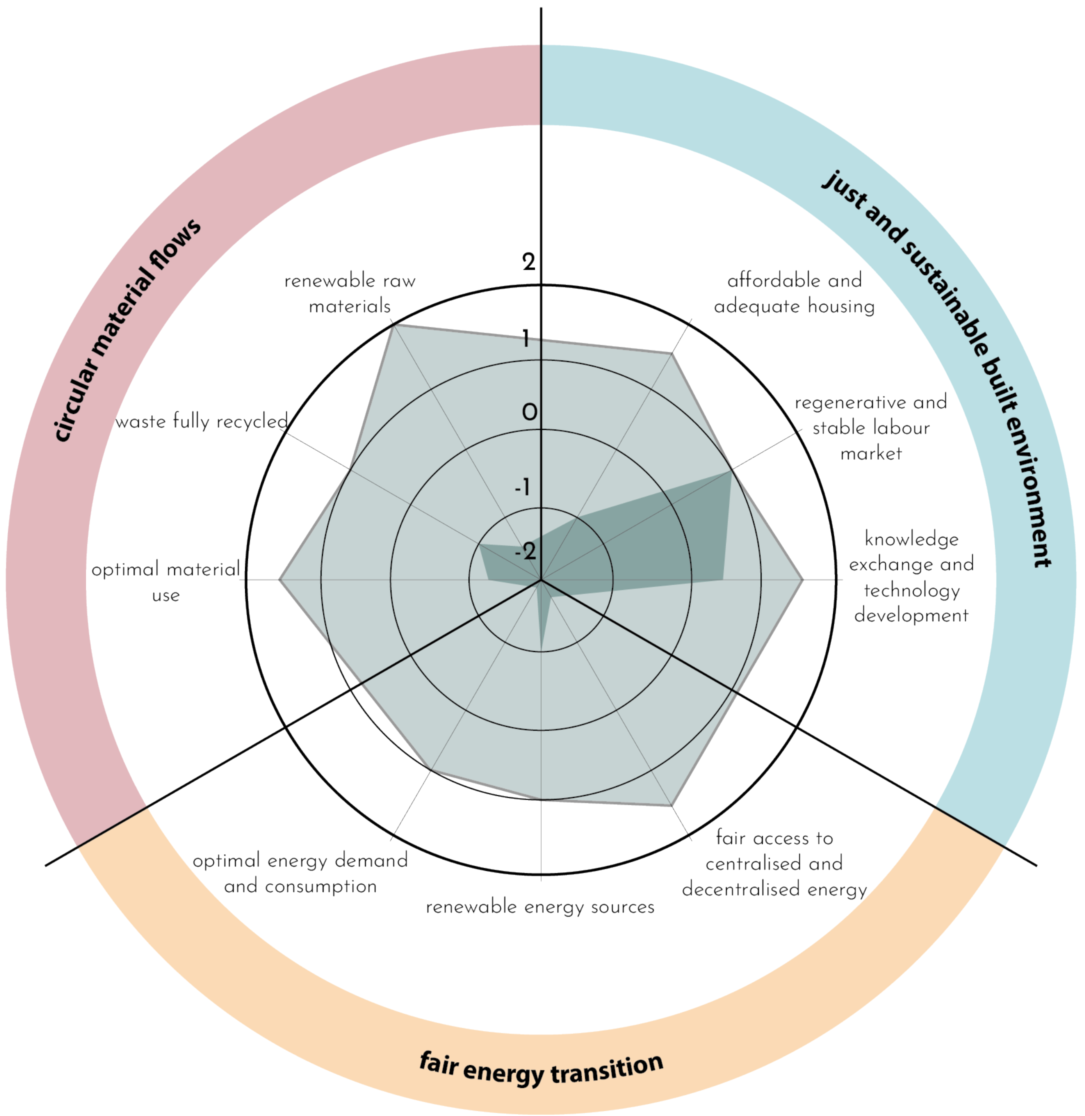


Fig: 107. Goal Assessment

In order to reflect on the project, an assessment is made to criticise the outcomes of the project. The assessment is based on the quantitative approach of BREEAM (BREEAM, n.d.) This assessment gives an overview of the impact of "Building a Fair Transition" on the goals formulated in the beginning of the report (p. 52). The strategy proposed in this report tried to achieve all goals in a positive way, but not all of them are improved in the same way. Each goal is explained by the assessment of its subgoals.

Just and Sustainable Built environment

One of the main subgoals was to have affordable and adequate housing. At the moment there is a clear shortcoming in housing. This has an effect on the availability of housing for people with a lower income. Through proposing the idea that all municipalities should invest in what the capital of people who are looking for housing is, they can secure this when talking with housing developers. This way more affordable housing will come to the market. Through making brownfields accessible for new residential areas and by densifying the transformation areas, a lot of houses will be added until 2050. The demand of 210.000 new houses by 2040 might be indeed challenging but if we apply the principles stated in this report, the goal can be approached further and also in accordance with the circular economy.

Fair Energy Transition

One of the subgoals is fair energy access. Through rising public awareness, they will fulfil the energy transition. The energy poverty is an issue that needs to be tackled immediately in South Holland. Without ensuring that all households are included, the energy transition is halted. Through centralised and decentralised systems, people are more in charge of their energy consumption. The establishment of the smart grid though can revolutionise the built environment. Giving inhabitants the ability to actively participate in the system and become prosumers of energy leads to the democratisation of energy. The detailed organisational structure of the smart grid in practice is recommended for further research.

By prioritising interventions in low income, and low energy label households, equal accessibility is further secured.

The Netherlands is already on the right track compared to other European countries, concerning renewable energy resources. However, the amount of renewable energy should be upscaled to a big extent. The transition from fossil fuel sources to renewable ones is required. The advance of smart grid sounds futuristic at the moment since there are not well applied and organized networks to regulate energy use to its optimum. This research has a contribution to the integration of circular material flow and social justice to the document of the Smart Multi Commodity Grid (2018). However, some ethical concerns about the smart grid have already been raised. Although we have taken the end-user into account, it is recognised that concerns about accessibility should be futher explored. (Milchram, Künneke, Doorn, van de Kaa, & Hillerbrand, 2020)

Circular Material Flow

For renewable raw materials, or bio-based materials, there will be some policies applied which should give this industry a boost. In order to achieve a fully circular material flow, importing of biobased materials should be minimised by producing locally a certain amount. However, the strategy does not propose a location on where to grow these products. The possibilities of biobased material production in the province for the construction and demolition sector should be reseached further.

When it comes to waste, South Holland already recycles some small percentages of it. It is crucial that demolition waste, as well materials, are treated differently. Through the building passport, and the material re-use hubs, waste will be re-used or recycled. An optimal material use can decrease demolition waste. Through stimulation the knowledge and use of modular building technologies materials will be made in a way they can be re-used and reconfigured for generations to come.

We hope that our project could provide fruitful insights and inspirations for projects in the future.

6.2 Conclusions

This design projects aims to find the answer to the question: How could the energy and material demand for the growing housing need of South Holland be integrated into a circular economy model, to create a just built environment for all?

In the current situation, the province contains spatial inequalities in the current energy landscape, like the minor use of low carbon, renewable resources, and the current low energy performance buildings. Prospects of low carbon renewable energy sources serve future generations as they can provide to more circular and decentralised systems to neighbourhoods. With the introduction of the smart grid, people are part of self-sufficient patches for their energy needs while still depending on a reliable mainframe.

Concerning the current material flow, building materials are degraded in value after the end of their lifespan. Due to the scarcity of these materials this creates unjust phenomena for future generations. Alternative ways of tackling the unjust availability are innovative ways of building, like modular building and building with biobased materials. If the job transition to these innovative ways of building is done fair, the material use will be optimised while guaranteeing a fair job transition in the construction and demolition sector.

In 2050, affordable and adequate housing is established in formerly deprived, inner redevelopment areas and former brownfields. The prioritisation of urban redevelopment is based on the social vulnerability and material and energy performance of buildings. This has led to creating a better living environment. The generative and stable construction labour market ensures a just way of job transition. Due to the upscaling of knowledge exchange hubs on multilevel scale, capacity building is done to transit to a circular built environment. Renewable raw materials like biobased materials are implemented on the regional scale and building waste is monitored and fully recycled. An optimal material use is therefore reached. The smart grid permits fair accessibility to low carbon renewable resources. Through the democratisation of energy, social upscaling is approached. Gentrification is prevented by ensuring a socio-economic mix of population in the neighbourhoods without forcing the population to displacement.

6.3 Individual Reflections

Hannah Bos
4698622

When working on Building a Fair Transition the complexity of regional design unfolded itself to me. The interdisciplinary practises to take into account and our task to make it spatial, is a big puzzle in which it came quite clear that there will always be people in a disadvantage because of it.

Something what made this project easier than it would be in real life, is that all of the group members had the same values. In real life we would deal with a lot more people from different disciplines with different interest. These parties would also have more power inside the process than the vulnerable households we focussed our project around. This fact would make the process even more complex than it was right now and would have resulted in a different strategy.

But with this in the back of our minds comes the one tool that makes it possible to prove that your (social) viewing point could be of enormous relevance: research. Through thorough research you can have proof of your ideas and can persuade people into your direction. This is why doing research is so important during the design process. Especially whilst working with so many stakeholders.

Through research we found out that a lot of people are in a disadvantage of the linear economy and that there are a lot of ways to prevent this and change to a circular economy. But by keeping our main focus on social justice and a fair transition, a really difficult layer was added. This is because all transitions will have winners and losers so there isn't really something like a fair transition. For example: big companies who are very important for the economy would have to shrink or invest a lot into changing. The whole way of how the governance is structured would have to change whilst pursuing this strategy. The government should gain influence over the market. Like telling the housing developers what kind of buildings they should build or rising taxes on fossil fuels. Again making the companies, thriving in our market driven society, losers inside this strategy.

