Strategic planning of energy landscape:

Synergies and trade-offs in Parkstad Limburg



Yueting Wang 4715853
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Yueting Wang

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Harvest

This thesis has been produced with the guidance of the mentors:
Dr. René van der Velde
Dipl. Ing. A. (Alexander) Wandl

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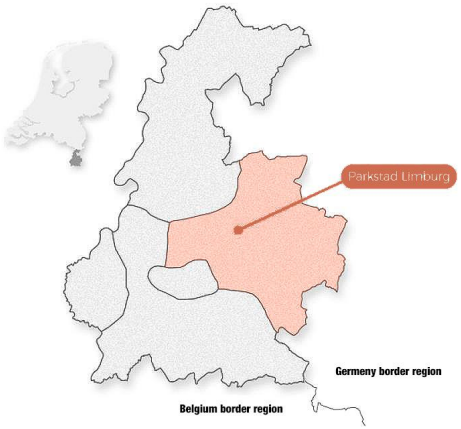
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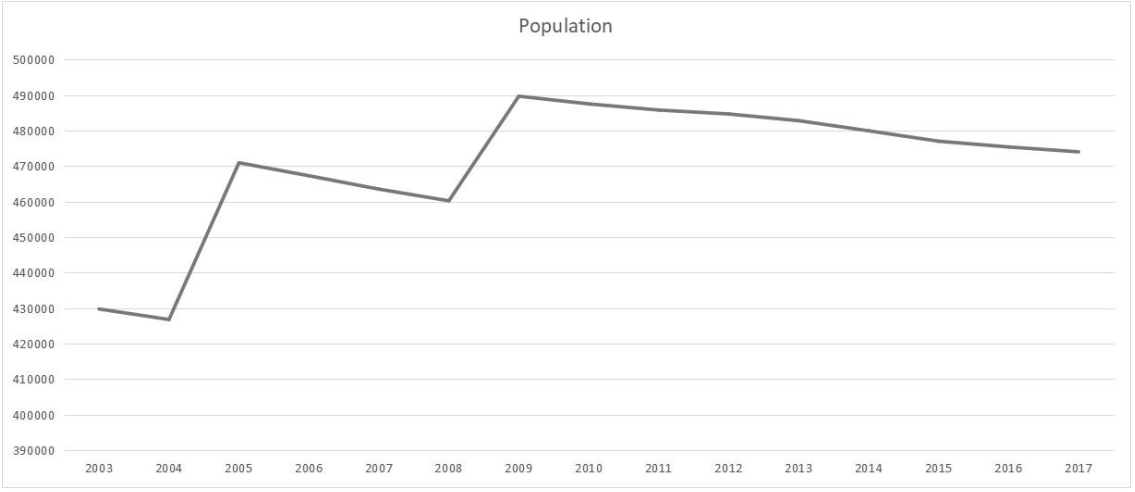
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1. Introduction

1.1 Fascination

Parkstad Limburg located in the southern part of the province of Limburg in the Netherlands, with an estimated 2017 population of 245109 and consists of eight municipalities. It covers a total area of 211 km², with a population density of 1,161 per square kilometers. Heerlen is the center of the economic and social activity within the city-region of Parkstad. In total it has around 15,000 companies and institutions

.

Parkstad Limburg currently is described as the fastest growing tourist destination in the Netherlands. It is a region full of contrasts and extremes. Parkstad Limburg has some of the finest Roman archaeological sites in the Netherlands, the largest indoor ski centre in the world, the largest furniture retail park in Europe, the most innovative and most modern zoo in Europe, one of the largest castles in the Netherlands which is open to the public, the most extensive themed gardens in the Netherlands ("Discover Zuid-Limburg", 2019). But in the meantime, Parkstad is a shrinking place both in terms of popularity and economy.



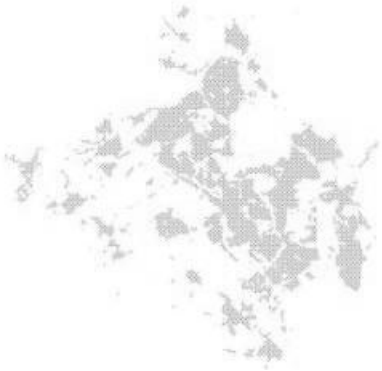
Before 1900



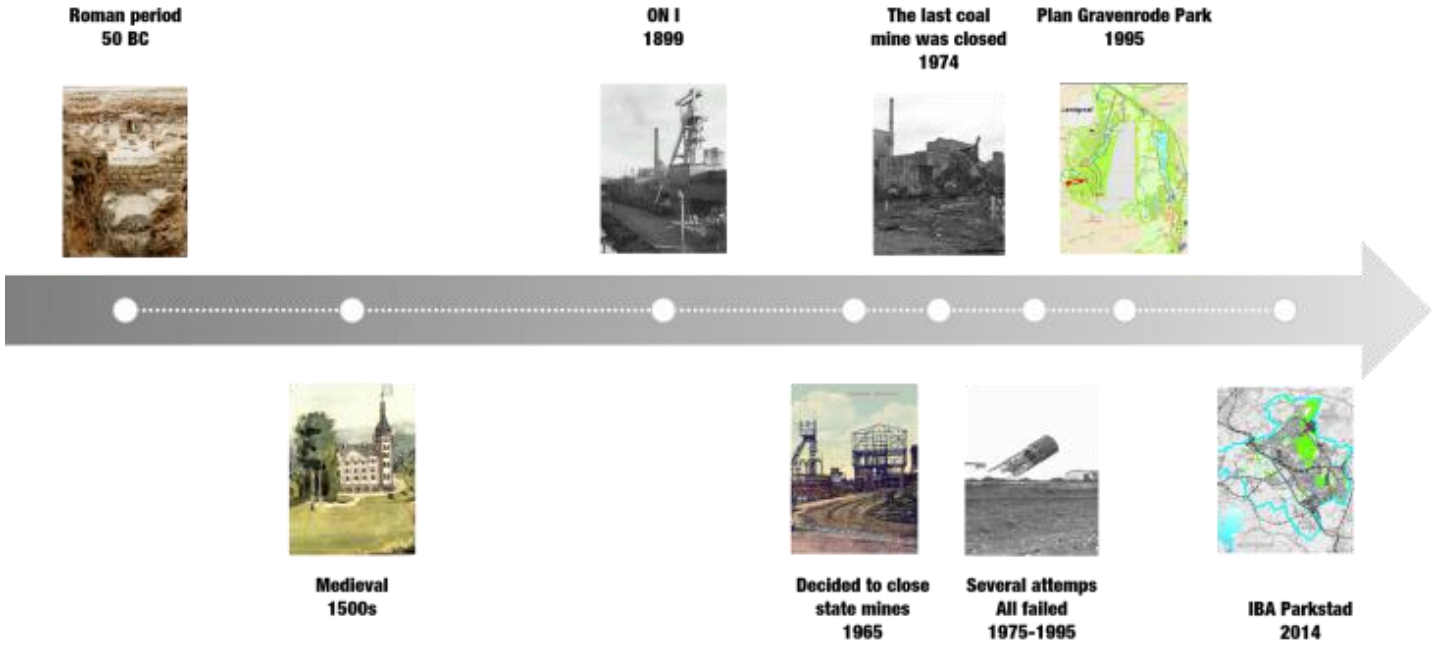
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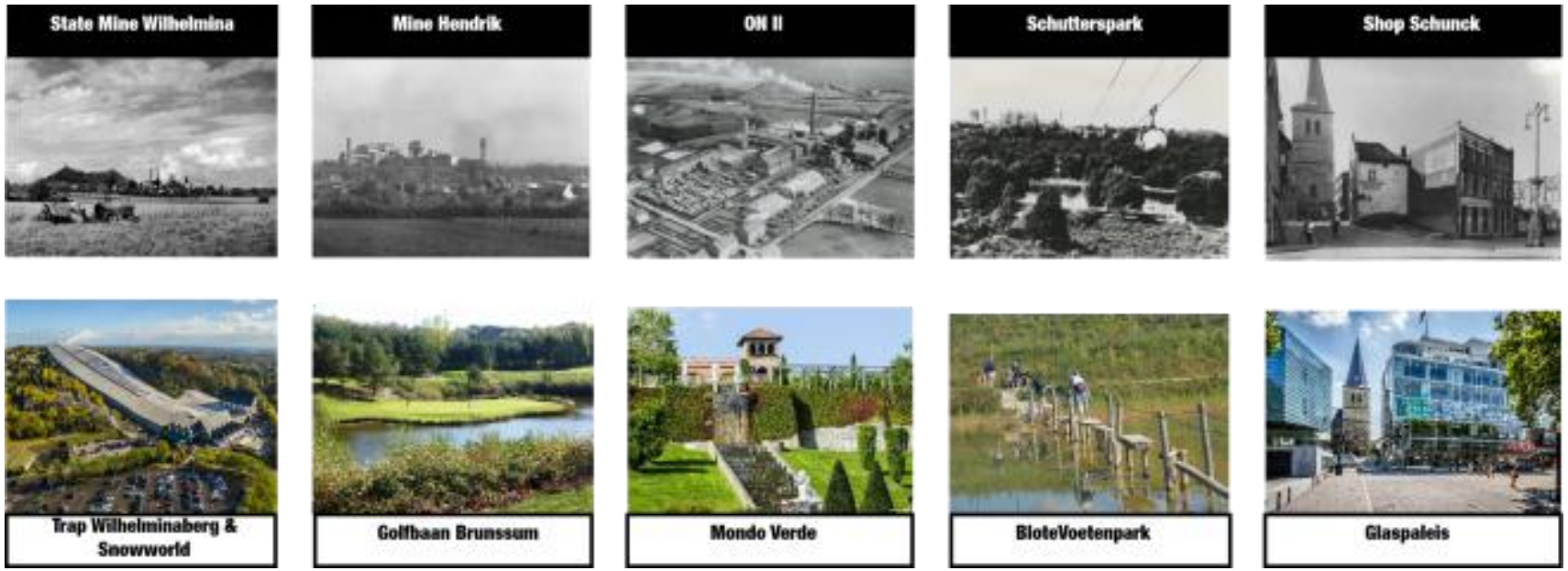


1965-1974



1974-now





The GDP of Parkstad Limburg is less than the GDP of the Netherlands of 35,800. The region has attractive scenery and its districts, which in former times used to be small villages, have their atmosphere and culture. Heerlen is a center of activity with a regional function including big companies as ABP/APG, CBS, and DSM. A key tourist attraction is the furniture mall, with approximately 4 million visitors per year..

This region used to be known as the Eastern Mining Area. Around 1900, the formerly agricultural area rapidly developed as the epicenter of Dutch coal mining. At the height of its development, the regional mining industry counted three state mines and five private mines. Mining for coal was so lucrative that the eastern part of Zuid-Limburg region adapted everything to this source of income. Almost everyone worked down the mines in the 1950s ("The mining history of Zuid-Limburg", 2019). The mining industry disappeared as quickly as it emerged. In 1965, the Dutch national government decided to close the state mines. Within ten years, not only the state mines but also all private mines were closed. This meant a total of 65.000 jobs that were in direct danger. Moreover, the potential increase in unemployment was threatening another 10.000 jobs because of the expected decrease in consumption (Derks, 1990).

1. vacant buildings and demolished buildings





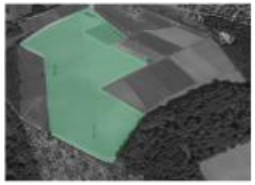


2. Identity losing

3. Distrupted landscape







4. Energy consumption way

5. Aging population

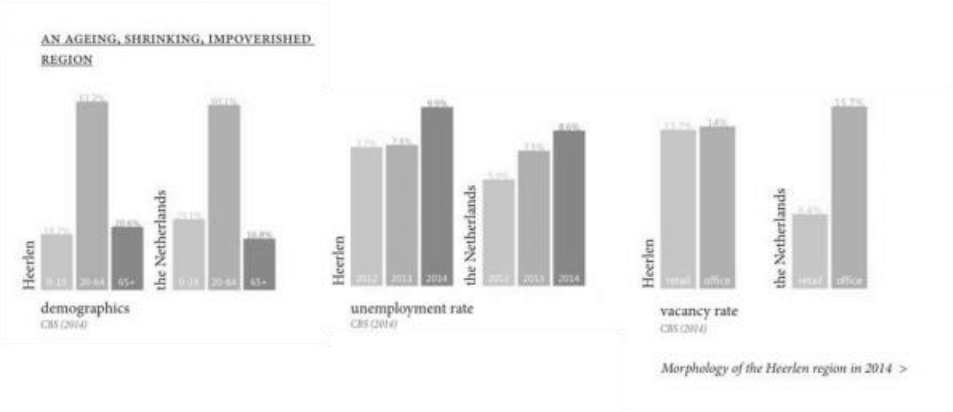
6. Unemployment rate











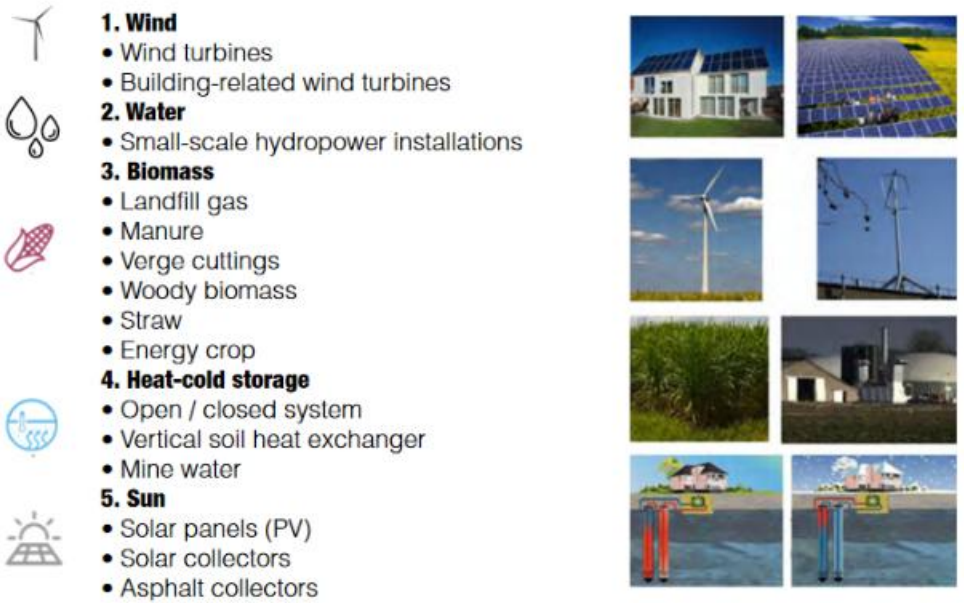
Most former mining complexes were demolished and replaced by natural areas, parks or housing areas, but the old miners hardly profited from those new jobs, so the city begins to shrink. There are lots of empty streets, shops. The depressed economic environment leads to a high rate of unemployment, and it causes a lot of social problems as well. In the Netherlands, so far shrinkage is mainly happening at the peripheral edges of the country, but an urbanized area as Parkstad is facing the same problem.

Processes of shrinking and an aging population have increased the vacancy rate. Within the Parkstad Limburg region, there is a vacancy of more than 100,000 square meters of shopping space, while at the same time plans exist to build 60 000 square meters of new shopping space.

It is fascinating when the landscape is a tool to deal with a social and economic problem. My main interest in this Lab is energy flow in a landscape. In a large scale perspective, shrinkage is an inevitable stage and does not mean passive; While in the sight of Parkstad scale, it is a shame to losing both the identity and population. It is thought-provoking as a landscape architect to rethink about what will landscape act in this procedure and what will Parkstad benefit from.

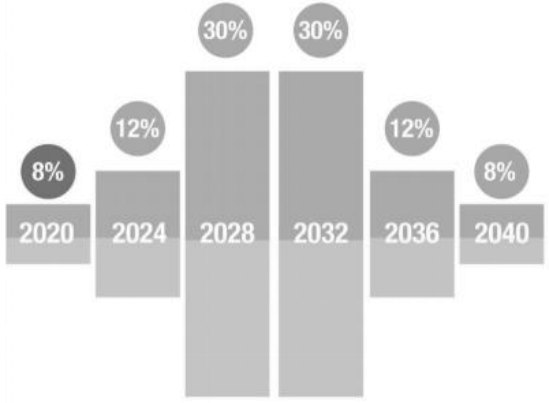
In the past, Parkstad Limburg was the energy center of the Netherlands thanks to the mining industry. Nowadays, because of other kinds of energy like natural gas and other cheaper source of fossil fuels makes the glory of the past vanished. Parkstad got into a lock-in situation after the closure of the coal mines in the 1960s. People would not like to live here, and the aging popularity results in a lack of vitality.

Shrinking areas are often associated with economic decline and mental regression – they are areas without growth and thus lack ideas, creativity and innovation (Reverda, 2010). However, shrinking places are places in transition and transformation, challenging people to come up with and invent new ways of thinking and acting, in order to maintain proper standards for the quality of life. Shrinking areas are thus inviting people to energise their innovative capacities. In this context, culture and creativity play a central role and contribute significantly to standards of life, especially in shrinking areas (Reverda, 2010).