When designing on this scale there is no right or wrong. But decisions should be based on evidence and if we are striving to transforming to a fair circular economy the whole way of how our society is structured should change with it.

Leto Demetriadou
5384052

This relatively short period of time for such a complex task was enough to make me realise the complexity of a regional vision and strategy process. The current pandemic has influenced our priorities, but also the way we perceived the input from the courses. The most essential aspect of the built environment are all the people within it. Therefore, throughout our project we tried to have justice as a guide to find evidence and locate, evaluate and eliminate current and potential inequalities. Inequalities that already exist for the current and future generations, or they might appear during the energy transition and the process to meet the extreme housing demand of South Holland in such a short timeframe. Through this process we aimed in envisioning the recreation of a fair and inclusive built environment for all.

The main unconscious consequences of the transition due to its lack of considering their social impact are the inevitable job transition and the major possibility of gentrification caused from the renovation and densification process. Through the process of this course, we realised that in many cases through history transitions, intentionally or not, leave behind certain groups of people. Consequently, one of the main actors that we realized that should be empowered through this transition was vulnerable civil society groups that we located, allowing all the groups that might be neglected to be treated fairly.

In short, top-down and bottom-up approaches throughout different scales are needed for a strategy to be well grounded. The idea of hubs, supporting the renovation and densification of the existing urban areas, was a strategy that has the potential to work efficiently across scales for both the material and energy sector and all the education and innovative technology needed to support them. The hubs have also the power to drive the society in a non-technocratic state. Educating and organising the people with low skill jobs that will have to also face a job transition, is the main step towards ensuring that they will be able to adapt to all the changes. In relation with ensuring that the renovated clusters will become socially mixed areas is also a way to tackle gentrification. This task also hindered the path of tackling the energy poverty crisis. A longer process of-bottom up and top-down actions in both energy generation and transmission in a low carbon sustainable way can through our eyes lead to the democratisation of energy. This can serve as a way of people to gain power through a flexible, decentralised energy system.

To sum up, this long distance, journey has enabled me to understand a not so glamourous side of the transitions through the potential left out groups. Through this detailed process of understanding the mechanism of the built environment, setting priorities, milestones in multiple phases, we understood the importance of abstraction to reshape the complexity of the built environment in a fairer way.

Marieke van Esch
4545508

Strategic spatial planning, especially in the regional development, requires re-coupling of interdisciplinary approach between planning, design and social sciences. Thereby five themes per discipline correlate in the analysis and creation of a regional development; the disciplinary focus, understanding of space, understanding of future, outcome, orientation and work mode.

An empirical social focus of research of the past is needed in order to understand the demographic and thus social relations in the spatial context. The design focus have to formulate the design for the future (Gillard, 2021). A mental leap is needed to come to a visionary and subjective future outcome. This process is done by an option-orientated and explorative process. The vision relates to the main feature of the generic framework which you can equip as regional urban developer. It entailers the experimentation of the several domains in a conceivable visual envisioning a possible spatial outcome (Rooij et al. , 2013). This vision can set in as a tool to jump into a different work mode to realize the possible future. The mental leap of the vision is taken to the table to communicate to actors the inter-subjective, to get a sustainable transition. In the ''Building a Fair transition''-vision is stated to create a synergy between the different networks of material transition, energy transition in socio spatial setting. A substantiated transition is not possible without the encouragement of the former neglected vulnerable civil society to make the change. An organised facilitated bottom up approach is needed in order to form capacity building (Hobma, 2020). The hubs are spatial commons of the neighbourhoods to give citizens a podium to explore for them the best possibilities for making their environment more sustainable and circular in terms of energy use and material use. Housing corporations will get subsidies from the higher Administration levels like the European Union and the Netherlands governance to invest again in making their housing stock more sustainable. This will move their interest more towards building a fair transition. The plan of ''Building a Fair Transition'' adds to the planning decisions for the South of Holland to explore the social possibilities that the document of Fabrications ''Smart Multi Commidity Grid'' claims (2018).

This regional development process is also iterative since the outcomes of each planning, social science and design process have their own outcomes which will be again the new input for further options orientation in the creative process to new outcomes. In this design one option and one path to come there is explored to come to ''Building a Fair transition''. Due to the span served for the development of this report some practical questions still remain unanswered: which precise organisational ecnomical methods are needed for municipalities to let urban developers work together with housing corporations, to level the housing corporations properties?

To sum up, as a group we found an unique way to deal with certain flow transitions in regional design while recognising the social embedding of the design. I enjoyed the groupwork meetings we have and I would like to thank the tutors and my team members.

Ioanna Karadimitriou
5391830

The aim of this quarter was to understand the high level of complexity that characterises regional design. The way the course was structured gave students a lot of freedom to set the scope of their research, especially during the first weeks. As interesting this was, it has also been challenging from time to time. The interconnectedness of a plethora of aspects made it difficult to build a coherent storytelling that could be addressed wholly within the duration of the course.

The Research and Design Methodology course that run in parallel, contributed greatly to building a conceptual framework by setting important guidelines. The way research skills were interlinked and reflected throughout the design process was unique and of paramount importance for the graduation thesis next year. Also, the theoretical issues that were developed during the course, reflected the current debates in urbanism, sharpening considerably thus the project.

From the beginning of the quarter, the focus of our study was heavily inspired by the notion of justice. There has been already extensive research towards a circular economy, but little has been done to ensure that this much-needed transition is done in a fair way. Although this is mainly a theoretical term, we actively tried to recognise the spatial implications and build the narrative around it. In that sense, parallel to literature, we did a lot of mapping in order to gain an overview of the province. We soon realised that the construction and demolition sector and the demand for new housing is only one side of the coin. Of course, when building the new dwellings, radical changes should be made in the way material flows are handled. However, the social aspects should not be overlooked. The province of South Holland relies heavily on the presence of housing associations which means that a high percentage of people are low incomers. Moreover, energy poverty, in its broader sense, can be a limiting factor for the transition. In order to accelerate it, people should be given the means to improve socioeconomically. In that sense, the project paid equal attention both to top-down and bottom-up actions needed.

One could easily argue that the most futuristic part of the report is the smart grid already envisioned by the province. This could, indeed, be a solution in the context of a circular economy that embraces many aspects. Concerning justice, though, some objections, such as data governance, technology accessibility and user inclusiveness, have already been formed. Certainly, further research is needed on the feasibility of collective ownership and the effects of governance as commons in smart grid systems (Milchram, Künneke, Doorn, van de Kaa, & Hillerbrand, 2020). However, works like the aforementioned can set the foundations and provide a fruitful insight on the subject. The goal for 2050 is a challenging one but, by considering all the aspects, building a fair transition can be guaranteed.

Bowen Yuan
5334489

Regional design is a very complex and multidisciplinary process. However, thanks to the knowledge from the Capita Selecta, SDS sessions, and methodology course, we could have a comprehensive understanding of theories and methods of the regional design, then we could be guided to develop a coherent and systemat-ic design process.

In our project, I think the process of research and design is not linear and kept in a balance. In the begin-ning, we did comprehensive research to discover problems and decide on our point of concern. Through evidence-based research, we found the missing focus on the social aspect in the transition process towards circularity, like gentrification issues and energy poverty, etc. Therefore, besides the basic goals of sustaina-bility and circular economy, we regarded social justice as a steady umbrella for our design. We paid much attention to the unjust phenomena for the vulnerable groups, such as the low-incomers who suffered from energy poverty, the unemployed workers whose skills are obsolete, the public who are neglected in circular education and relevant information, and so on. Sometimes, when we were lost in researching, the design concept led us to organize and filter information. On the other time, when we thought our design was not suitable for some locations, we researched more to get inspiration.

The vision acts as a key instrument to build scenarios and tell our story. In our prospect of 2050, South Holland will reach three main goals: just and sustainable built environment, fair energy transition, and cir-cular material flows. Among subcategories of our main goals, we propose the most important goals as af-fordable and adequate housing, knowledge exchange and advanced technology, fair access to centralized and decentralized energy, and optimal material use.

Towards our vision, we developed our strategies. For example, the hubs are a key strategy in our project. We would establish multi-function hubs with multi-scale to improve the commons of the society. On the neighborhood scale, we would have all the hubs accessible to people in their daily lives. Some hubs are de-signed for every resident to recycle their discarded items and have circular education. Some hubs are creat-ed for the unemployed workers to be empowered. Some hubs are made up of the patchwork of smart-grid. Not only for the individuals, but we also include relevant initiatives, institutions, companies, and administra-tions as the user or the duty officer of the hubs. Because those hubs are built upon the existing community centers or schools, almost most of them could be built up by the end of phase 0. Like this, we also have considered multiple actors and different governance of all multi-function hubs with multi-scale, together with a timeline. In my opinion, thinking of governance and phasing makes our policies and interventions more concrete and tangible. Concerning our vision, strengthening the synergy of different stakeholders and enhancing their collaboration is vital, especially for the voice and interest of the vulnerable groups.

In my perspective, the vision-strategy method is nonlinear. To be specific, there is a dynamic interaction between vision and strategy. The vision is like a forward approach to helping us to think out strategies. In return, by developing concrete strategies, we have a further understanding of our vision. Sometimes, we go back to revise and refine our vision, making the whole story more logical and consistent.

To sum up, by learning and practice in this studio, I have got a thorough understanding of regional design and can express my insights. It is a pity that we did not have the field visit and real interviews due to the pandemic. Thus, our considerations may differ from reality and we are not able to discover all the conflicts and potentialities. At last, I appreciate my teachers and team members, who always help me.

Bibliography

Afman, M., & Rooijers, F. (2017, November 23). Net voor de Toekomst. Retrieved from Netbeheer
Nederland: https://www.netbeheernederland.nl/nieuws/resultaten-onderzoek-net-voor-detoe-komst-1204

AlleCijfers. (2020). AlleCijfers. Retrieved from Information province of South Holland:: https://allecijfers.nl/

Atkinson, R. (2003). Misunderstood saviour or vengeful. Urban Studies, 40(12), 2343-2350.

Atkinson, R. (2015). Losing one's place: Narratives of neighbourhood change, market injustice and symbolic displacement. Housing, Theory and Society, 32(4), 373-388.

Atlasleefomgeving. (2016). Zonpotentie. Retrieved from https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/b7d2fd24-8cd8-4965-a997-69eb1a987b5a

AtlasLeefomgeving. (2018). Bouwjaar panden (BAG). Retrieved from nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/6b-8c934b0324-479e-8b8d-f3912eb1ca68?tab=general

Bet, E., van Meijel, T., & Hinterhur, H. (2008). CH verkenning Rotterdam Zuid. Retrieved from elsbet: https://www.elsbet.nl/dl/CH%20verkenning%20Rotterdam%20Zuid.pdf

Blijstroom. (n.d.). Blijstroom energie voor optimisten. Retrieved from Blijstroom: https://blijstroom.nl/

Boeck, S. (2017). Making space for a more foundational economy: The case of the construction sector in Brussels. Elsevier, DOI: 10.1016/j.geoforum.2019.07.011.

Borenstein, S., & Davis, L. W. (2016). The Distributional Effects of US Clean Energy Tax Credits. Tax Policy and the Economy, 30, 191-234.

Boterman, W., & van Gent, W. (2014). Housing. Tijdschrift voor economische en sociale geogra-fie, 105(2), 140-160.

BREEAM (2021) BREEAM: Sustainable assessment model. Retrieved from BREEAM: the world's leading sustainability assessment method for masterplanning projects, infrastructure and buildings - BREEAM

Buurtman. (n.d.). Buurtman werkplaats. Retrieved from Buurtman: https://www.buurmanrotter-dam.nl/

Carley, S., & Konisky, D. M. (2020). The justice and equity implications of the clean energy transition. Nature Energy, 5, 569-577.

CBS. (2017). Monitoring warmte. Retrieved from Nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/3EE3A218-BBD4-41EF-8854-16CC72203296?tab=general

CBS. (2020, March 05). Sharp rise in green electricity production. Retrieved from https://www.cbs.nl/engb/news/2020/10/sharp-rise-in-green-electricity-production

CBS. (2020a). Wijken en buurten. Retrieved from nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/88a337a9-bed3-4d79-80fa-ff4b45990d7d?tab=general

CBS. (2021, March 22). CBS. Retrieved from Biggest house price increase in almost 20 years: https://www.cbs.nl/en-gb/news/2021/12/biggest-house-price-increase-in-almost-20-years

Davidson, M. (2009). Displacement, space and dwelling: Placing gentrification debate. Ethics, Place and Environment, 12(2), 219-234.

De Zwarte Hond &CO-URB. (2017). Discussienota Verstedelijking Provincie Zuid-Holland Koers en Inzet. Retrieved from https://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=we-b&cd=&ved=2ahUKEwjzj5f4mML
vAhUN16QKHcBlAaQQFjAAegQIARAD&url=https%3A%2F%2Fwww.zuid-holland.nl%
Doucet, B. (2013). Variations of the entrepreneurial city: Goals, rules and visions in Rotterdam's Kop van Zuid and the Glasgoq Harbour megaprojects. International Journal of Urban and Regional Research, 37(6), 2035-2050.

Doucet, B., & Koenders, D. (2017). 'At least it's not a ghetto anymore':. Urban Studies, 55(16), 3631-3649.

Drift, M. &. (2020). Zuid Holland Circulair. Verkenning van grondstofstromen voor de provincie. Retrieved from Zuid Holland Circulair:
https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.zuidholland.nl/publish/pages/21255/hoofdrapportzuidhollandcirculair.pdf&ved=2ahUKEwjHhNWc6-TvAhWQDuwKHAFPAkQFjAAegQIBRAC&usg=AOvVaw2mjP8kiAKtt7a__4ir-PK4

Duany, A. (2001). Three cheers for gentrification. American Enterprise Washington, 12(3), 36-39.

Ekker, H., & van de Wiel, M. (2019, October 09). NOS News. Retrieved from https://nos.nl/artikel/2305389-tennet-breidt-stroomnet-uit-voor-7-miljoen-zonnepanelen.html

Eurostat. (2020, December 7). Circular material use rate by material categories EU-27 2010-2019 .

Faaij, A., & van den Brink, R. (2019). Energie wordt goedkoper: Innovatie maakt energietransitie rendabel. Amsterdam: ECN Part of TNO.

FABRICations, Kamangir. (2018). Smart Multi Commodity Grid: mapping the South Holland energy
infrastructure. Province of South Holland: Energy Innovation Board.

Gasunie. (2021, 03 26). Intentieverklaring Warmtelinq ondertekend. Retrieved from Warmtelinq: https://www.warmtelinq.nl/

Geodan. (n.d.). Verstedelijking van 35+ steden. Retrieved from Atlas leefomgeving: https://www.atlasleefomgeving.nl/kaarten?config=3ef897de-127f-471a-959b93b7597de188&gm-x=163737.72353617928&gm-y=473590.5566165401&gm-z=4&gmb=1544180834512,true,1;1552982649450,true,0.8;&activateOnStart=layermanager,info

Gilliard, Rooij, Alaily, Mattar, Zonneveld & Thierstein (2021) Interdisciplinary Pedagogies for Regional Development Recoupling Planning, Design, Social Sciences (SDS lecture 22th of March, 2021) (forthcoming in 2021 in the Routledge Handbook on Regional Design

Groeneregentes. (2020). Buurtschuur. Retrieved from Groeneregentes: https://www.groeneregentes.nl/buurtschuur/

Hackworth, J., & Smith, N. (2001). The changing state of gentrification. Tijdschrift voor econo-mische en sociale geografie, 92(4), 464-477.

Hobma (2021) Planning tools SDS lecture of the 15th of March. PDF published on educational platform brightspace Urbanism Q3 - Planning tools - Fred Hobma - 15.03.2021 - AR2U086 R and D Studio: Spatial Strategies for the Global Metropolis (2020/21 Q3) (tudelft.nl)

Hochstenbach, C. (2017). Inequality in the gentrifying European city. University of Amsterdam.

J.A.Puppim de Oliveira, O. C.-P. (2011). Cities and biodiversity: Perspectives and governance challenges for implementing the convention on biological diversity (CBD) at the city level. Biological Conservation, 1302-1313.

Kallin, H., & Slater, T. (2014). Activating territorial stigma: Gentrifying marginality on Edinburg-h's periphery. Environment and Planning, 46(6), 1351-1368.

KNMI. (2010). Windsnelheid. Retrieved from KNMI Klimaatviewer: https://www.knmi.nl/klimaatviewer/kaarten/wind/gemiddelde-windsnelheid/jaar/Periode_1981-2010

KNMI. (2020). Gemiddelde zonnige dagen 1991-2020. Retrieved from Klimaatviewer: https://www.knmi.nl/klimaat-viewer/kaarten/zon/aantal-dagen-zonnig/Periode_1991-2020

KNMI. (2020). Zonnigedagen. Retrieved from Klimaatviewer: https://www.knmi.nl/klimaatvie-wer/kaarten/zon/aantal-dagen-zonnig/Periode_1991-2020

KNMI, M. v. (2020). Klimaatviewer. Retrieved from Klimaatviewer: https://www.knmi.nl/klimaat-viewer/kaarten/zon/aantal-dagen-zonnig/Periode_1991-2020

Kokx, A., & van Kempen, R. (2003). oining forces in urban restructuring: dealing with collabora-tive. Environment and Planning A, 41, 1234-.

Koninkrijksrelaties, M. v. (2020, September 28). Retrieved from https://www.rijksoverheid.nl/documenten/kamerstukken/

Koster, H., & Dröes, M. (2020, September 20). VOX EU. Retrieved from Wind turbines and solar farms drive down house prices: https://voxeu.org/article/wind-turbines-and-solar-farms-dri-ve-downhouse-prices

Lambooy, J. G. (1998). PolyNucleation and economic development: The Randstad. Taylor Fran-cis Online, https://doi.org/10.1080/09654319808720474. Retrieved from tandfonline.com

Lees, L. (2008). Gentrification and social mixing: towards an inclusive urban renaissance? Urban Studies, 45, 2449-2470.

Leguijt, C., Meijer, M., van der Niet, S., Teng, M., Vendrik, J., van der Veen, R., . . . Usmani, O. (2021, January). Systeemstudie energie-infrastructuur Zuid-Holland. Delft: Provincie Zuid-Hol-land, Stedin, Havenbedrijf Rotterdam.

Leidelmeijer , K., Marlet, G., Ponds , R., Schulenberg , R., van Woerkens, C., & van Ham, M. (2015). Leefbaarometer - online informatie over de leefbaarheid in alle buurten en wijken. Retrieved from LEEFBAAROMETER 2.0:
https://doc.leefbaarometer.nl/resources/Leefbaarometer%202.0%20Instrumentontwikkeling%20CONCEPT.pdf

LISA. (2019). LISA DATA . PZH.