Renewable energy generation types

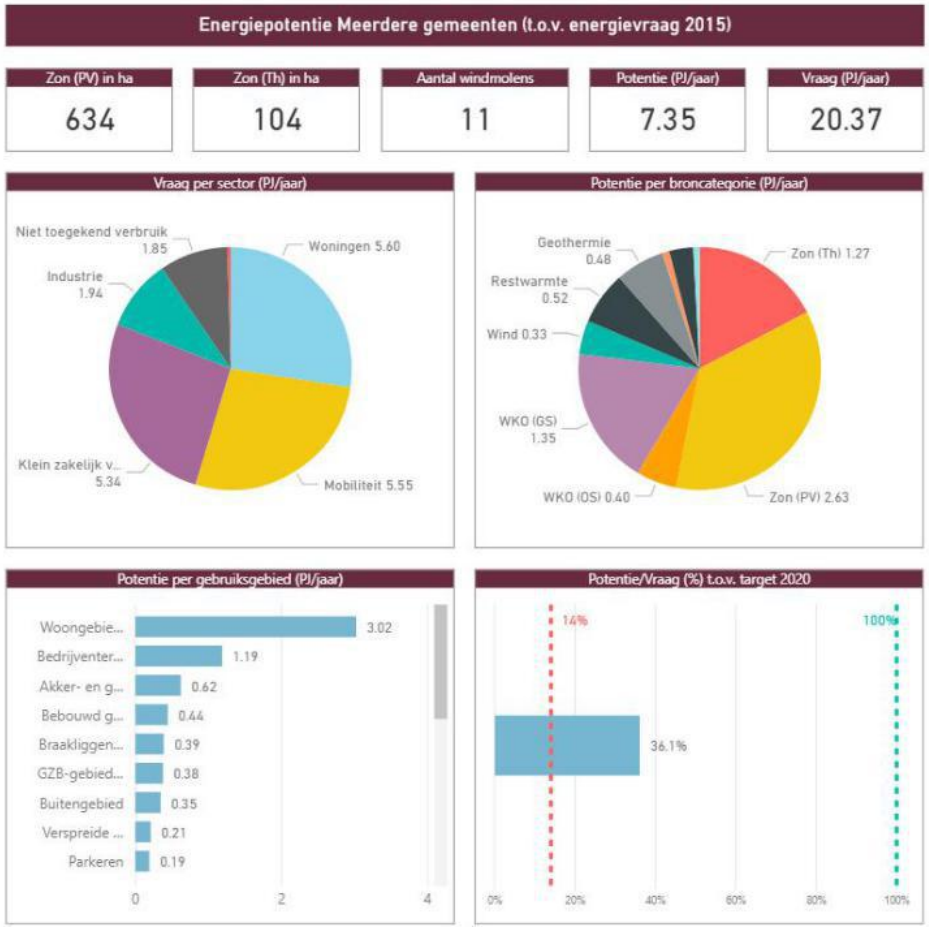
Source: Author



Source: Parkstad Limburg Energy Transition Implementation Program PALET 3.0

1.2 Transition in Parkstad

As an essential part of urban metabolism, energy and material flows exist in cities, interacting to create economical and societal patterns as well as spatial and geographical patterns (Perrotti and Pouteau, 2013). On the whole, the reason for an energy transition is the severe global warming situation. However in terms of landscape design, the notion of “energy landscape” is the implementation of it in the physical realm. How to shape landscapes do not only accompany with technologies, the sustainability and functionality are the key factors in my research. The project aim is to follow the trend of the energy transition to improve the quality of the landscape in Parkstad, using this instrument to build more infrastructure and green spaces, to make this place become a real tourist destination and ideal home for local people.



Energy potential dashboard

Source: https://dashboardlimburg.nl/energiedashboard/

The energy transition is a pathway toward a transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO2 emissions to limit climate change ("Energy Transition", 2019).

The European Commission calls for a climate-neutral Europe by 2050, which means a long-term vision should be considered when making the energy landscape proposal. There are already some incentive policies here; for example, the government in Parkstad encourages citizens to put solar panels on their roofs and gives them allowance and loads. Some attempts such as reusing abandoned mine water to heat and cold the houses.

As the chart shows the total energy demand in Parkstad is 20.37 PJ in 2015, where still mainly rely on the traditional energy supply. The house and mobility sector are the biggest consumers. The solar panel and the heat-cold storage system have the most significant potential here.

The most efficient way to accommodate this change here is to strengthen the advantage of solar power and cooperate with other renewable energy like geothermal and biomass. Furthermore, building several districts by the demand and make it expand step by step. In this case, more job opportunities are available here, which give a reason for people to stay and even move in.

1.3 Parkstad's opportunities and challenges: a potential field

Parkstad is an urban area in a rural environment, which has a favorable geographical position - with close links to bordering Belgium and Germany. It combines a strong economy with a quality environment to face the challenge of a declining population ("Parkstad Limburg (Netherlands) | Citizens Rail", 2019). Besides, it has also an outstanding location for business opportunities for rental properties in the Euregio, less than 10 miles from the German city Aachen.

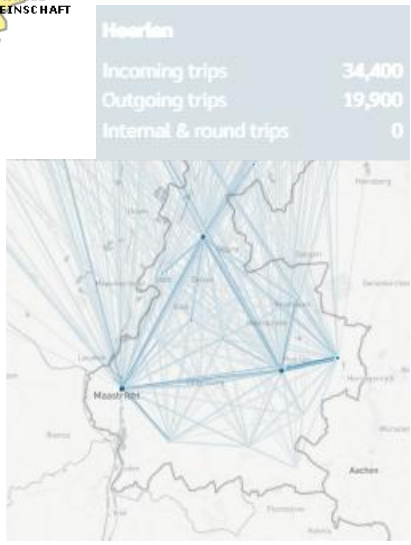
As what show on flow maps, on south limburg region, the relocation and commuting are active. For example, the municipality of Heerlen is an popular destination for jobs.

Meantime, Parkstad is a place of contradictions, without an attractive reason people would not like to live in a place like here, let alone the aging problem will be severer after few years. The energy transition is happening here, but the strategic vision is invisible. The connection between renewable energy and landscape need to be re-defined; the potential of this new trend is underestimated. The separated urban area and suburb have different characteristics, but the terrain in between still has the potential to develop into a new kind of function and acts as a zone of transition.





Relocation of residents between municipalities in the Netherlands (2017). Nr. of trips = nr. of relocated residents. Created by: Leon Meulen Original data source: Statistics Netherlands

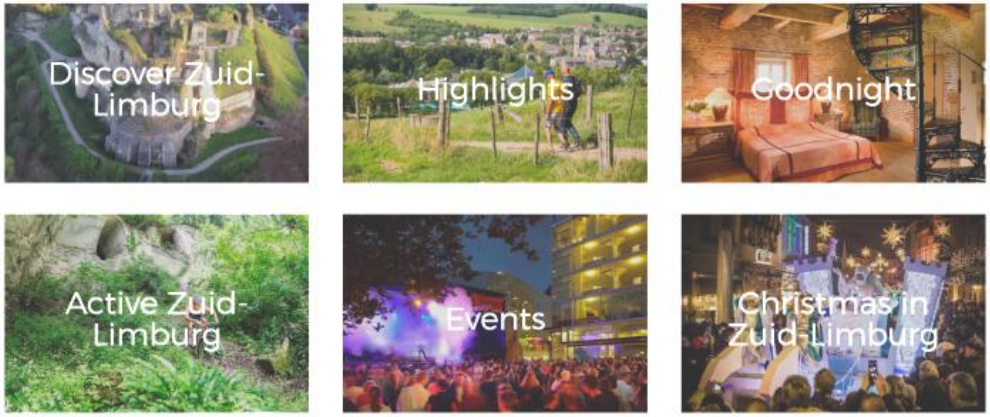


Commuters in the Netherlands in 2016
Created by: Dick ter Steege
Original data source: Statistics Netherlands

The lack of economic growth and loss of employment caused a structural shrinkage. The structural depreciation works as a catalyst and causes even more problems in the region, like loss of social services, the younger generation moving out and the changing identity of the area. The mining-settlements have always provided a haven and, together with the church, created local communities where people would support each other. The mines are closed, and the influence of the church is decreasing, which means that the region will have to create support from new communities (Elzerman & Bontje, 2015).

Another issue is the demographic aging in the Netherlands and especially in the Parkstad area. In comparison to the rest of the Netherlands, the area copes with low birth rates and high death rates (Garssen, 2011). Students and start-ups do not find enough opportunities in the area and a lot of people are moving out to the border areas in Germany. These developments put a lot of pressure on health care and cause a decrease in available facilities in the area (de Jong & Verwest, 2009).

Although the local government has a strategy for tourism, the inner cities still have a problem with empty shops and houses, and social services cannot be maintained because the profit doesn't make sustainable enough. (see Fig. ?)



Source: Zuid-Limburg tourist website
https://en.vvvzuidlimburg.nl



1.4 Research objective and questions

As a mean of energy provision, the mining industry changed the landscape and brought Parkstad prosperity once, so the objective of this research paper is to experiment the feasibility of reusing energy to improve the landscape value here.

The energy transition is a spatial issue because it is forms of sustainable energy inherently entail new demands on space. A regional spatial vision on energy, based on which issues like landscape integration can be coordinated shortly, is called for. To do energy-conscious spatial planning, and achieve synergies in such a complicated place, the questions are invited for: **What are the energy-conscious spatial strategies, to integrate with energy sinks, urban green network, and differentiation of niches, to facilitate sustainable energy landscape design to improve environmental quality in Parkstad?**

According to the types of question, it can also be divided into three aspects:

Reflection question:

How to make a versatile scenario which is suitable for the whole area?

How to make strategic planning procedures as it progresses in time?

Application question:

How to build an energy landscape system in such a big area?

How to cooperate with different kinds of energy and exert effects on space?

What character does energy play in landscape design in Parkstad?

Design-oriented question:

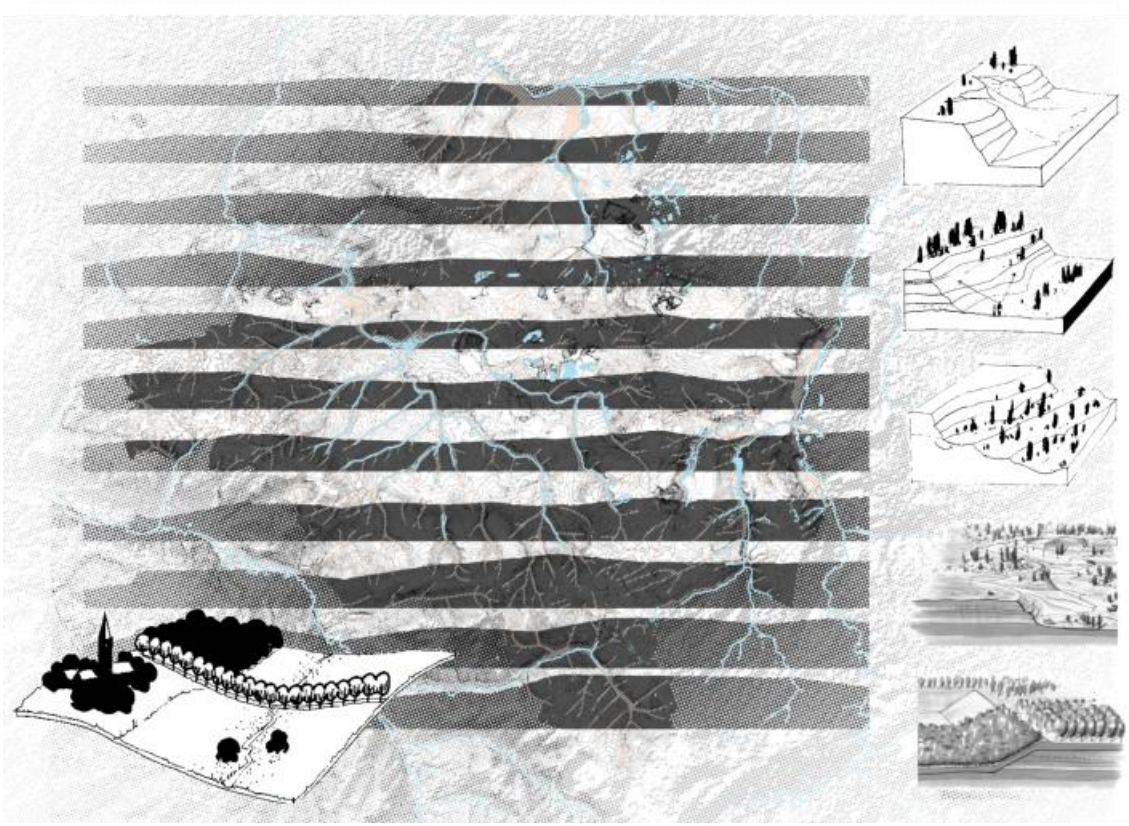
What can landscape benefit from energy transition?

1.5 Scope and relevance

To understand the social-economical situations in the present, researchers should figure out the historical stories on this aspect and its left issues, and if it is feasible to prioritize energy as the way to solve the landscape problems. I will come up with a sequence of energy landscape strategy. To figure out the role of the energy in landscape design, and if it is the best way to rethink the historical characteristics and its links to nowadays.

The most challenging part for this research report is that the energy seems a disturbance of the beauty of nature rather than contributing, as the power supply differentiate between the past and now. But actually, energy and space change each other, and they change together over the course of history (Sijmons, 2014). Until the middle of the 18th, renewable energy gradually into our sight, but people rejected to embrace the transition in the beginning, because of an emotional transition is also required.

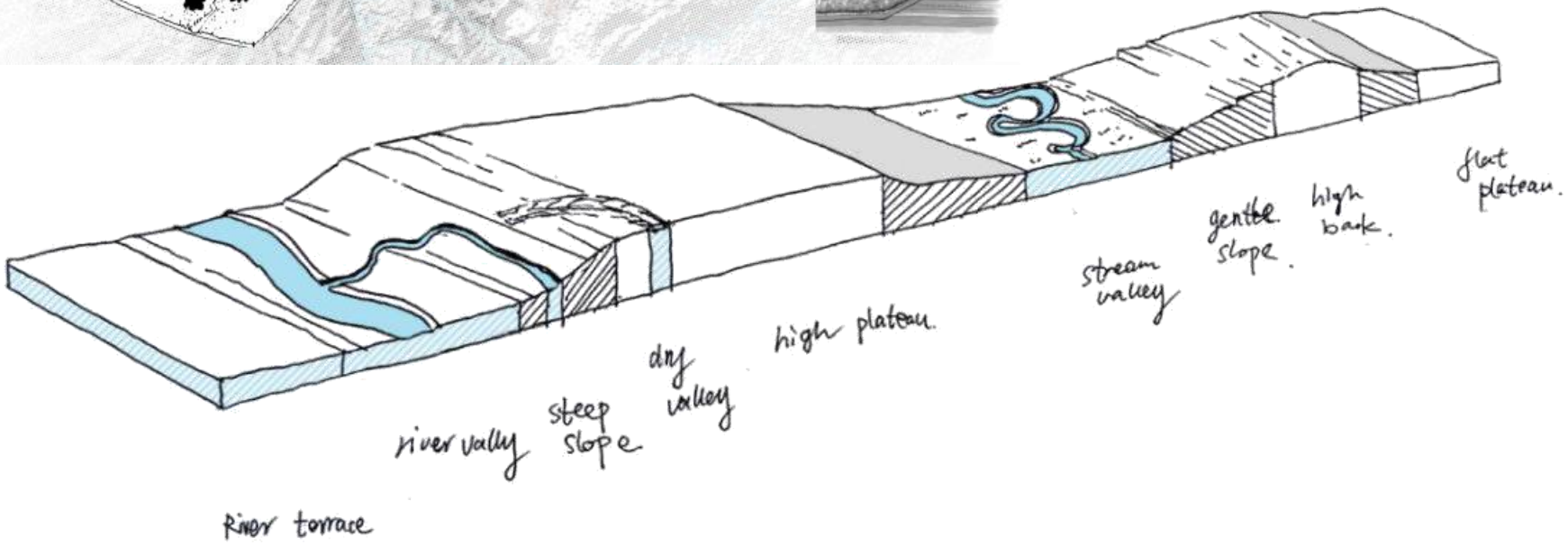
According to Dirk Sijmons, When we talk about the energy transition, the policy transition, mobility transition and emotional transition should not be neglected. For example, in discussions about wind turbines. They are seen as symbols of hope and transition, as well as of loss and an uncertain future. They also mark a profound transformation of the landscape (Sijmons, 2014). But the emotional transition can be solved by spatial design. **The energy supply and space could be integrated in a better way by designer, and this is the primary aim of this research.**