Mashhoodi, B., van Timmeren, A., & Stead, D. (2018). Spatial homogeneity and heterogeneity of energy poverty: a neglected dimension. Annals of GIS, 25, 19-31.

McCauley, D., Heffron, R., Stephan, H., & Jenkins, K. E. (2013). Advancing energy justice: The triumvirate of tenets and systems. International Energy Law Review, 32, 107-116.

Metabolic, Drift . (2018). Zuid-Holland Circulair: Verkenning van Grondstofstromen en Hande-lingsopties voor de Provincie. The Hague: Provincie Zuid-Holland.

Middlemiss, L., Mulder, P., Hesselman, M., Feenstra, M., Herrero, S. T., & Straver, K. (2020). Energy poverty and the energy transition, Towards improved energy poverty monitoring, measu-ring and policy action. TNO.

Milchram, C., Künneke, R., Doorn, N., van de Kaa, G., & Hillerbrand, R. (2020). Designing for justice in electricity systems: A comparison of smart grid. Energy Policy.

Ministerie van Economische Zaken, N. (2018, feb). Nederwind. Retrieved from Wind op Zee in relatie tot Wind op Land: kosten, groene stroom, CO2-uitstoot en draagvlak: http://tegenwindn33.nl/documents/WindopZeeinrelatietotWindopLand.pdf

Ministerie Van Infrastructuur en Waterstaat, D. W. (2016). Rapportage Monitoring bouwgrond-stoffen. Arnhem. Retrieved from https://www.bodemplus.nl/@154443/rapportage-monitoring-bouwgrondstoffen/

Ministeries van Infrastructuur en Milieu, E. Z. (n.d.). Kaarten daken zonnepaneelpotentie. Retrie-ved from Nationale Energie Atlas: https://www.nationaleenergieatlas.nl/kaarten

MinisterievanBinnenlandseZakenenKoninkrijkrelaties. (2015). Woningwet 2015 in vogelvlucht. Retrieved from Rijksoverheid documenten: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/publicaties/2015/03/17/woningwet-2015-in-vogelvlucht/Woningwet-2015-in+vogel-vlucht-def2.pdf

MinisterievanBinnenlandseZakenenKoninkrijkrelaties. (2018). Leefbarometer dataset. Retrieved from Leefbarometer: https://www.leefbaarometer.nl/page/Open%20data

Municipality, R. (2007). Stadsvisie Rotterdam, Ontwikkelingsstrategie tot 2030. Rotterdam: Gemeente Rotterdam.

Nabielek, K., Hamers, D., & Evers, D. (2016). Cities in the Netherlands. The Hague: PBL Netherlands Environmental Assessment Agency.

Nationaalgeoregister. (2020). Voorzieningen voor de samenlevingsatlas Nationaal georegister,. (2016). Netherlands circularly 2050. The Hague: Ministry of Infrastructure and Environment and Ministry of Economic Affairs.

NIBE. (2019). Potentie van biobased materialen in de bouw: een onderzoek naar de mogelijk-heden en impact. Amsterdam. Retrieved from https://www.houtnatuurlijkvannu.nl/rapport-de-po-tentievan-biobased-materialen-in-de-bouw/

Paton, K. (2014). Gentrification: A Working-Class Perspective. London: Routledge.

PBL, C. (2019). Regionale bevolkings- en huishoudensprognose. Retrieved from themasites pbl: https://themasites.pbl.nl/o/regionale-bevolkingsprognose/

PDOK. (2017). Nationale EnergieAtlas informatielagen Kadaster WFS. Retrieved from nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/meta-data/56b3e195-a631-4d76-a90e-0467900c65a1?tab=relations

Port of Rotterdam. (2021). Onze haven in cijfers. Retrieved from https://www.portofrotterdam.com/nl/onze-haven/feiten-en-cijfers/feiten-en-cijfers-over-dehaven/goederenoverslag

Priemus, H. (2003). Dutch housing associations: current developments and debates. Housing Studies, 18, 327–351.

Probos. (2019). Kerngegevens bos en hout in nederland. Retrieved from bosenhoutcijfers: http://www.bosenhoutcijfers.nl/de-houtmarkt/handel/

PZH. (n.d.). Alle gemeenten. Retrieved from Alle gemeenten - Provincie Zuid-Holland : https://www.zuidholland.nl/overons/feiten-cijfers/alle-gemeenten/

Raworth, K. (2011). A safe and just space for humanity: can we live within the Doughnut? Oxfam Discussion Papers.

Rooij, Van Dooren, Willekens (2013) Generic framework for regional development Five elements in regional design processes. Published in: Atlantis, Delft.

Rotterdam, P. o. (2021, 02 5). Schroot. Retrieved from Haven van Rotterdam: https://www.portofrotterdam.com/nl/zakendoen/logistiek/lading/droge-bulk/schroot

Rotterdam, P. o. (n.d.). Kaarten Havengebied. Retrieved from Port of Rotterdam: https://rotterdamtransport.com/nl/maps-port-of-rotterdam/

Rotterdam Makers District (n.d.). Retrieved from https://www.rdmrotterdam.nl/

RVO. (2018). Restwarmte. Retrieved from nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search?uuid=1261ea0d-a5bb-4144-a796-c5b743593f57#/metadata/E6A0D958-67DC-4450-933C-D70C3061F78C?tab=general

RVO. (2020). Warmtenetten. Retrieved from Nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/75f196bd-6fb2-4939-99a5-cd40d753183d?tab=general

Sanya Carley, David M. Konisky. (2020). The justice and equity implications of the clean energy transition. Nature Energy, 569-577.

Schlosberg, D. (2007). Defining Environmental Justice: Theories, Movements, and Nature. New York: Oxford University Press.

Schonewille, G., & Crijnen, C. (2019). Financiële problemen 2018. Utrecht: Nibud.

Scoones, I. (2010). Sustainability. Retrieved from Taylor & Francis: https://doiorg.tudelft.idm.oclc.org/10.1080/09614520701469609

SDG Nederland. (n.d.). SDG Nederland. Retrieved from https://www.sdgnederland.nl/sdgs/

Séveno, V. (2021, February 19). I am expat. Retrieved from Housing sector and municipalities call for 1 million new homes by 2031: https://www.iamexpat.nl/housing/real-estate-news/housing-sector-and-municipalities-call-1-million-new-homes-2031

Shaw, K., & Hagemans, I. (2015). Gentrification without displacement and the consequent loss of place. International Journal of Urban and Regional Research, 39(2), 323-341.

Smith, N. (2002). New Globalism, New Urbanism: Gentrification as Global Urban Strategy. Antipode, 34(3), 427-450.

Studio Marcovermeulen, FABRICations, Wolf Pack, Kamangir. (2019). Deltagrid 2050: Perspectieven voor de Zuid-Hollandse eneregie - infrastructuur. Province of South Holland: Energy Innovation Board.

SUM-TUDelft. (2021). SUM. Retrieved from Delft Solar Decathlon: https://www.delftsolardecathlon.com/

Teernstra, A. (2015). Contextualizing state-led gentrification: goals of governing actors in generating neighbourhood upgrading. Environment and Planning A: Economy and Space, 47(7), 1460-1479.

Uitermark, J., Duyvendak, J. W., & Kleinhans, R. (2007). Gentrification as a governmental strategy: social. Environment and Planning A, 39, 125-141.

United Nations. (2015). Transforming our World: The 2030 Agenda for Sustainable Development.

United Nations. (2015). Universal Declaration of Human Rights. United Nations.

van der Velde, O., & van Leeuwen, M. (2019). Potential of biobased materials in the constructi-on. Bussum: Rijksdienst voor Ondernemend Nederland, experts in sustainabiity NIBE.

van Gent, W. (2013). Neoliberalization, housing institutions and variegated gentrification: How the 'third wave' broke in Amsterdam. International Journal of urban and Regional Research, 37(2), 203-522.

Vestia. (2019). Jaarverslag 2019. Retrieved from Vestia: https://www.vestia.nl/Media/ad375651-60a2- 4871-9cd5-4e089bc08d1b/original/jaarverslag-2019.pdf/

Vlaanderen Circulair. (2010). Retrieved from How much is left?: https://www.vlaanderencirculair.be/nl/kennis/wat-is-het/how-much-is-left

Volkerswessels. (n.d.). BouwHubs voor slimme bouwlogistiek. Retrieved from Volkerswessels: https://www.volkerwessels.com/nl/projecten/bouwhub

Waal, V. d. (2019, 4 4). Overslag . Retrieved from van der Waal: https://www.vanderwaalbv.nl/bedrijven/overslag/

Waterstofmagazin. (n.d.). Nederland: test met waterstof in oude aardgasleidingen is geslaagd. Retrieved from Waterstofmagazine: https://www.waterstofmagazine.nl/11-nieuws/1088-nederland-testmet-waterstof-in-oude-aardgasleidingen-is-geslaagd

Windstat. (2020). Windenergielocaties en parken. Retrieved from nationaalgeoregister: https://nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/54D15182-DF1A-4F27-A4B3-8DAB14653E3E

zaken, M. v. (n.d.). Import en export. Retrieved from Kerngegevens bos en hout in Nederland: http://www.bosenhoutcijfers.nl/de-houtmarkt/handel/