2.SITE UNDERSTANDING

2.1 Topography transforming

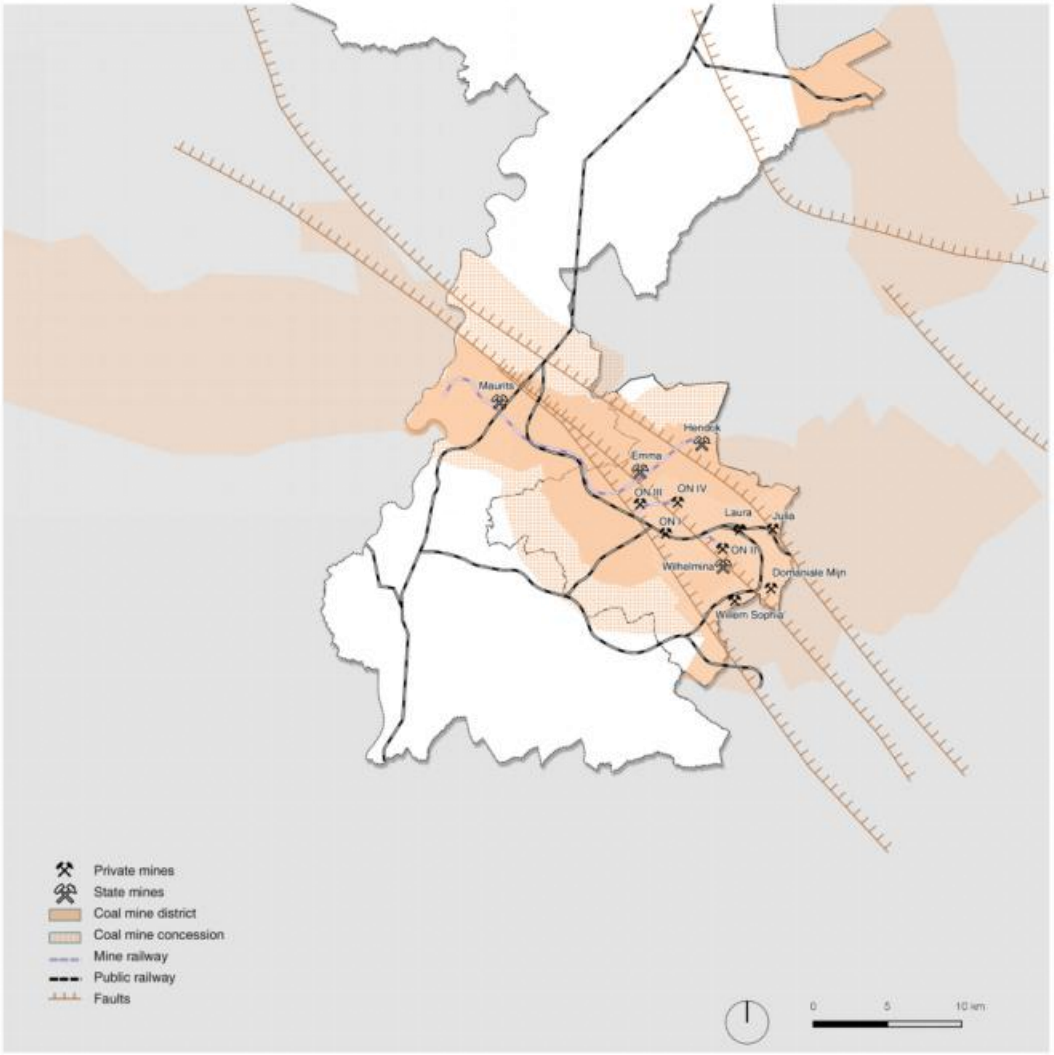
The South Limburg area has a unique topography in the whole Netherlands. The core quality of Parkstad lies ahead undeniably on its physical basis, in its landscape. In South Limburg, from west to the east, there is a unique geological form. On the west, there are river valleys with its terraces and slopes, while on Parkstad, where on the eastern part, there are only stream valleys.



This geologic structure determined the position of the pits and colonies around them, and then influence the city sprawl pattern continuously.

Apart from the mine railway, the public railway also has been effected, and some of them are still in use today.

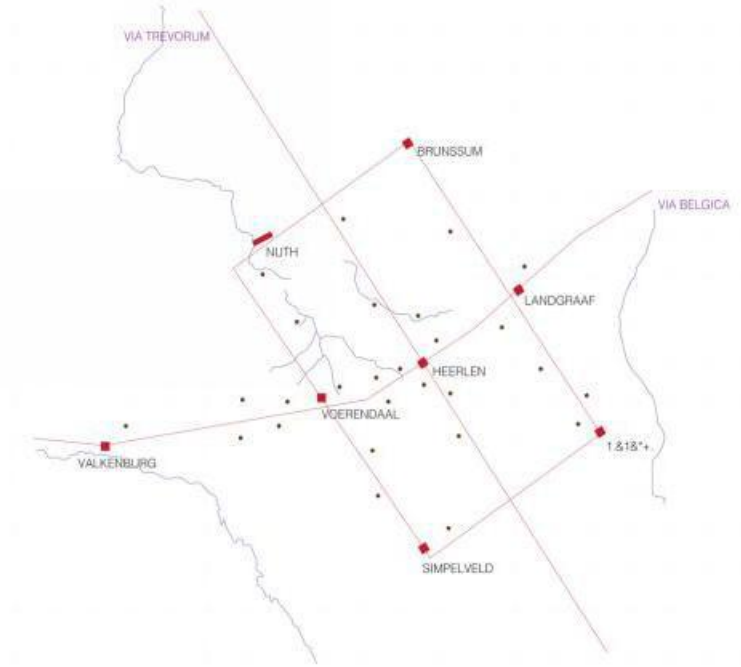
Understanding the spatial structure helps identify the potential planning opportunity.

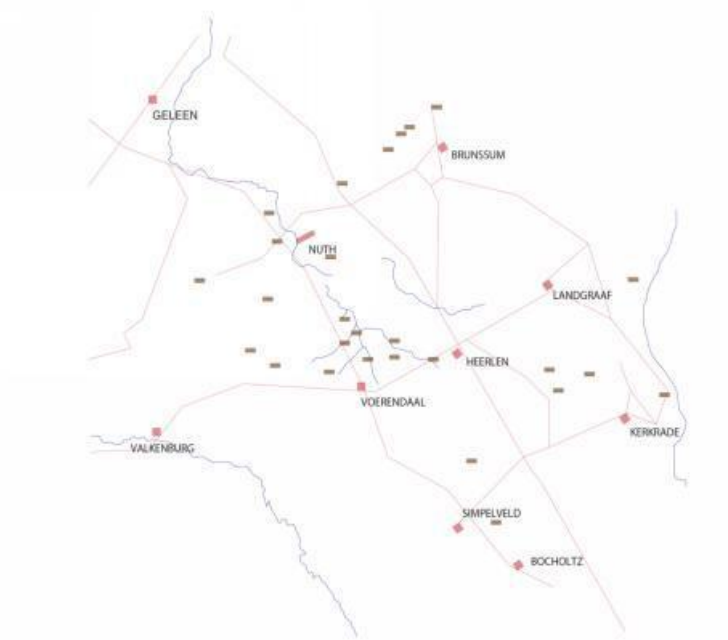






Source: http://www.limburgsemijnen.nl/





The Roman roots started to develop around 50 BC when Julius Caesar conquered the region. One of the most prominent elements still visible today are the roads built in this time. The Via Belgica, for example, was an east-west orientated road that connected the area with what is now Belgium and Germany.

The Romans cultivated the landscape further and for the first time, people built on these plateaus. During the middle age, the population grows rapidly.

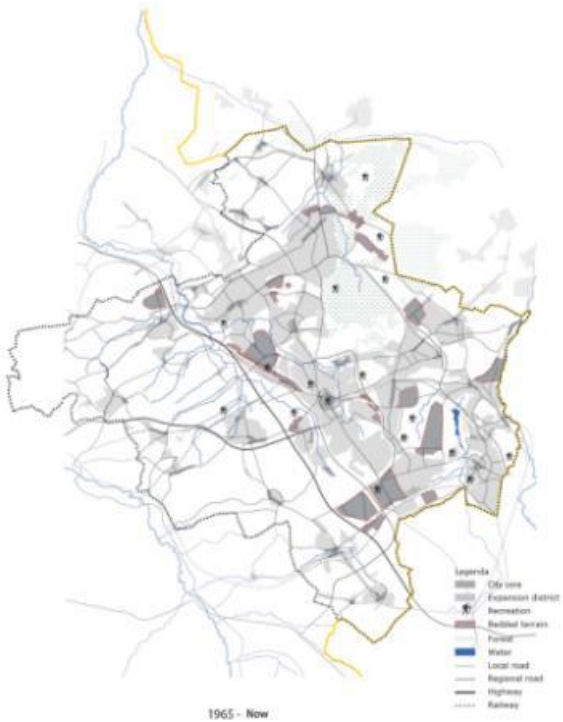
During the medieval, the plateau remains uninhabited. Most villages settled along the Meuse and in the valley. The soils in these valleys are fertile and thus easy to cultivate. With the cultivation on a plateau, ranches to a farmstead. Typical character about the settlements on this period is that castles and forts are indirectly surrounded by agricultural lands and directly by orchards, and evolve along the rivers and stream valleys.



Before - 1900



1945 - 1965



1965 - Now



City sprawl and its relationship with landscape

Source: Author

First period: Ancient river valleys through out the plateau. On the intersections arose settlements with farms. The typical characteristic of this period is that castles settled on stream valley, using the water as a defense. Villages are not around castles; they developed independently.

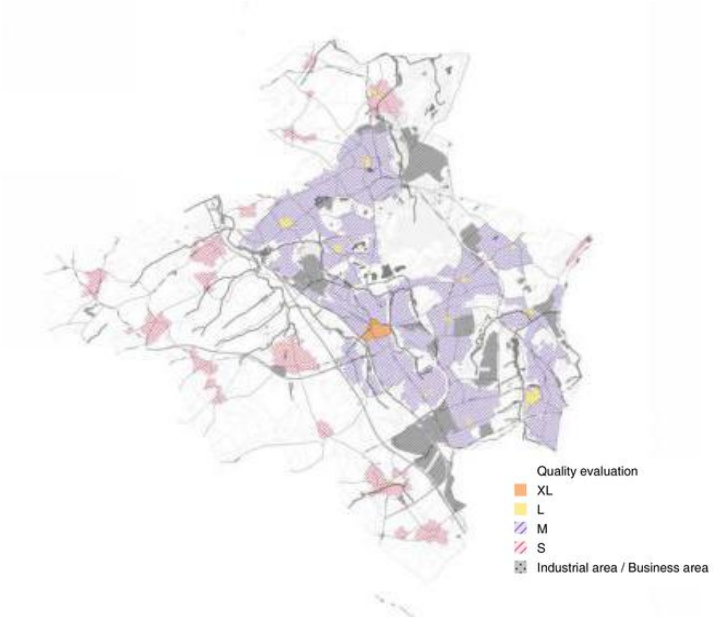
Second period: At the end of the 19th century, it became possible to dig deeper coal. This could happen underground but had a significant impact on the landscape on above ground. The shafts of the mines have been laid out on the pits in front of excellent locations, independent of the inhabited centers. Railways were built to unlock the mines and transport the coal. The stream valleys were channeled mainly to handle the increased drainage of water from the mine. Existing colonies were expanded, and the expansions in the countryside grew attached to the larger centers. In places where these islands were building together was a clash of the urban fabric. The region developed more and more into a poly-centric city. The underlying landscape here still less the support of the built environment.

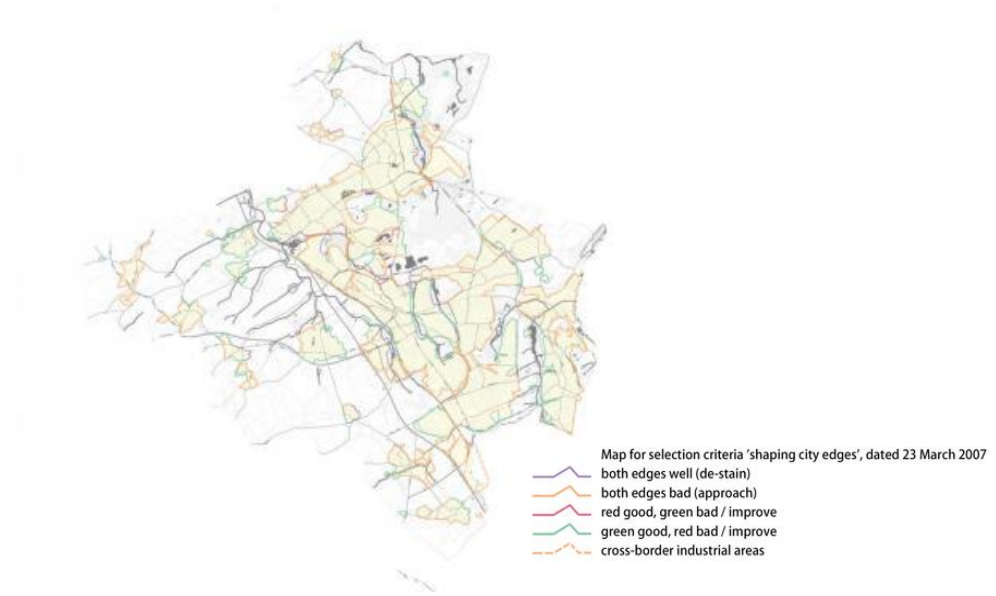
Apart from the dominated coal mine, the rural economy in Parkstad also underwent a structural transformation between 1850 and 1940. A crucial first factor was the switch from arable farming system to animal husbandry and horticulture. The second development was internationalization and world wild integration of agricultural and food market.

The landscape always gave all direction to the urbanization of the region. Only a short 50-year period, this principle was abandoned and flattened the region into a disjointed of pieces of city land without a clear structure and ultimately without a clear identity.

Third period: After the announcement of the closure of the mines in 1965, the region transformed the motto "from black to green". The mine sites at this moment were converted into industrial, residential areas or recreational areas. Almost all mine buildings, cooling towers, shaft buildings, and railways were destroyed or demolished. It is no longer clear where one place ends, and the other starts. The old town centers are still visible, but only as part of the continuous urban fabric.

The landscape is incomplete; the form of green patches is invisible. Since the shrinkage of the population in around 1995, Parkstad has been restructuring. The targeted demolished areas are one of those strategies, and constructing new housing types is another. Recently Parkstad began re-naturing stream valleys. Only the built environment does not exist yet in the plan.





Although with those changes, it has been shrinking after the closure of the coal mines in the 1960s, in terms of both social and economic aspects.

From the quality evaluation map, the poly-centric city fabric is more apparent. The highest value stands for the city center, and the value for the east is higher than the west, which could be explained with the city sprawl and coal mine colony maps.

The second diagram shows the value of the city edge - the level of connection between urban fringe. This connection is not decided by one actor alone, a good relationship needs the support from both sides. But how to deal with this area? There is a concept of terrain-in-between (urban area and countryside) which can be used to describe the fringe in Parkstad. This structure formed gradually with the development of history; it has the flexibility to be transformed from one function to another and even to multi-function.

2.3 Social and cultural network

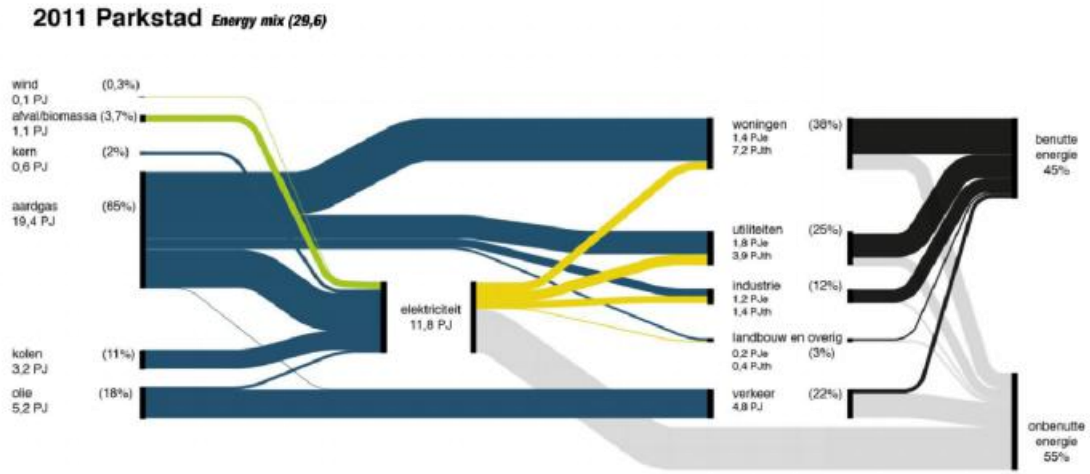
Parkstad invested in its culture in particular. In such a urban environment, in which creation and high-tech can develop, and it is better for social and economic future in its strategy.

Heerlen recognizes that modern citizens, and especially the members of the creative class, search for places of free thinking and acting, for an open public space in which they share their thoughts with people, who are alike and different. They are attracted to jobs that are offered in a vibrant social cultural environment: the “people’s climate”. An open public space, a vibrant network, is fundamental for both the regional quality of life and the regional economy (Florida, 2010).



2.4 Energy type and potential assessment

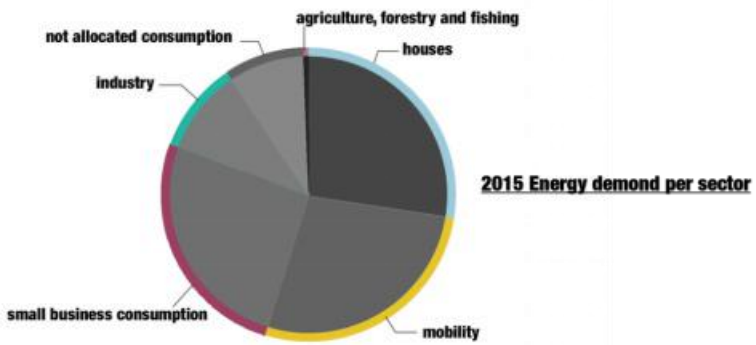
2.4.1 Dashboard

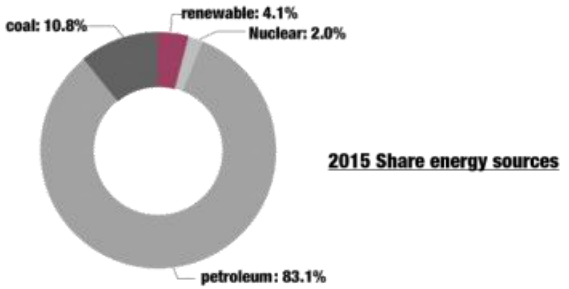


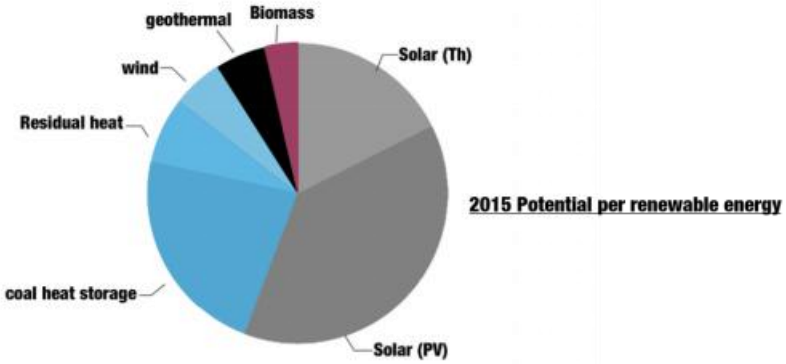
This chart shows the the energy utilization condition in 2011, the fossil fuels were the main suppliers, and the utilization rate is less than a half.

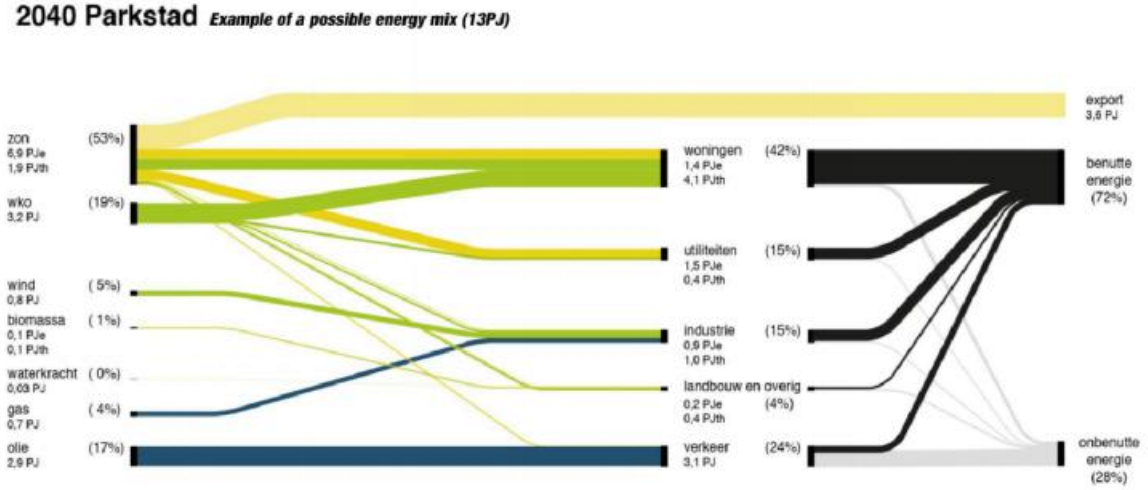
On 2015, Parkstad still relied on petroleum rather than renewable energy. But among those sources of renewable energy, solar power had a great potential.

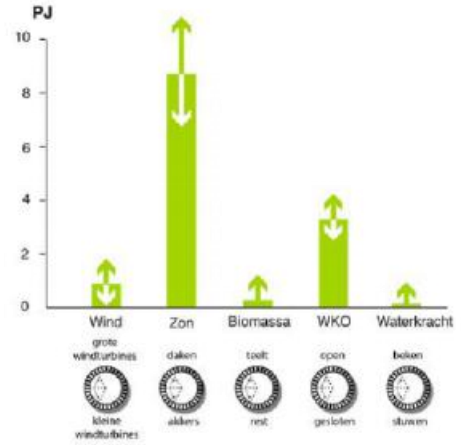


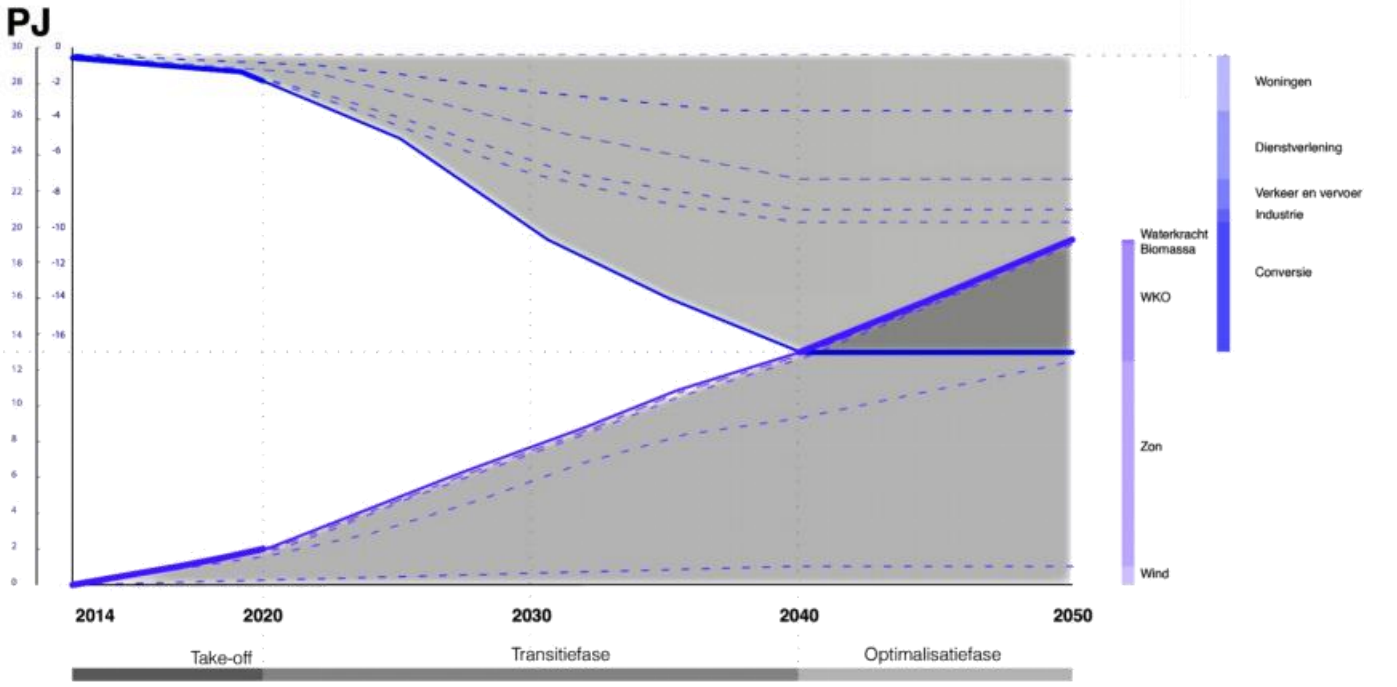












Ambition chart energy transition Parkstad Limburg

The prediction of possible energy mix on 2040 shows significant changes of energy supplier and utilization rate, and even has the ability to export the energy from Parkstad to other places.

And on the same year the quantity of supply and demand will achieve a balance, and after Parkstad would be self-sufficient.



Energy landscape in urban area

Source: *LANDSCAPE AND ENERGY*

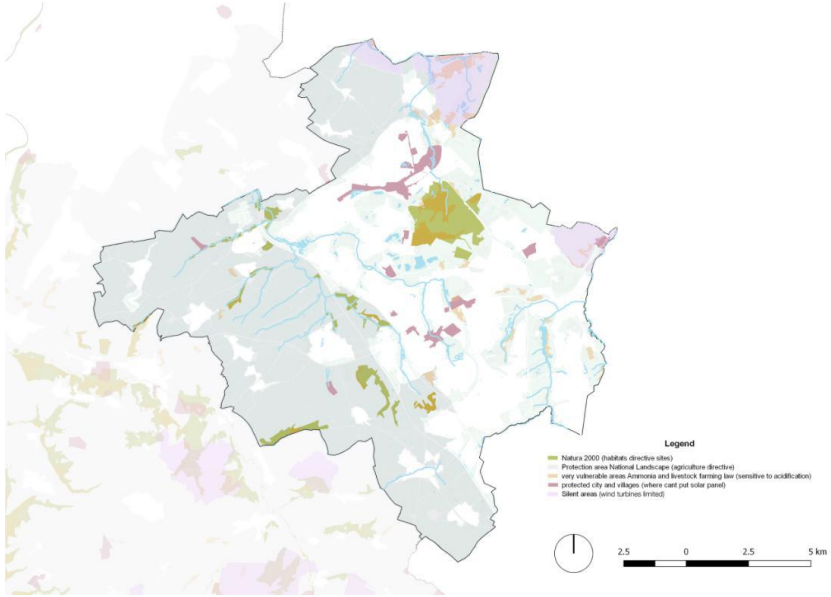
With this trend, Parkstad could also have a chance to experience a status transformation. As a former mining area, seeking a new characteristic is desired for a long time. New technique should be revolved into this transform, as well as a new landscape type. Apparently it is not realistic to make them all into energy landscape, because of the restrictions, such as protect policy or topography. So the first step is to define the most potential areas for energy landscape and shape them with landscape approaches.



2.5 Restrictions

Restriction maps are crucial because it helps decide the possible area for design intervention. But before the focus area design, a important step is to figure out the potential areas for both energy and spatial design. There are mainly three limitations for the design.

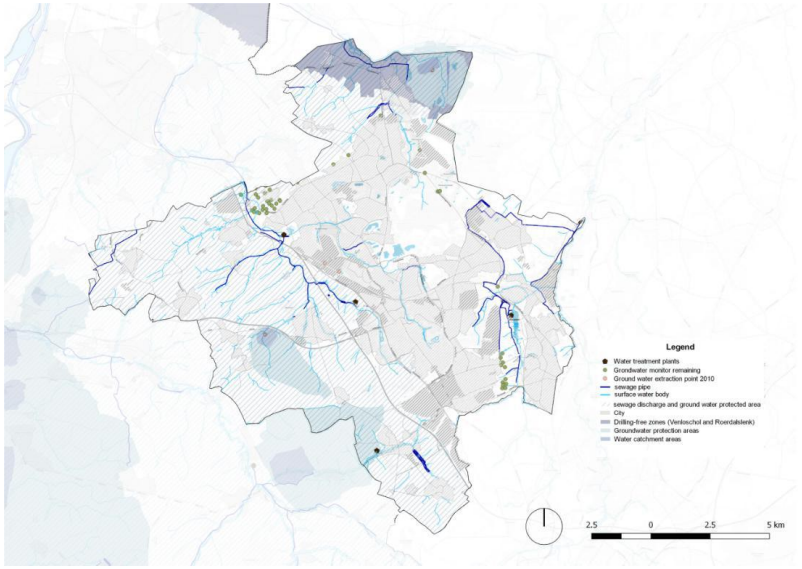
This diagram shows the transportation distances for energy carriers originating in Parkstad. Warm water should be transported a maximum of 10 km; solid biomass a maximum of 50 km. Liquid fuels can be carried over long distances depending on the mode of transportation. Electricity can be transmitted with a loss of approximately 10% over 1000 km.



Natura 2000 (habitats directive sites)
Protection area National Landscape (agriculture directive)
very vulnerable areas Ammonia and livestock farming law (sensitive to acidification)
protected city and villages (where cant put solar panel)
Silent areas (wind turbines limited)

The untouchable map shows the areas where could not be intervened because of the protection policy.

For example, a maximum of 10% of all agricultural lands that are not located within the National Landscape South Limburg protection area are considered suitable for solar farms in this study.

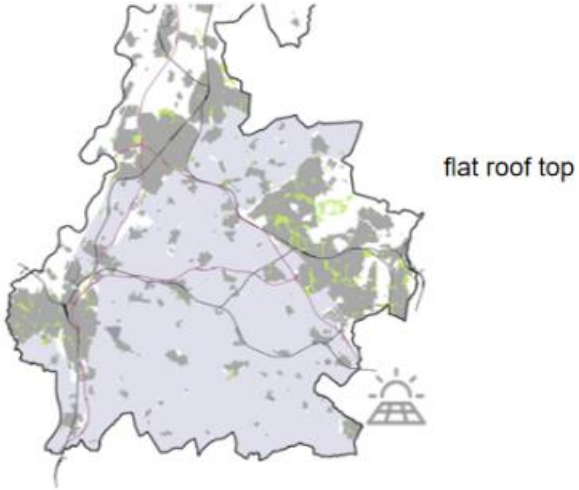


Water treatment plants
Grondwater monitor remaining
Ground water extraction point 2010
sewage pipe
surface water body
sewage discharge and ground water protected area
City
Drilling-free zones (Venloschol and Roerdalslenk)
Groundwater protection areas
Water catchment areas

The water system could also impact to energy utilization in terms of geothermal and biomass.

The water treatment plants could be used as the energy redistribution station. The location of existing plants restricts the beginning and terminal of the energy flow, then effect on the spatial design.

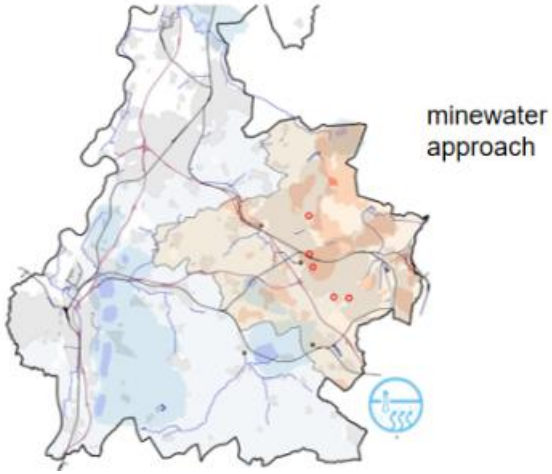
2.4.2 Distribution, and proportion



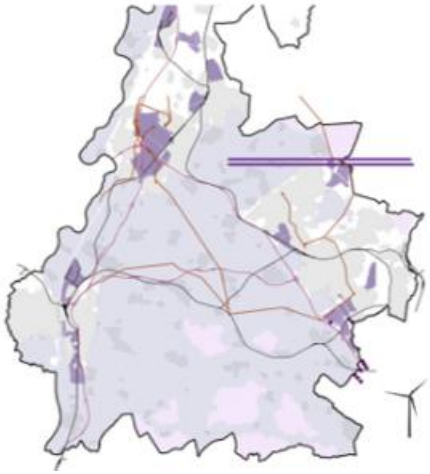
flat roof top



extensive farmland



minewater approach

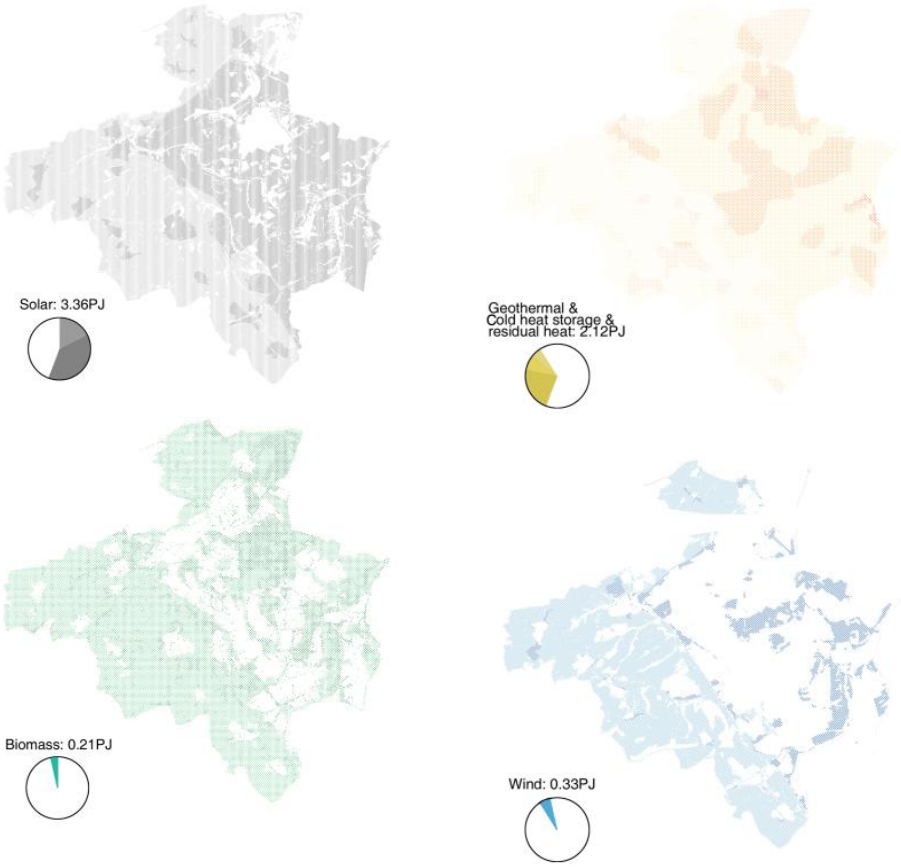


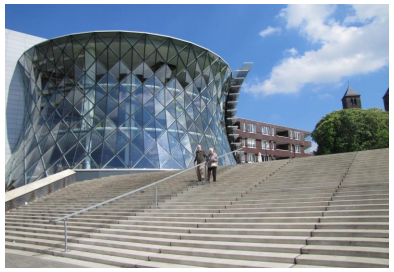
Wind turbins

During the coal mining period, it was an energy producer, and now, it is an energy consumer.