Appendix

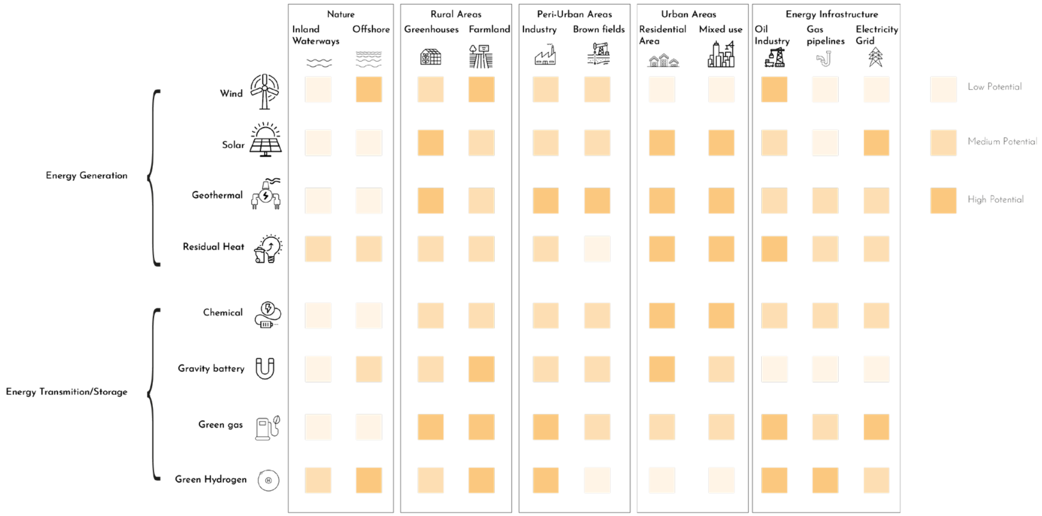


Fig. A Location Choosing principles for Renewable Energy Sources. Based on Analysis Chapter 3.

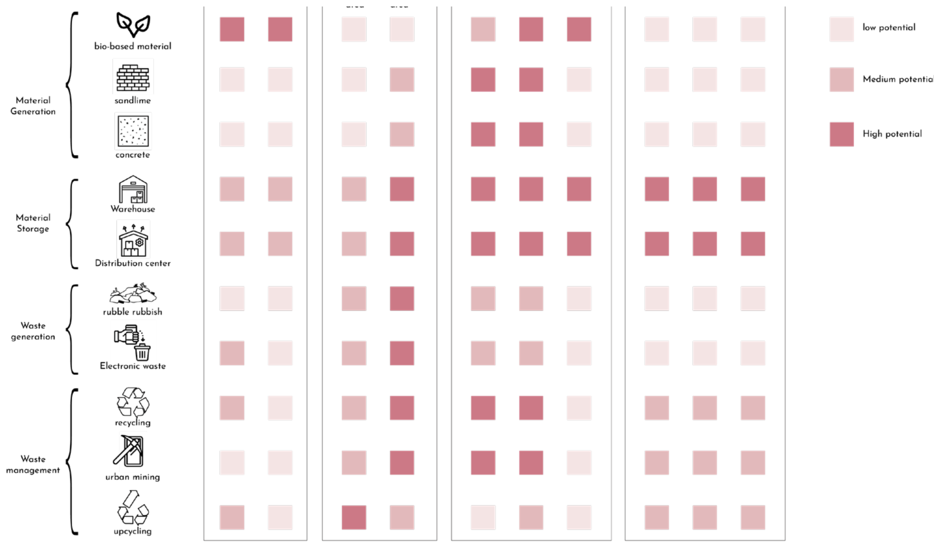


Fig.B Location Choosing principles for Material Hubs. Based on Analysis in Chapter 3.

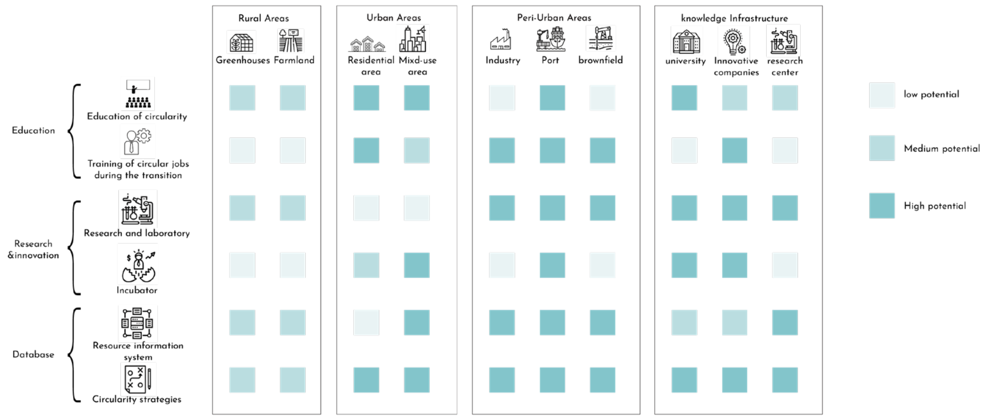


Fig. C Location Choosing principles for Knowledge Hubs. Based on Analysis Chapter 3.

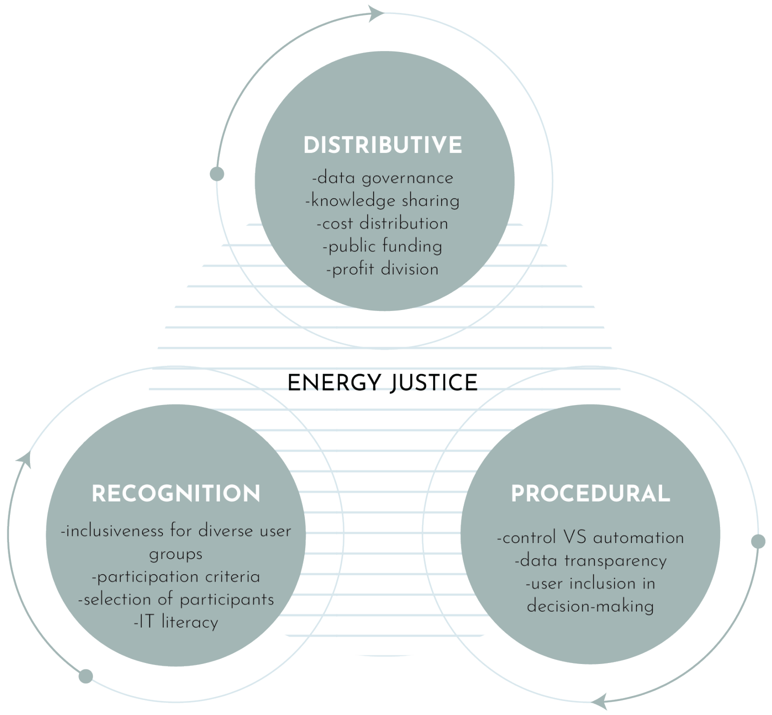


Fig. D. Smart Grid implementation according to Energy Just distinctions Based on: (Milchram, Künneke, Doorn, van de Kaa, & Hillerbrand, 2020)