With the energy potentials analysis, it is easier to look for spatial characteristic along with the optimistic choice.

There are more than 2/3 the land are protected, which means no energy facilities could be installed. It still has a potential to collect the biomass there, although the contribution of it is negligible at current.





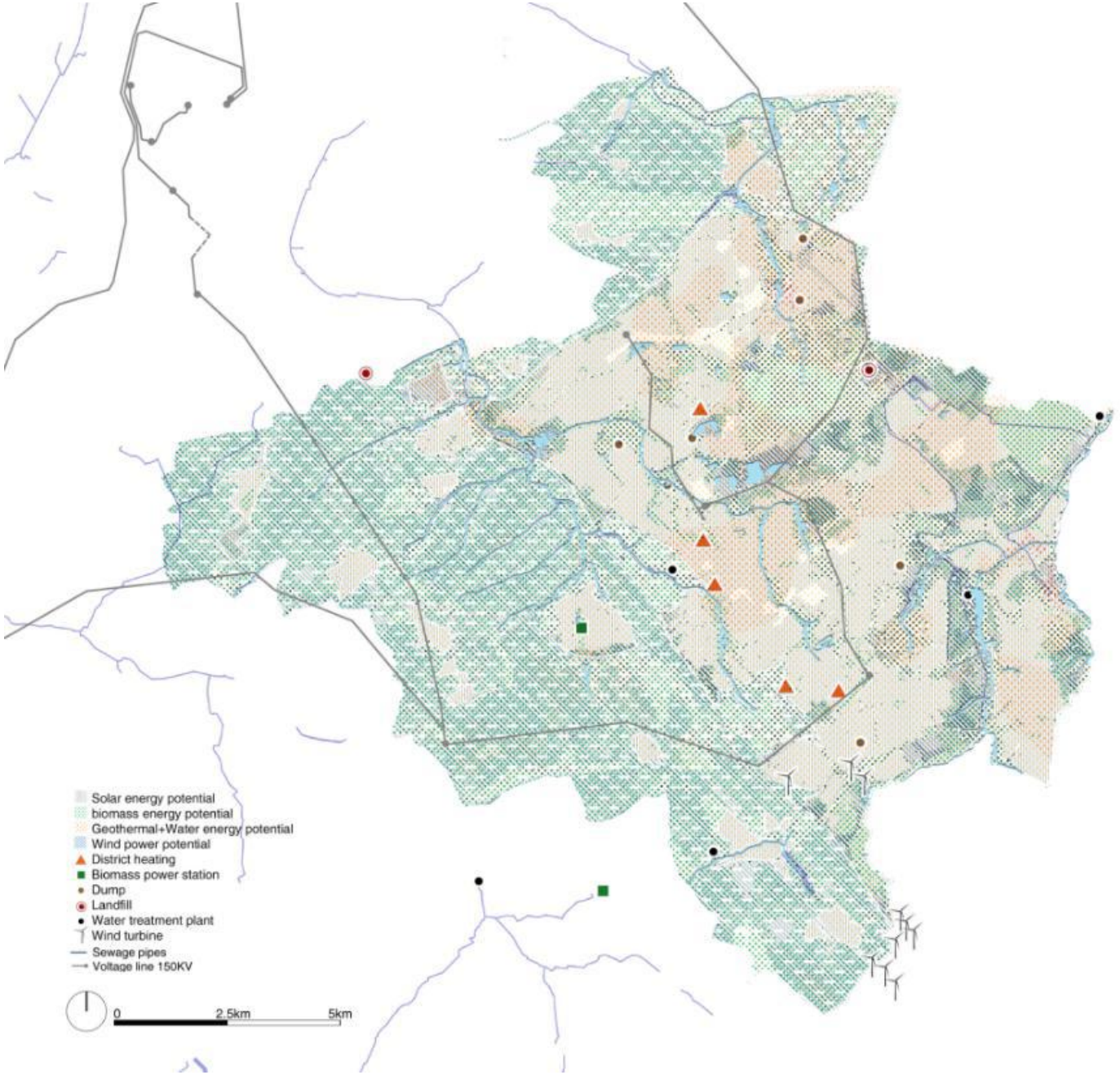
Mine water project: ’Gen Coel’ complex
Source: https://www.mijnwater.com/?lang=en

The sources of energy in Parkstad could be classified in four types.

Among these, solar power is the most supportive energy source, because the technique of solar pv and solar collectors is good and makes it become the main form of renewable energy source nowadays.

Biomass energy efficiency is low at present, but the amount of sources like biomass crops are huge. And there are more than half of the whole area are covered by green land. So with a more strategic approach, the biomass could be a decent supplement of energy.

Geothermal energy in Parkstad is also abundant and the mine water is used to heat and cold. Big wind turbine has a distance limitation, but the middle or small wind turbine have less restriction, and it could be installed on the top of the roof or with the street lamp.



After overlapping these layers, I got the energy potential map. Those dark areas stand for the most potential area for energy generation.

On my project, these areas are called energy parks; they are a form of energy landscape. One side, these areas are almost located on the terrain-in-between on which multiple transitions could happen at the same time. And on the other hand, these energy parks are essential components of the green system in Parkstad.

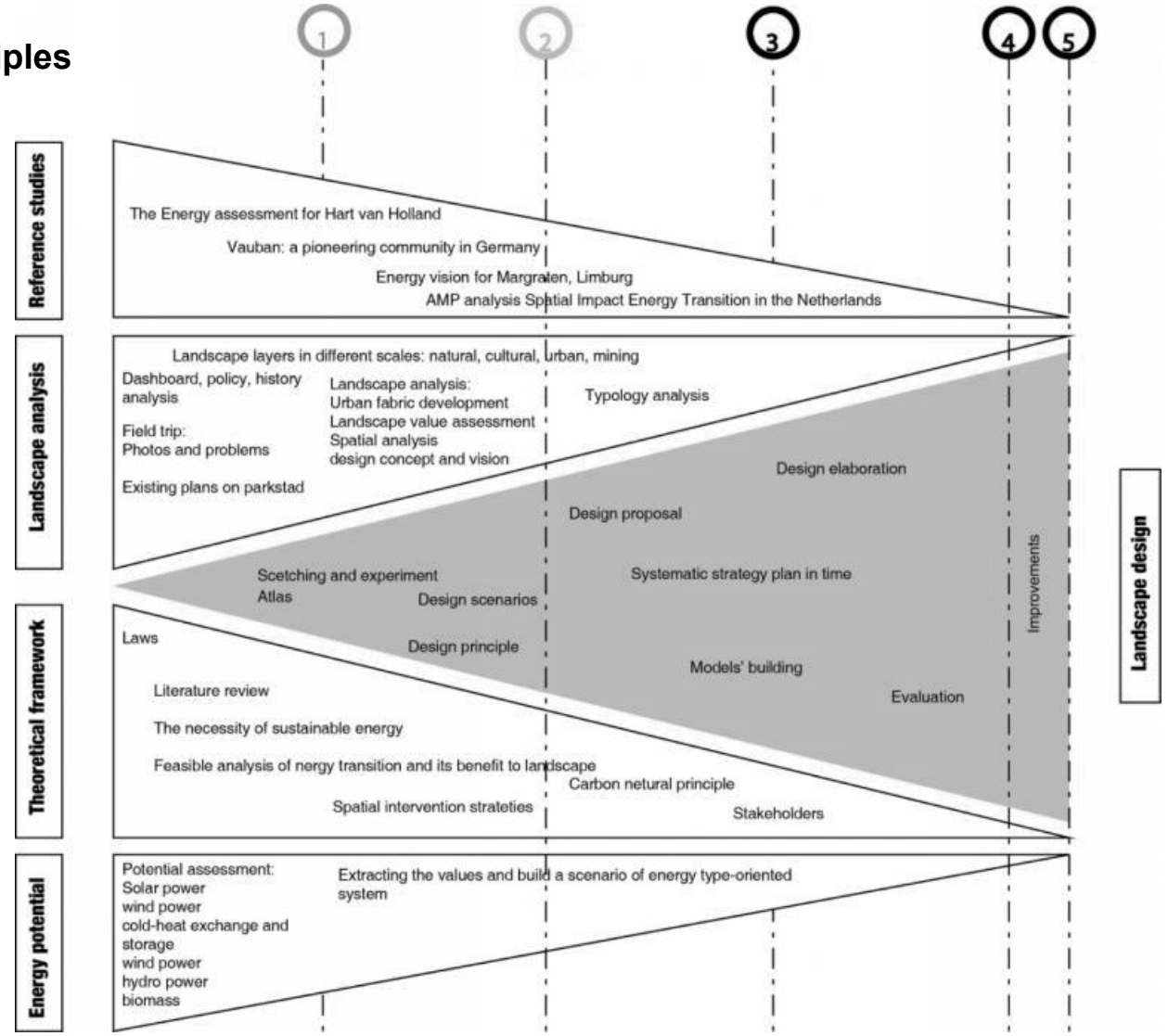
The energy landscape should be a mix of landscape with energy-related facilities, which also has recreational functions and aesthetic values. Energy is a way to improve the landscape value, rather than a dominant form of the backgrand landscape.

3. Methodology

3.1 Research approach and principles

The research approach in this paper starts from four parallel aspects: energy potential, theoretical framework, landscape analysis, and reference studies. In the preliminary, the energy potential analysis helps to decide the range of intervention and the quantity of the capacity. The theoretical framework includes some essential criteria for landscape and energy.

The landscape vision to elaboration design is a gradual process; it plays a decisive role at a later stage. I am abstracting useful information from landscape and energy analysis maps, with the guidance of theories and case studies.



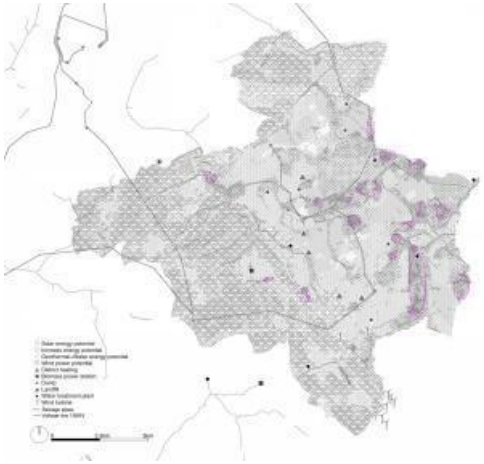
3.2 Theoretical backgrounds

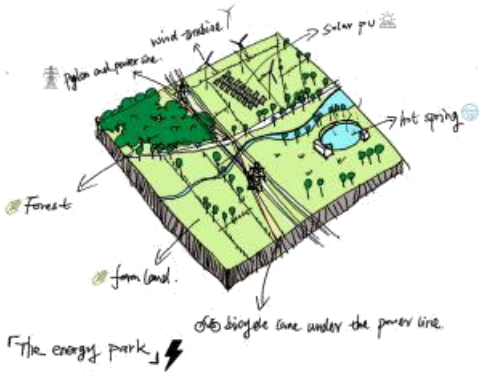
Environmental designers, according to Rowe, have three modes of inquiry at their disposal; they are deduction, induction, and abduction.

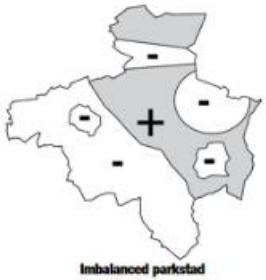
In this research paper, the logical deduction is applying energy-conscious urban design principles like from the energy potential map to the energy park hot point.

Induction is to formulate the generally applicable design strategy based on case-studies and summarize it into three stragegies: imbalanced, disconnected and delaminated Parkstad.

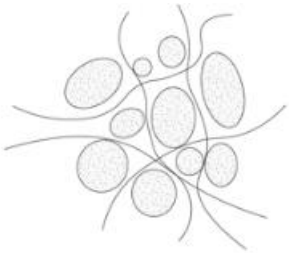
The third inquiry in my proposal is to translate the spatial energy application into the landscape language, to show the energy transition in this region. Using the three strategies as a guidance on regional scale.



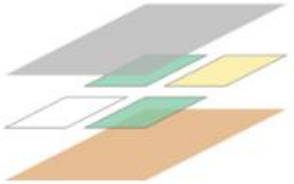




Imbalanced parkstad
energy sources
urbanization



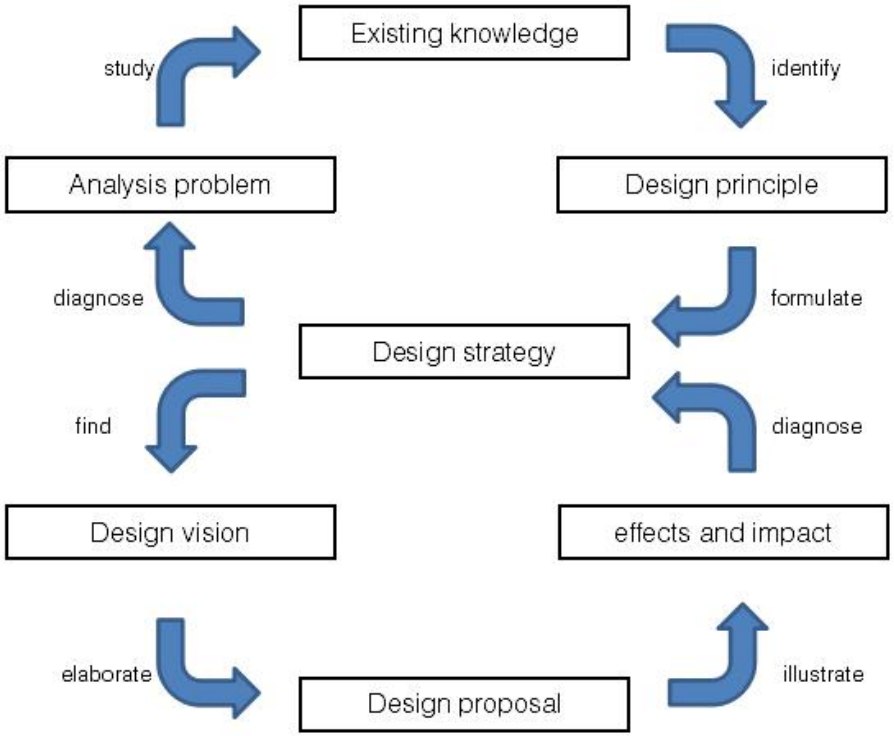
Disconnected parkstad
Green system
Infrastructure
Energy flow



Delaminated parkstad
upper layer
ground layer
underground layer

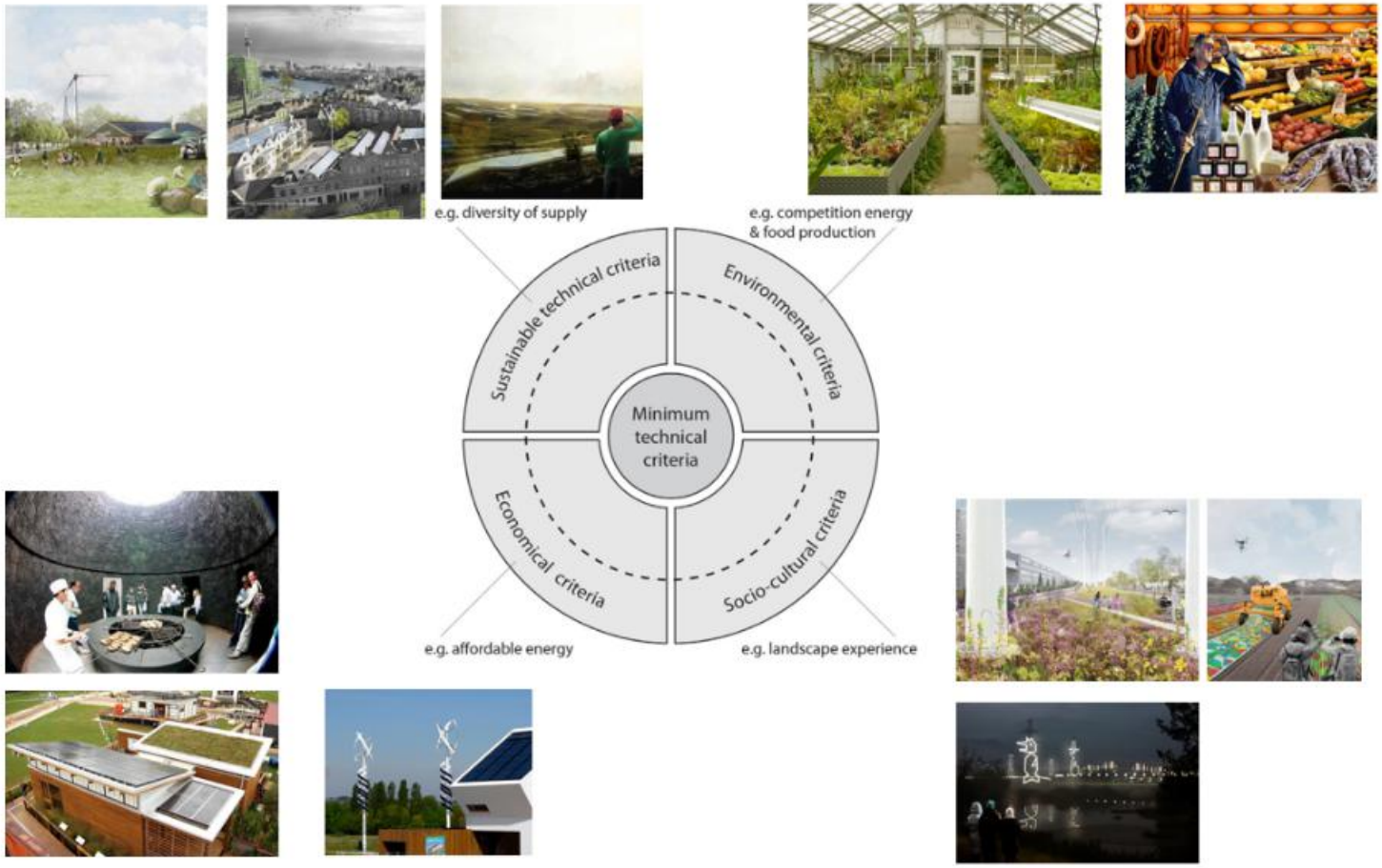
3.3 methodology framework

The methodology framework of my proposal is starting from the existing knowledge of landscape as process and energy transition as a language. Then according to the theoretical modes mentioned before to come up with the design principle: energy-conscious urban design. This principle leads to three different design strategies. These strategies are interacted with each other and effect to the design proposal.

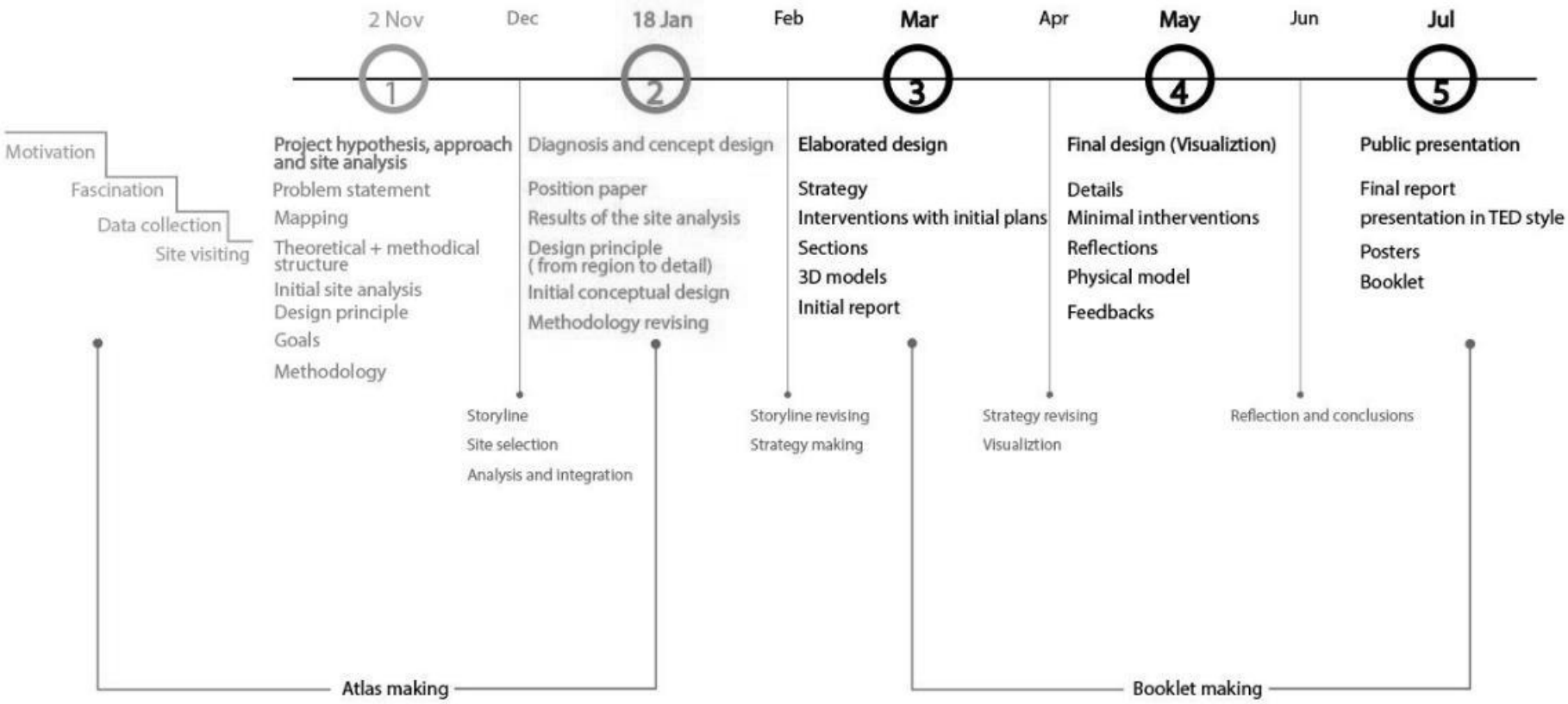


3.4 Energy landscape criteria

As energy-conscious design are related to practical approaches. There are four aspects of the energy technical criteria: sustainable technical criteria, environmental criteria, the economical criteria, the socio-cutural criteria. A decent energy landscape design should meet these requirements.



3.4 Time plan

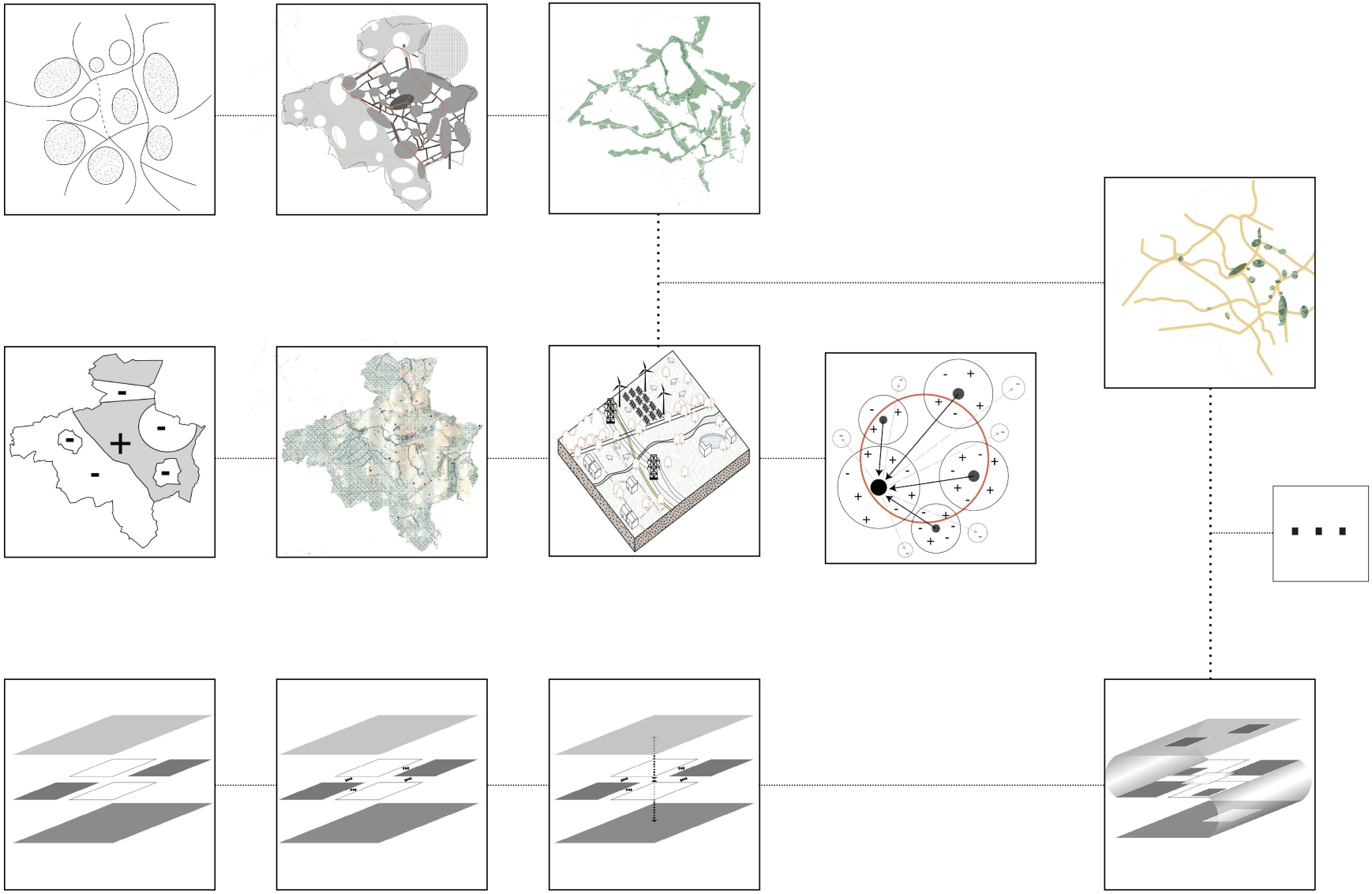

2 Nov
Dec
18 Jan
Feb
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Apr
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Jul
1
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Motivation
Fascination
Data collection
Site visiting
Project hypothesis, approach and site analysis
Problem statement
Mapping
Theoretical + methodical structure
Initial site analysis
Design principle
Goals
Methodology
Diagnosis and cencept design
Position paper
Results of the site analysis
Design principle (from region to detail)
Initial conceptual design
Methodology revising
Elaborated design
Strategy
Interventions with initial plans
Sections
3D models
Initial report
Final design (Visualiztion)
Details
Minimal intherventions
Reflections
Physical model
Feedbacks
Public presentation
Final report
presentation in TED style
Posters
Booklet
Storyline
Site selection
Analysis and integration
Storyline revising
Strategy making
Strategy revising
Visualiztion
Reflection and conclusions
Atlas making
Booklet making



4. REGIONAL STRATEGY

Because Parkstad is a conurbation, those municipalities of it have economical and spatial common interests. And because of the mining history, the fragmentation resulted in a special urban structure, and the terrain in between the city and suburb area is the physical parts of it. The social and cultural segregation has also caused some issues. This so-called amorphous urbanization is a consequence of the regions' history, which is heavily characterized by coal mining (Gordijn, et al. 2003).

With the research question, I come up with three strategies for the whole Parkstad region, based on the existing problems in a big scale. They are green grid strategy, energy flow strategy and spatial composition strategy. These three strategies are parallel and correlated in some respects, for example the social and cultural activities. It is a challenge as the complexity of this area, but makes the intervention approach more interesting. And how to achieve a delicate balance between the synergistic effect and trade-off is my primary task and research orientation.



The schemetic diagram shows three strategies. The energy ring is the most complicated one. I proposed the energy plants in the ring structure, combine it with the sewage treatment plants, or the dumps. The sewage treatment plant can be seen as an energy roundabout.Energy sources and sinks are seen as the start and terminal of one loop. So it's the first circulation: the residual heat flow.

The second flow is the energy park flow, there are same energy parks which have the function of energy production, and recreational and ecological feature. They are seen as the micro energy hubs which have a limitation of the radius effect but with a strong connection to the surrounding areas. So this flow is a supplement of the residual heat flow. Combining these two flows, the system of the ring is settled.

After overlapping the green grid and energy park, I get an integrated energy landscape network. Then combining it with the spatial composition strategy, a combination in three dimension is derived. A more concrete strategy for elaboration design is deduced from this integrated strategies.

The outer ring road is a backbone of Parkstad. It connected the most important attractions and green patches. Along it there are different types of buildings in different conditions. The sink and source concept helps to make the energy circulation strategy.

Cooperating with the physical ring, the energy ring helps to strengthen the circle and provide more possibilities.

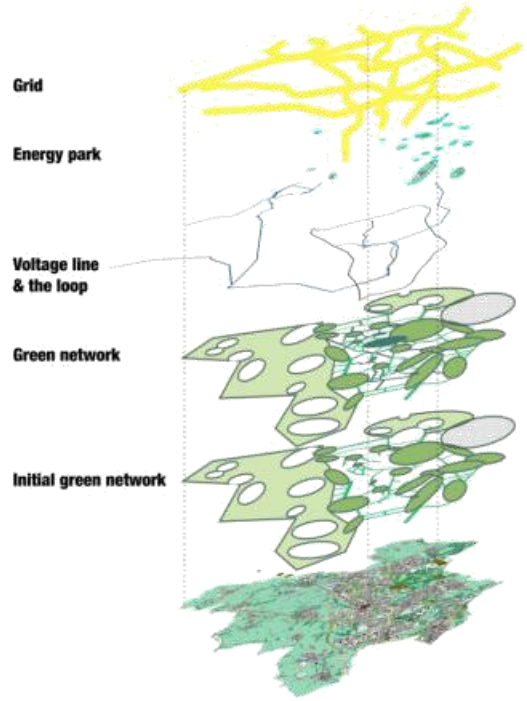
The symbiotic network and green grid strategy is more ecology oriented. As the most significant part of a city's ecological environment, the green system acts as a moderator and organizer. The current green network is unconnected and dispersed.

Reconnecting the green corridors, making more relations and knit them into a whole net, then the pattern of the symbiotic network has been settled. From the first and second strategy, the ring road are not only the transport ring but also the ecological corridor and energy flow circulation. It helps to reinforce structure of green grid.

The third strategy helps to make intervention on specific location.

4.2 Symbiotic network and green grid strategy





The symbiotic network and green grid strategy is more ecology oriented. As the most significant part of a city's ecological environment, the green system acts as a moderator and organizer. The current green network is unconnected and dispersed.

The first step is to reconnect the green corridors (dark green in the picture), making more relations and knit them into a whole net (light green), then the pattern of the symbiotic network has been settled. Then analysis the connection with the ring road and the voltage line. From the last strategy, the ring road are not only the transport ring but also the energy ring. But it also given another characteristic, it is strengthened and makes up the green grid system (yellow lines in the picture).