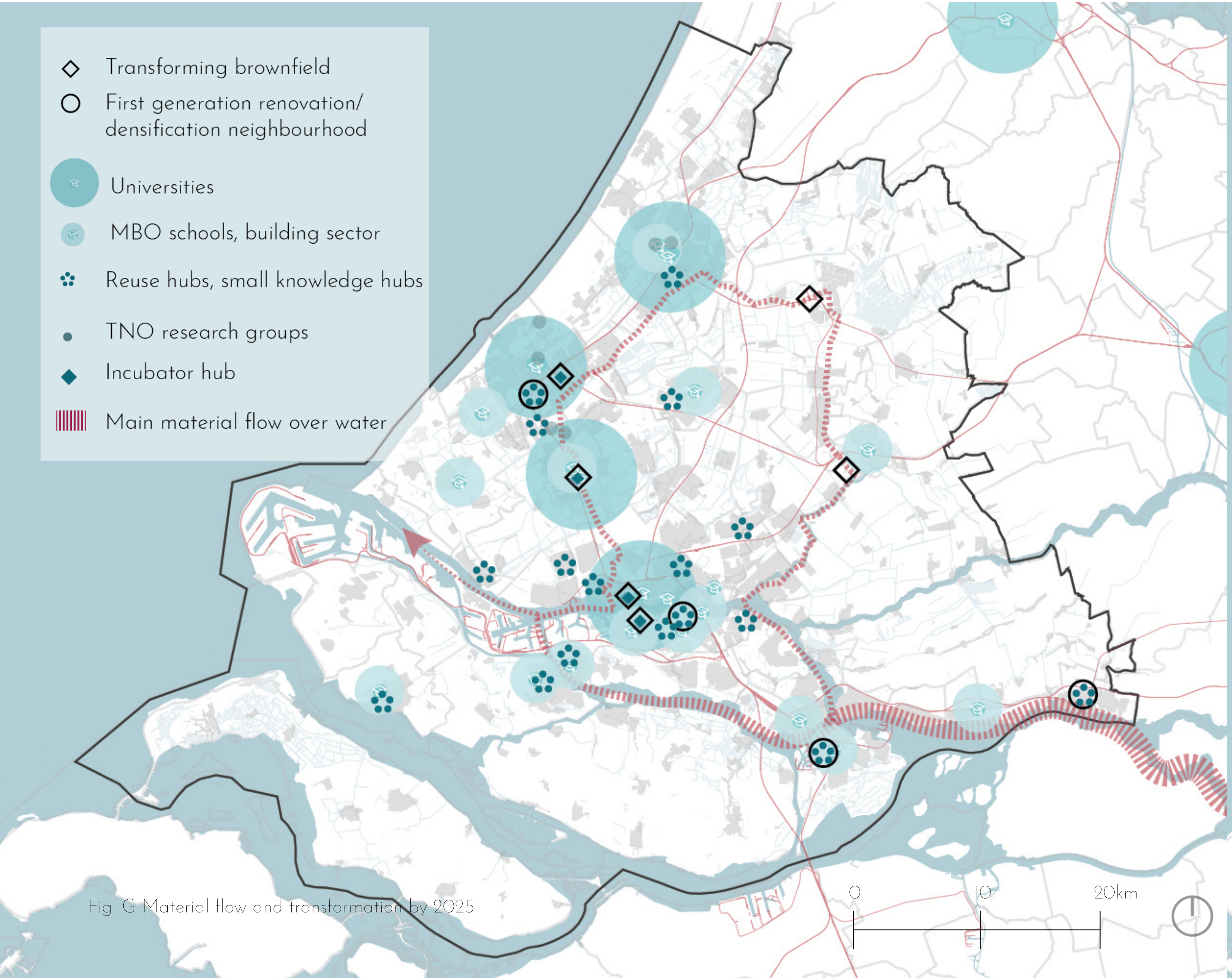


Fig. G Material flow and transformation by 2025

Fig. F Energy landscape and transformation by 2025

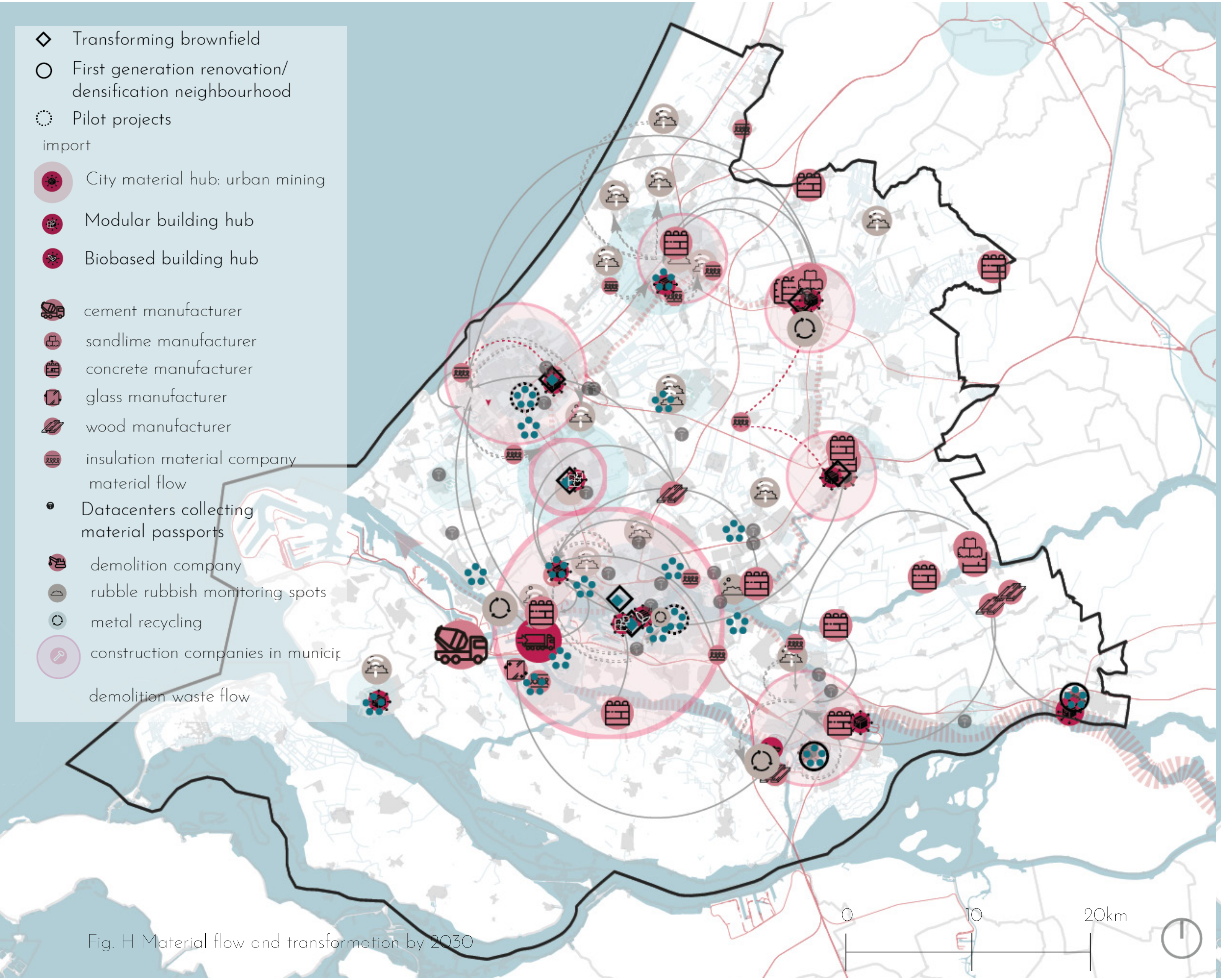


Fig. H Material flow and transformation by 2030

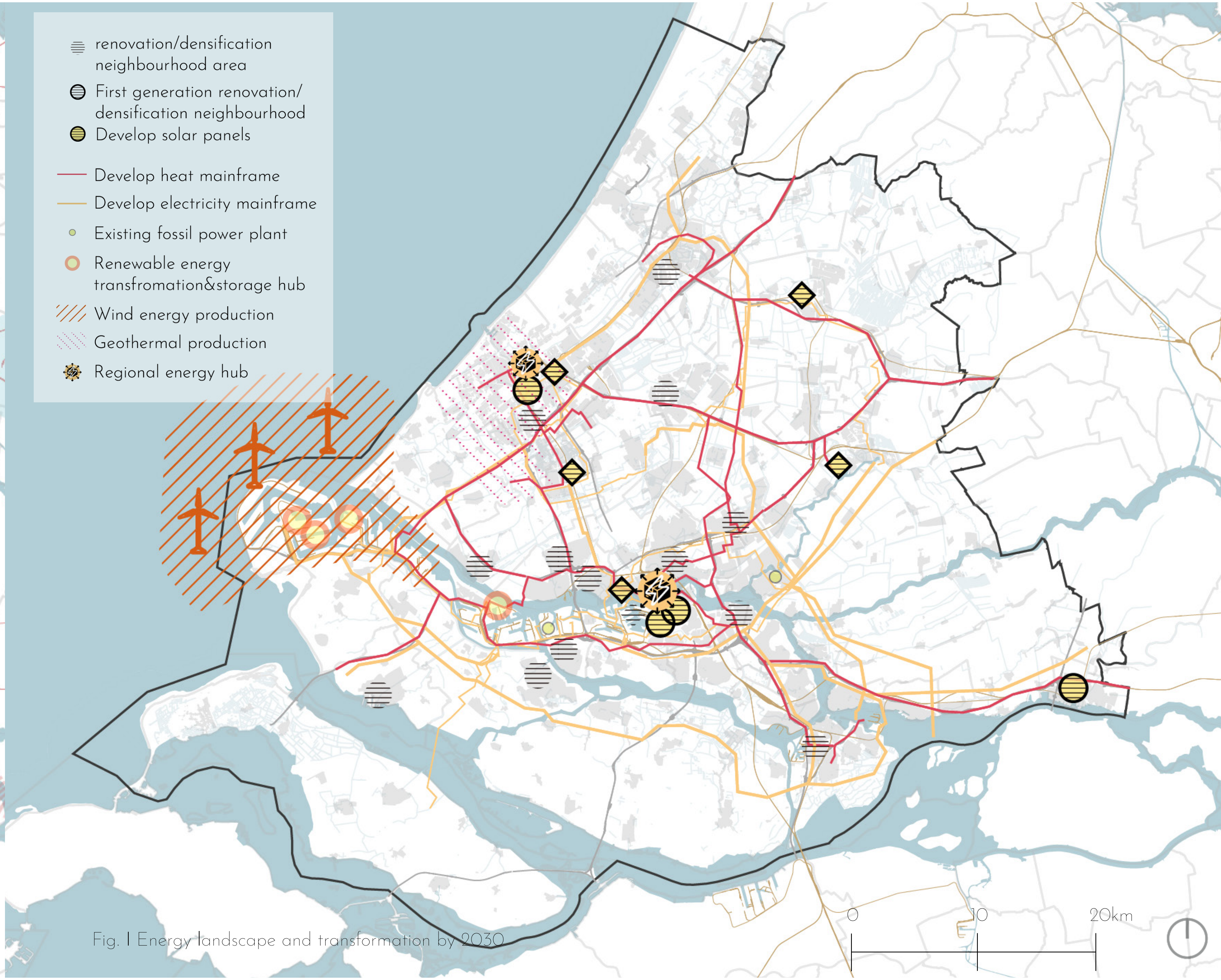


Fig. I Energy landscape and transformation by 2030

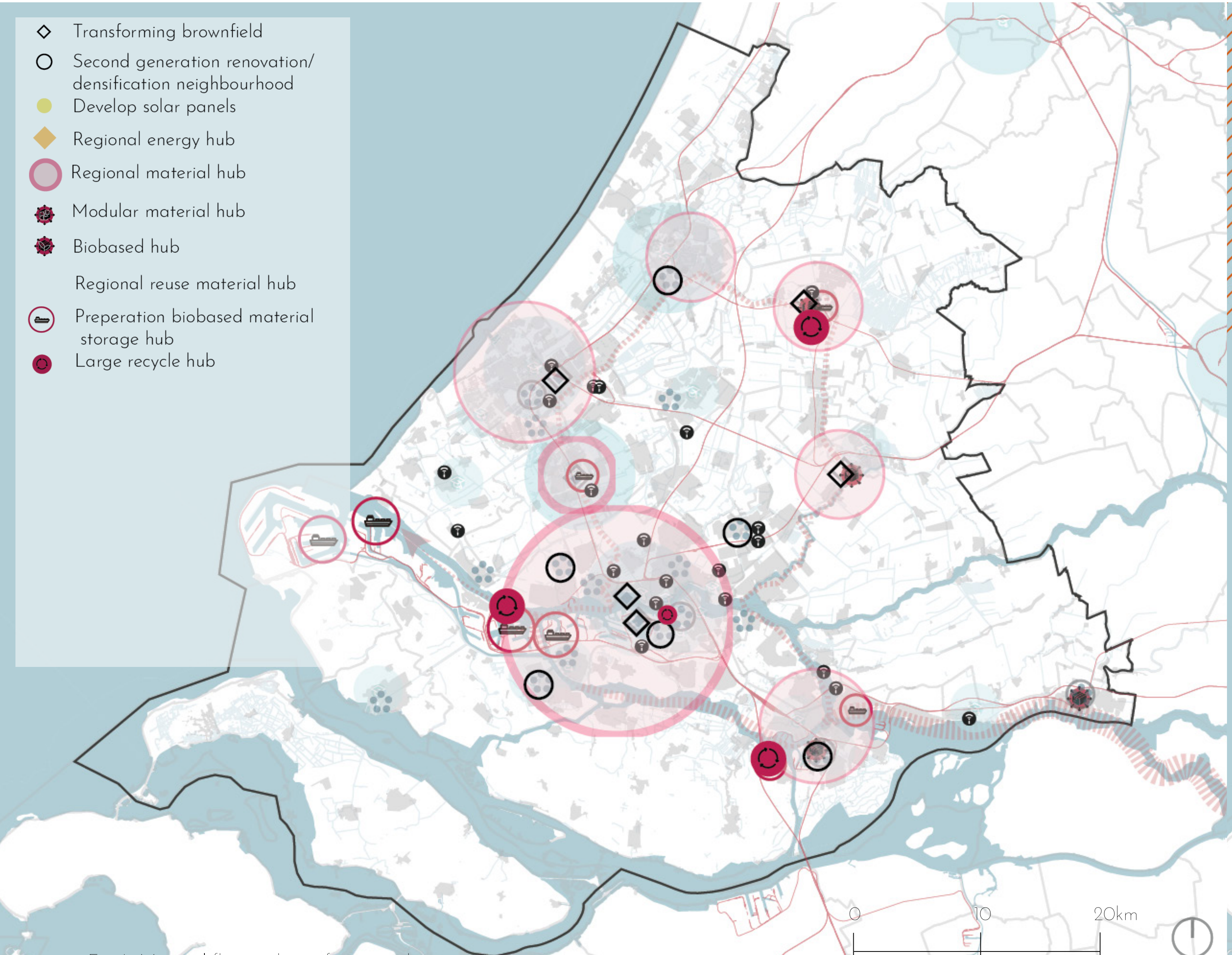


Fig. L Material flow and transformation by 2040

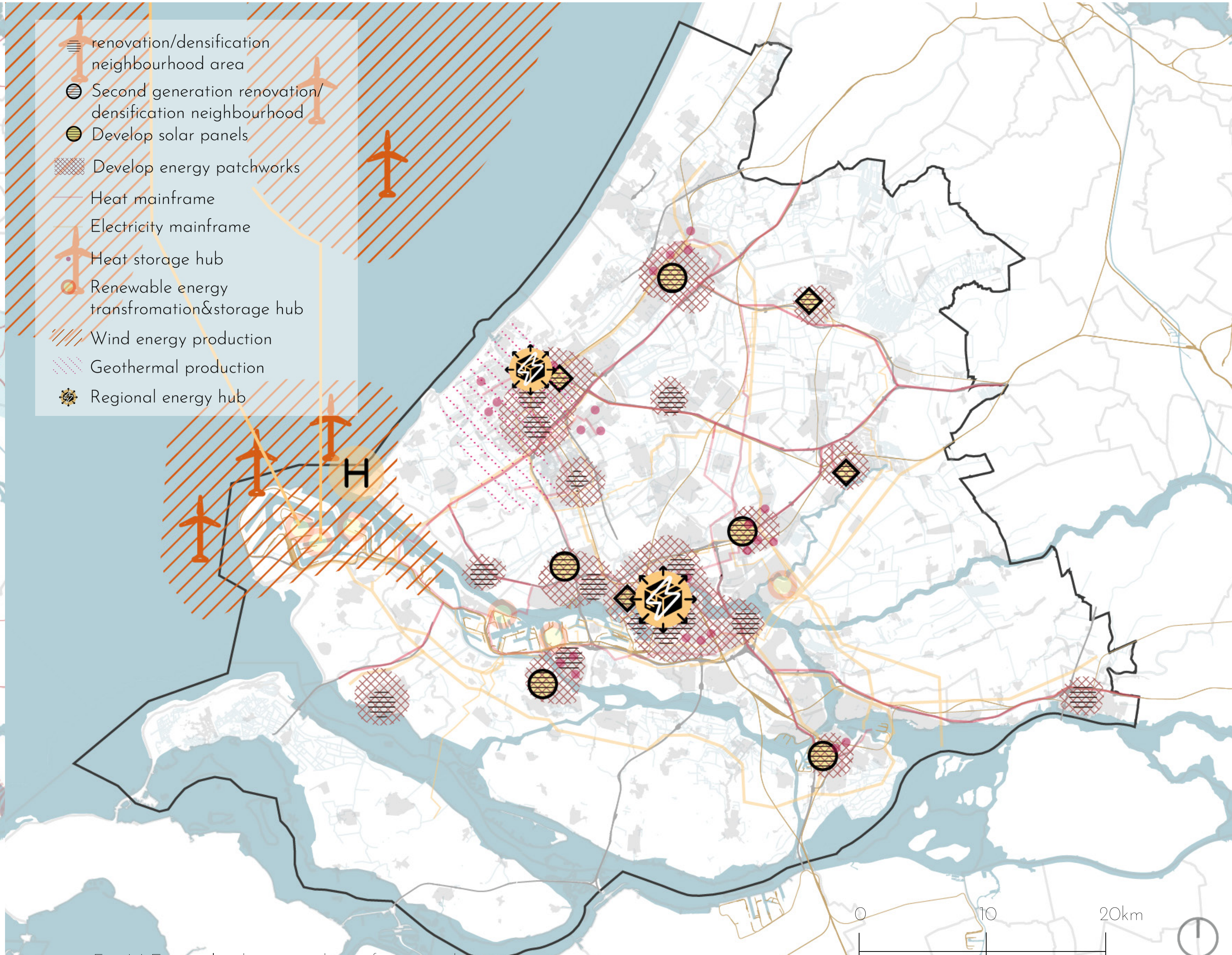


Fig. M Energy landscape and transformation by 2040

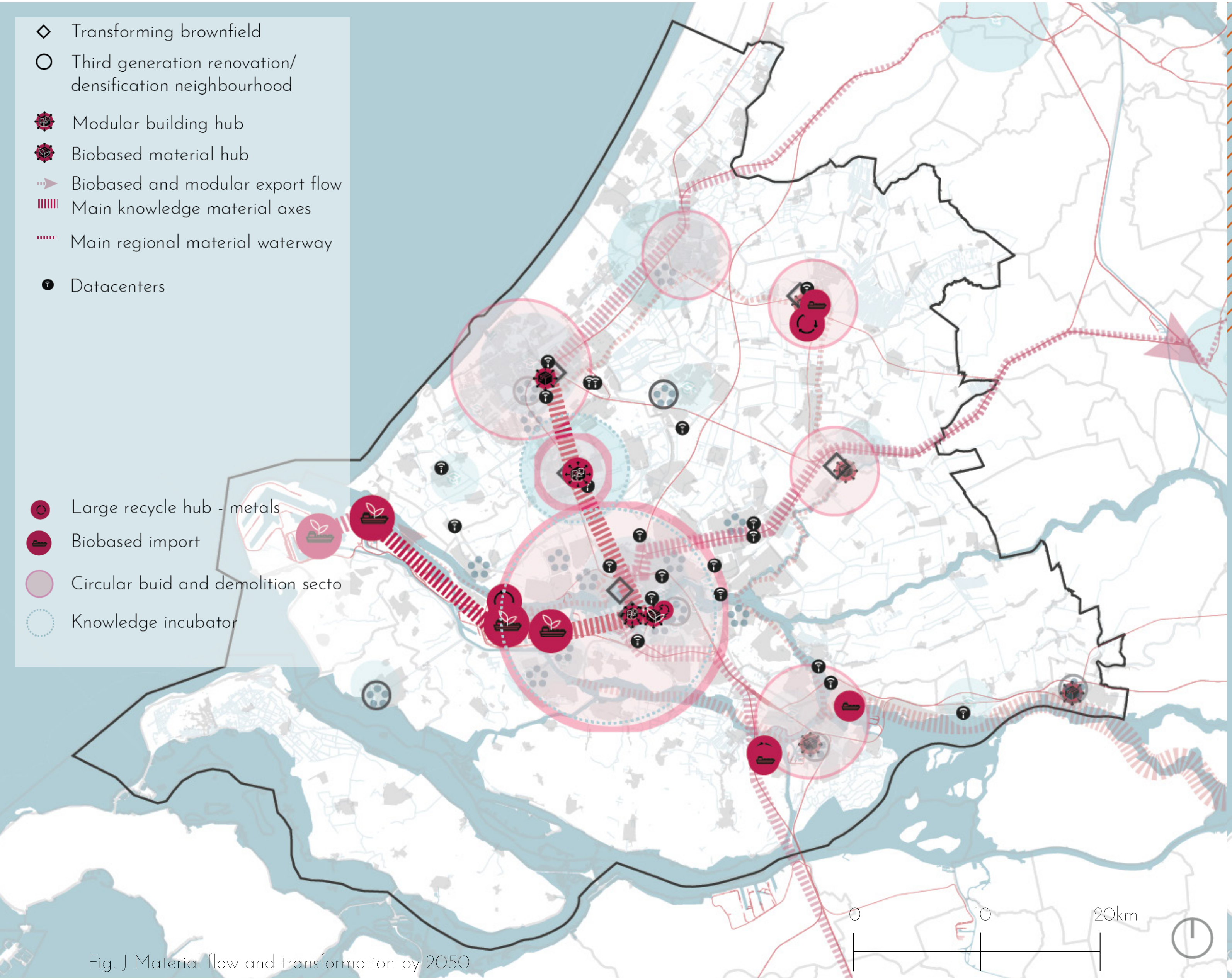


Fig. J Material flow and transformation by 2050

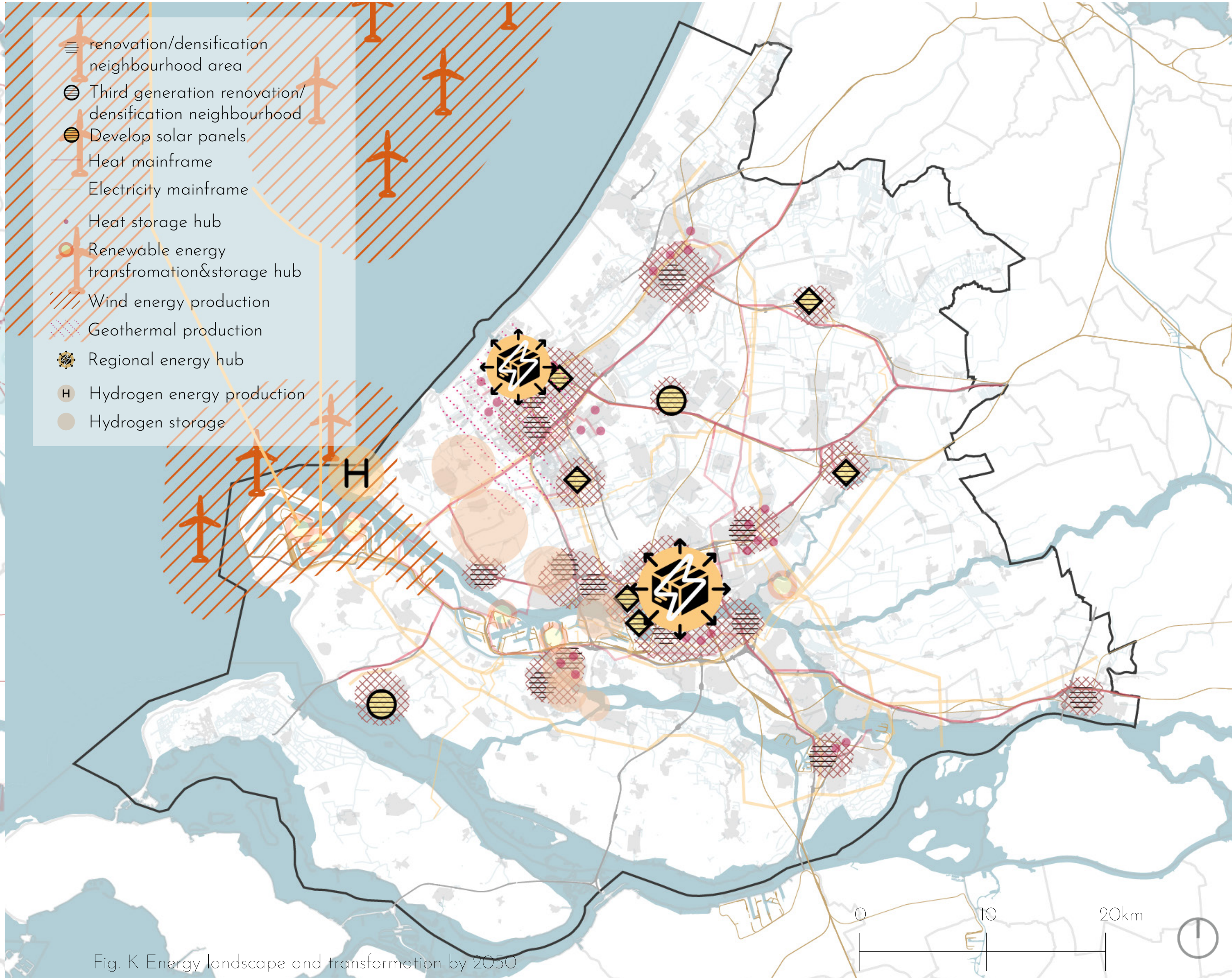


Fig. K Energy landscape and transformation by 2050

Fig. N Initiatives Materials