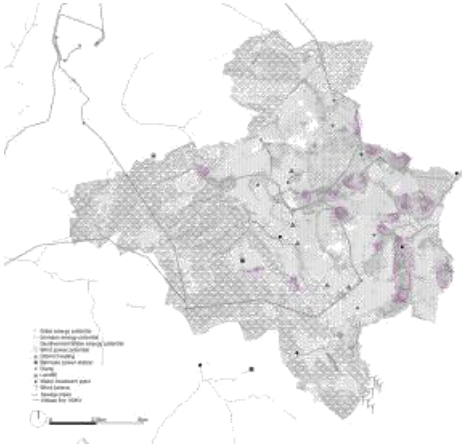
In this way, the green system strategy will make the Parkstad region a integrated system







4.1 Source-sink strategy

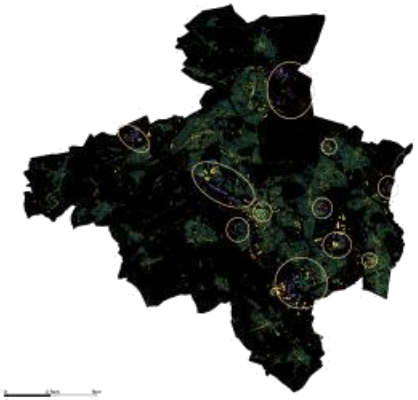


Source: Energy park



\+

Sink: Business park
Old district

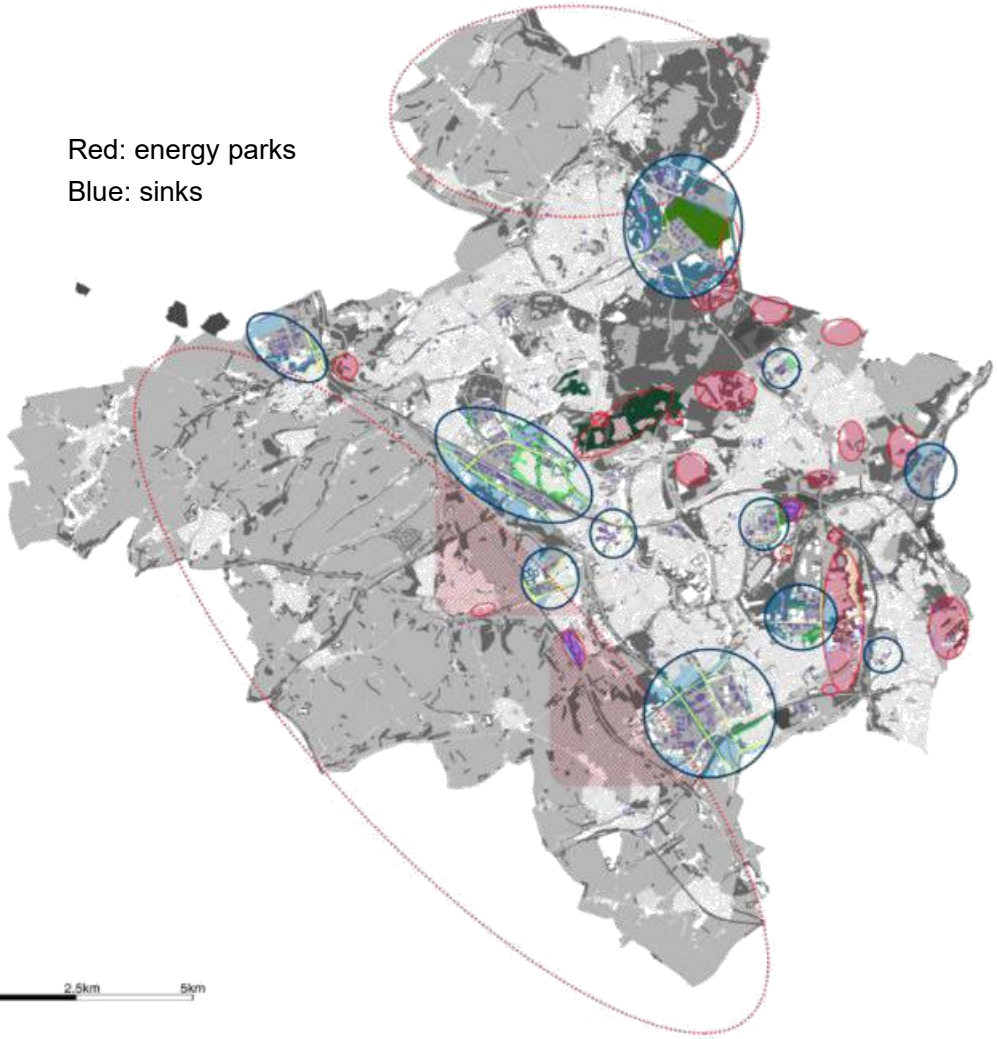






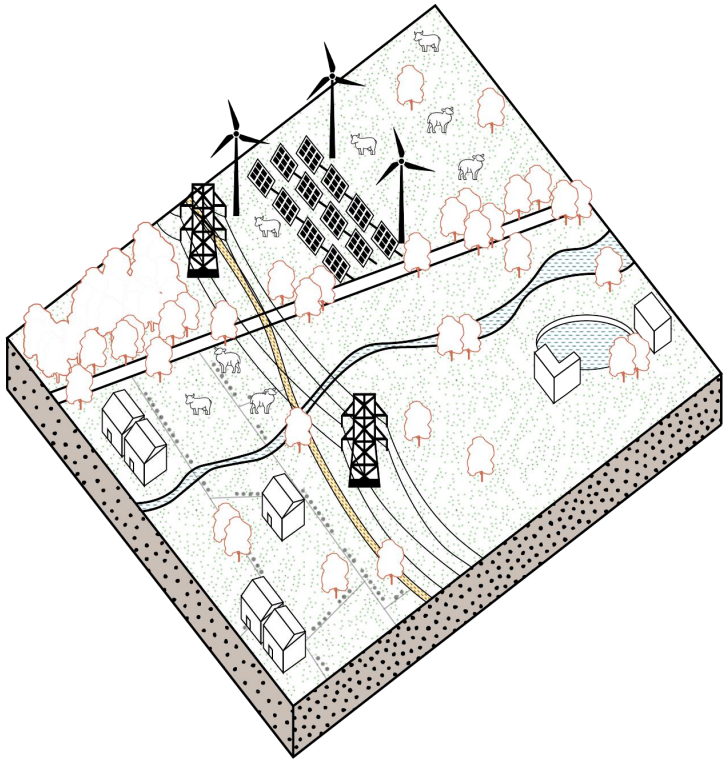


Red: energy parks
Blue: sinks



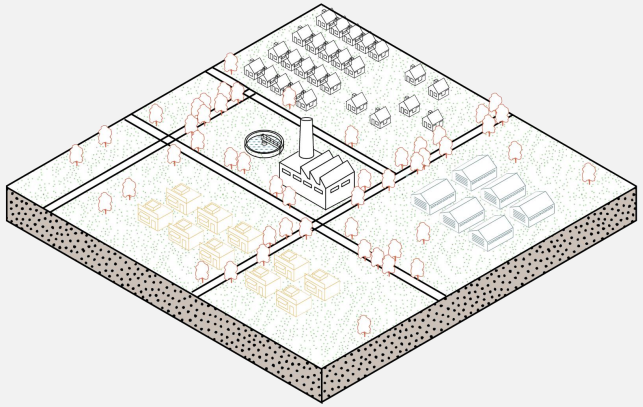


Energy park mode



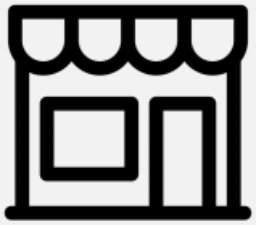


Sink types





Business parks



Shops and companies



old houses

The ring road

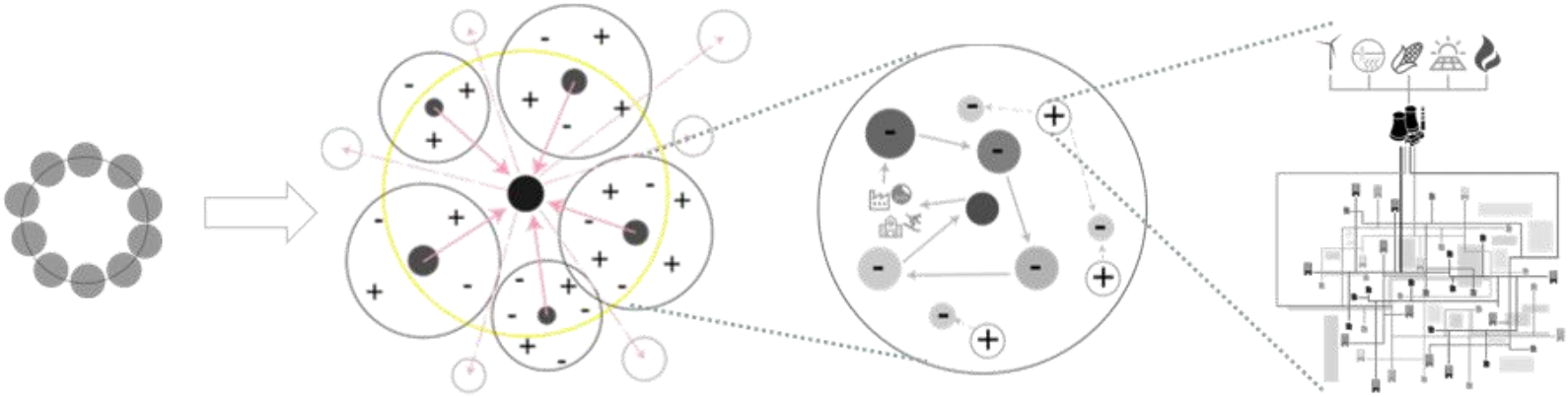
The outer ring road is a backbone of Parkstad. It connected the most important atrractions and green patches.

Along the ring road there are different types of buildings and in different conditions. The sink and source concept helps to make the energy circulation strategy.

Cooperating with the physical ring, the energy ring helps to strengthen the circle and provide more possibilities for the whole area.

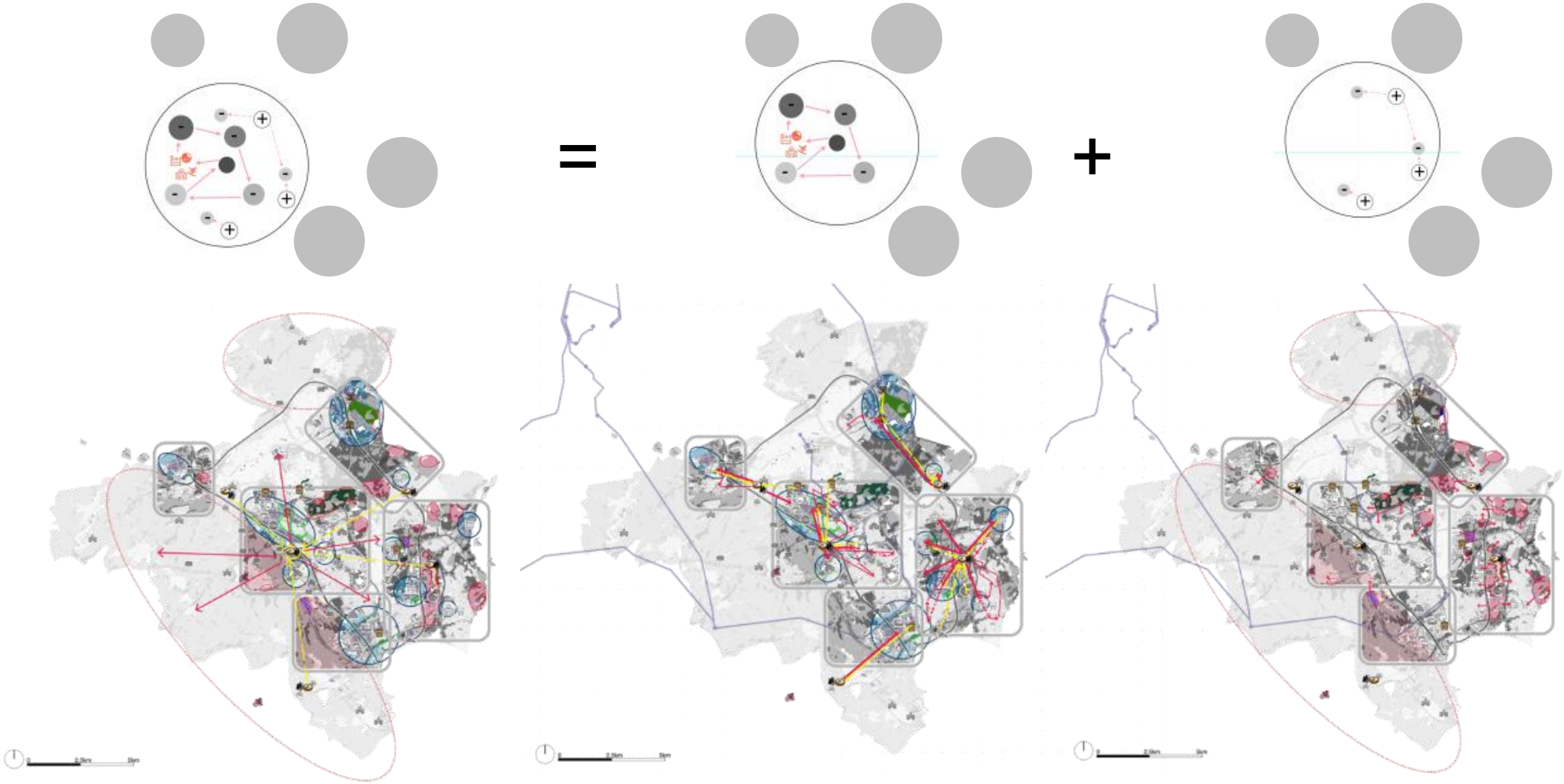


The ring: Energy circulation mode





Big circulation



I proposed the biomass plants in the ring structure, combine it with the sewage treatment plants, or the dumps. The sewage treatment plant can be seen as an energy roundabout. Energy sources could be the fossil fuels or the exported electricity here, while sinks lead the direction of the energy flow. The energy transport to the most significant consumer like the industries and then to the old neighborhoods because of the poor thermal insulation, and then to the newer communities. And in the end, if there is still heat left then transport back to hubs. So it's the first circulation: the residual heat flow.

The second flow is the energy park flow, there are same energy parks which have the function of energy production, and recreational and ecological feature. They are seen as the micro energy hubs which have a limitation of the radius effect but with a strong connection to the surrounding areas. So this flow is a supplement of the residual heat flow.

Combining these two flows, the system of the string is settled.

4.3 Spatial composition strategy

There are three spatial layers on Parkstad: upper layer, ground layer and underground layer. Now the urban fabric is separated and delaminated. Urbanized area and rural area or green spaces have different characteristics and functions. There to quote a notion of terrain in between, it is a spatial gradient from urban center to rural periphery(Alexander Wandl, Nadin, Zonneveld & Rooij, 2014). It is a way to blur the edge and find other functions for both side.

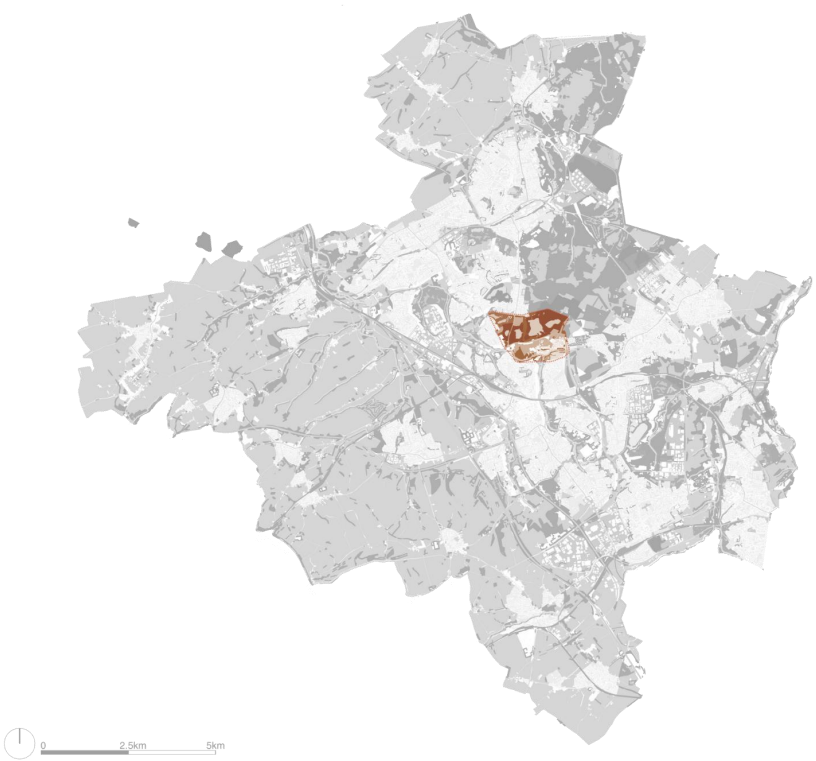




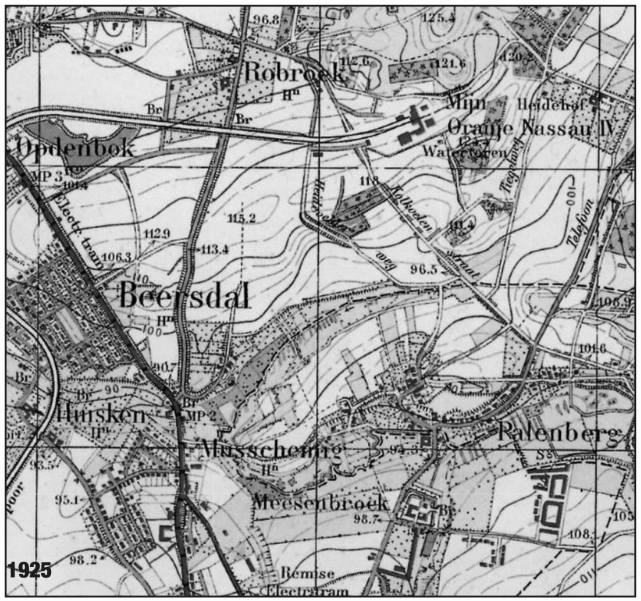
5. DESIGN IMPLEMENTATION

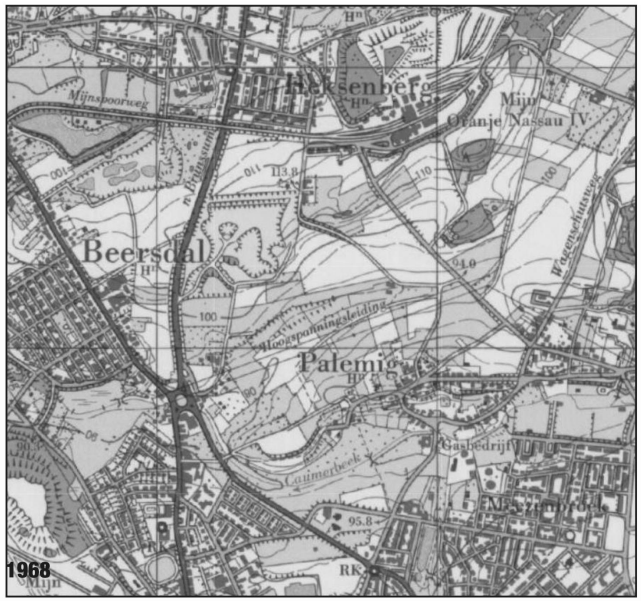
5.1 Location analysis

As my focus area is next to Brunssummerheide, where is a silver mining area now, it is a terrain in between the nature area and urban structure. Since this area has a unique location, it can be seen as a gradation that emerges during the transition from green to gray. When it is proposed to be a stepping stone, it should have multiple identities and functions. As a city park, it is a recreational place gathering people who live nearby and tourists. However, as an energy landscape, it also has the characteristic of energy harvest and exhibition. The quantified energy shows the technical capacity and potential. And provide a possibility for the bigger area to become an energy supplier and make more jobs opportunities.