Fig. O Initiatives Energy

Fig. P. percentages of housing associations per zipcode

Fig. Q. percentages of housing associatons per zipcode

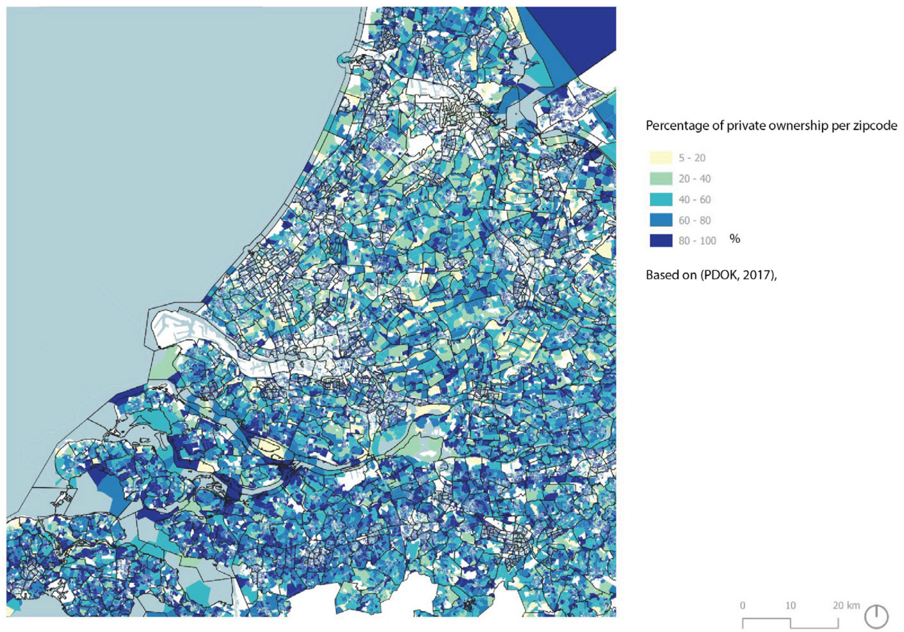


Fig. P. percentages of private ownership per zipcode

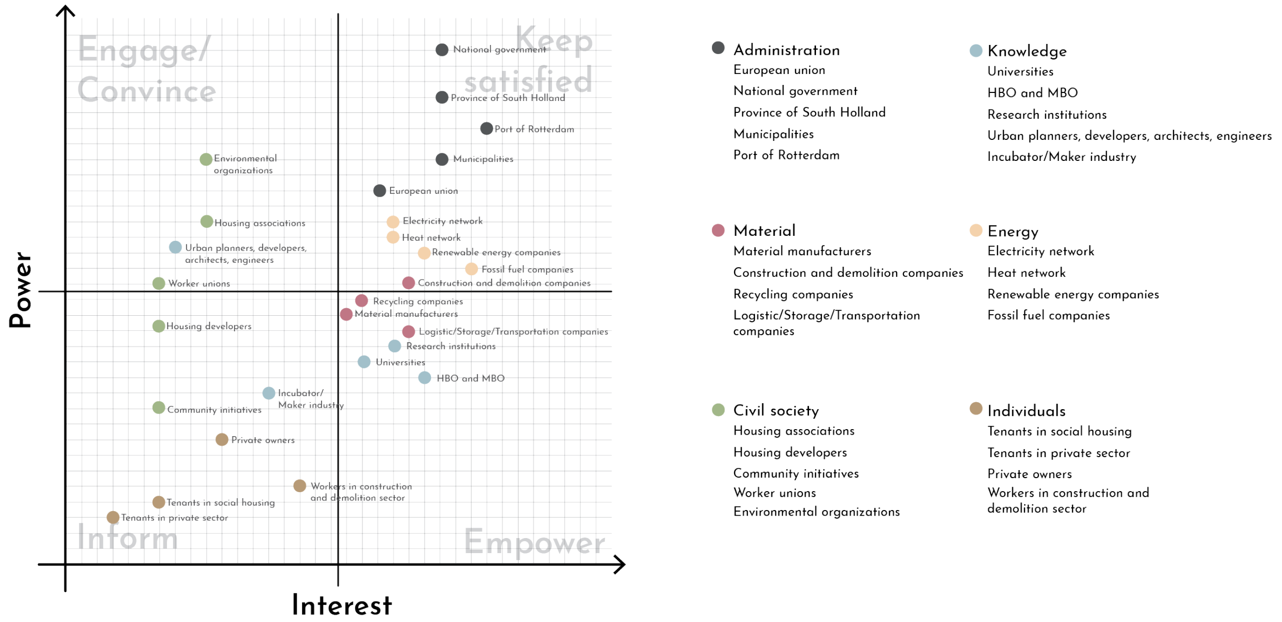


Fig. R. current stakeholder analysis

A report by
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