Location introduction





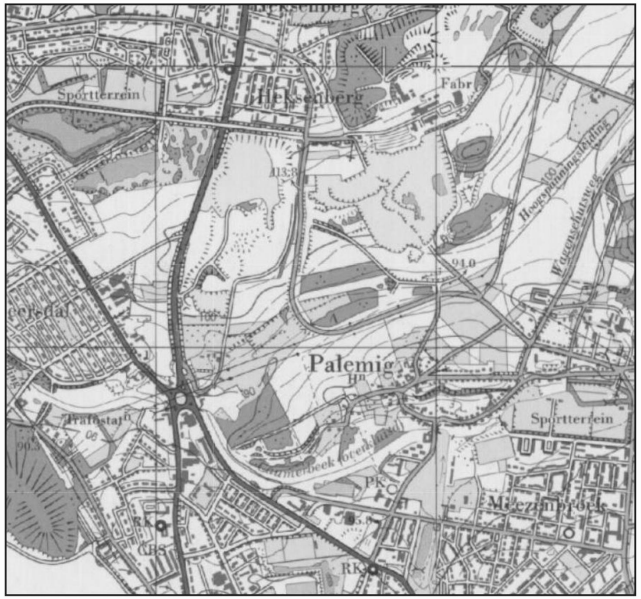
Oranje Nassau IV

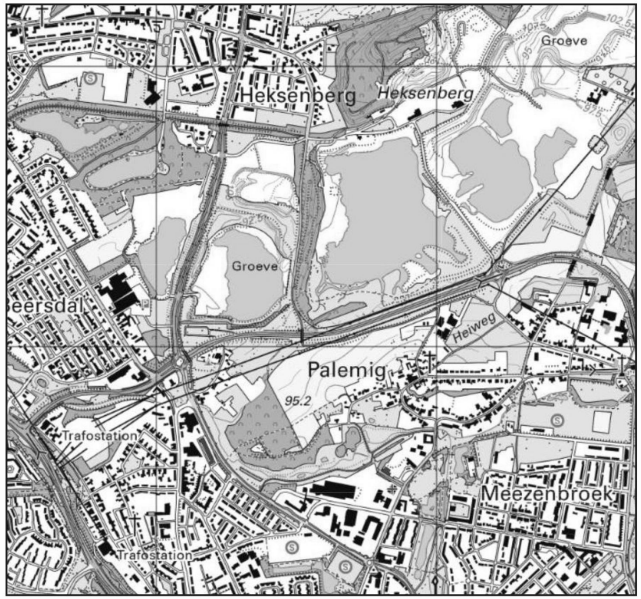
Location: Heerlen
Start building: 1910
Product period: 1925-1966
Total production: 13,754,000 ton
Shaft: 740 meter deep

SIBELCO Sibelco Benelux B.V.

Masonry contractor
Date of establishment: 28-04-1970
Products and services: Sand, gravel and clay extraction

The current license from Sibelco will expire in 2020.





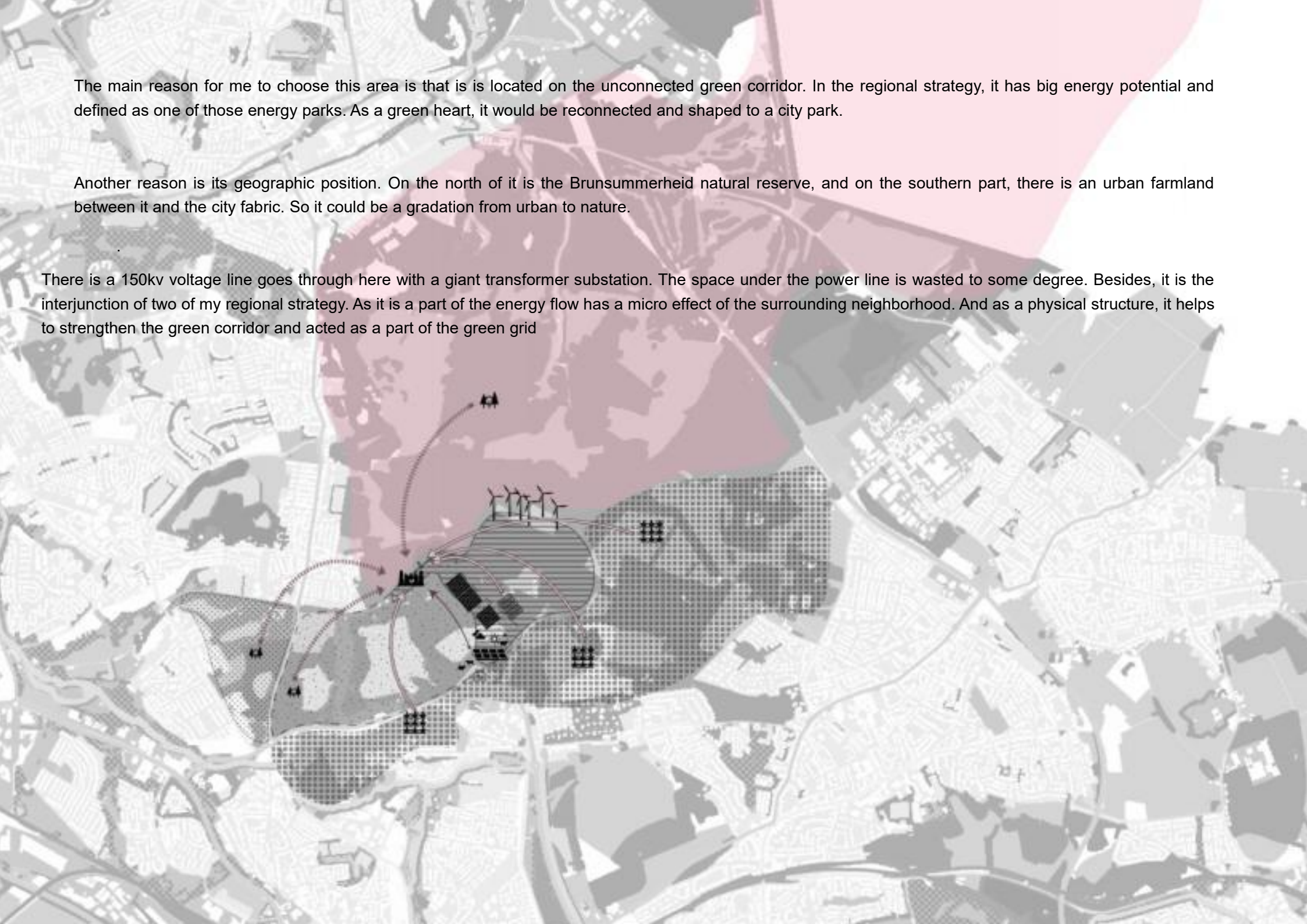
The proposal, the so-called provincial integration plan, provides that Sibelco may continue to extract silver sand until 2035.
It is an elaboration of an agreement

The main reason for me to choose this area is that is is located on the unconnected green corridor. In the regional strategy, it has big energy potential and defined as one of those energy parks. As a green heart, it would be reconnected and shaped to a city park.

Another reason is its geographic position. On the north of it is the Brunsummerheid natural reserve, and on the southern part, there is an urban farmland between it and the city fabric. So it could be a gradation from urban to nature.

.

There is a 150kv voltage line goes through here with a giant transformer substation. The space under the power line is wasted to some degree. Besides, it is the interjunction of two of my regional strategy. As it is a part of the energy flow has a micro effect of the surrounding neighborhood. And as a physical structure, it helps to strengthen the green corridor and acted as a part of the green grid



Existing situations of the focus area



Forest
Grass
Agriculture



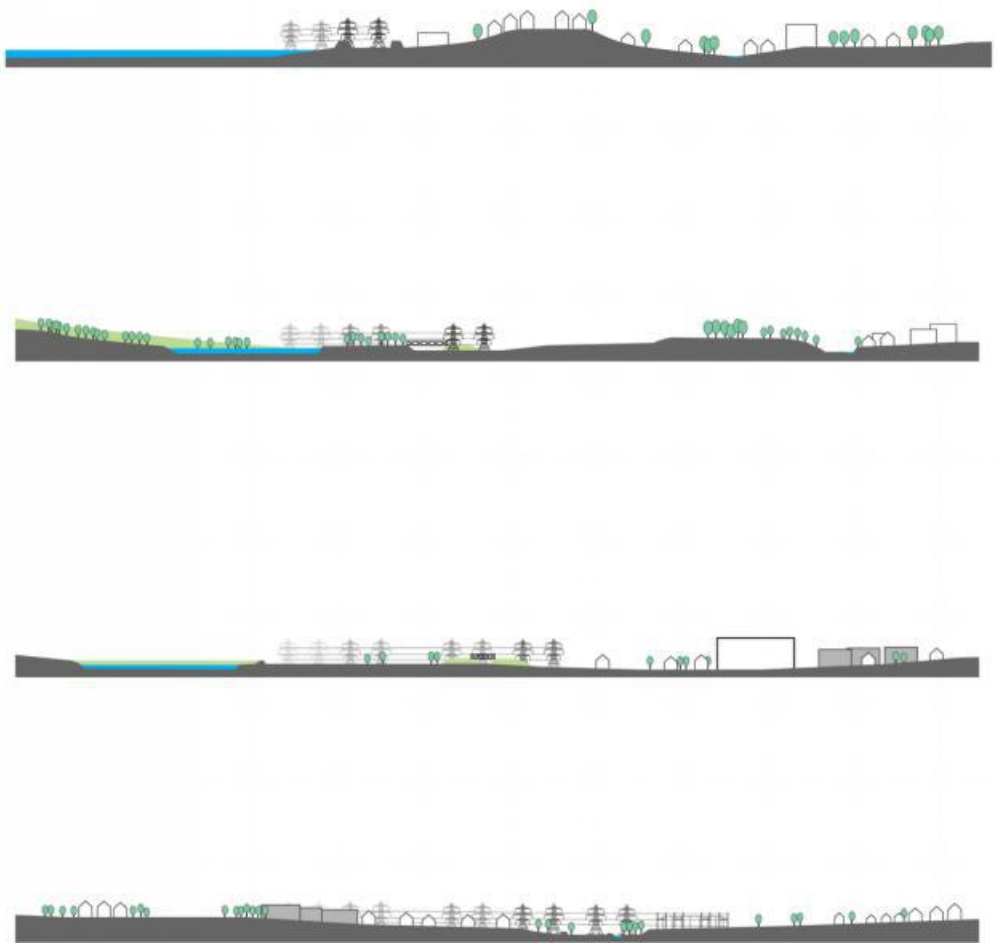
Bike lane



Agriculture

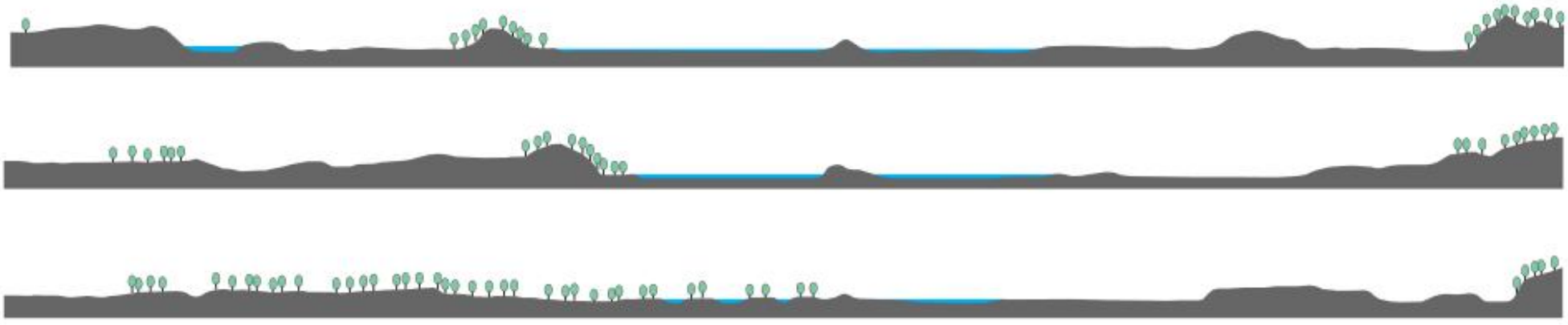


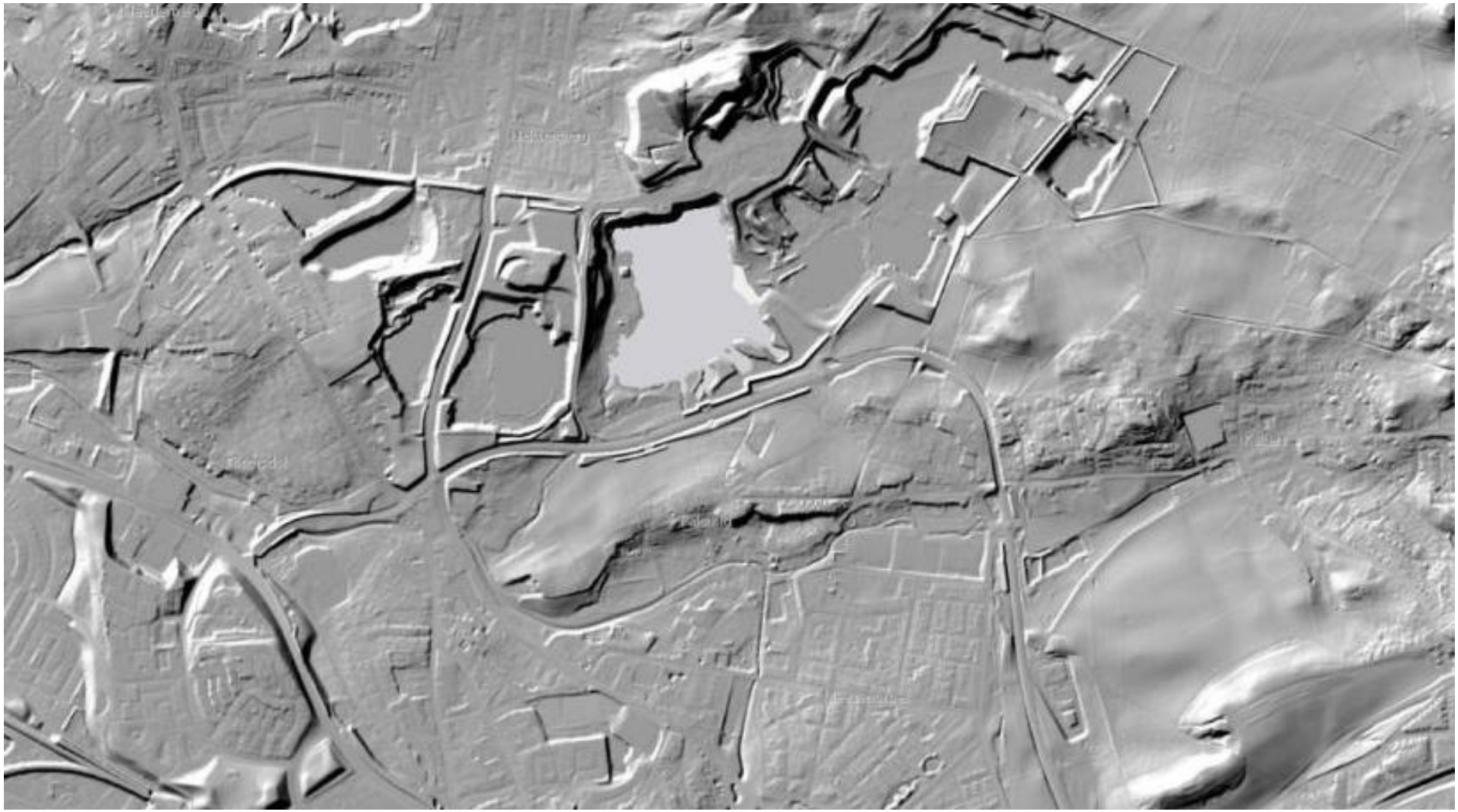












The concept

As energy is an engine in my design instead of only a representation of the landscape in such area, energy topic in my concept would not be a physical form or technical meanly. It should be a language of the quarry.

There should be three forms of energy activities happening here: energy transition, energy saving, and energy redistribution. What the landscape can benefit from it is my first concern.

My concept is to make this place as a showing case of the trend of the energy transition. The synergy between landscape and energy provides a space for people to experience the energy transition, which means energy is a part of the landscape, and people could also appreciate it. By this way, people will also go through an emotional transition and be more sensitive to the new trend. Saving is another form of generation. Because of the energy shortage, the energy transition is also a way to help improve the efficiency of energy utilization; for examples, more energy saving buildings are needed in the long term.

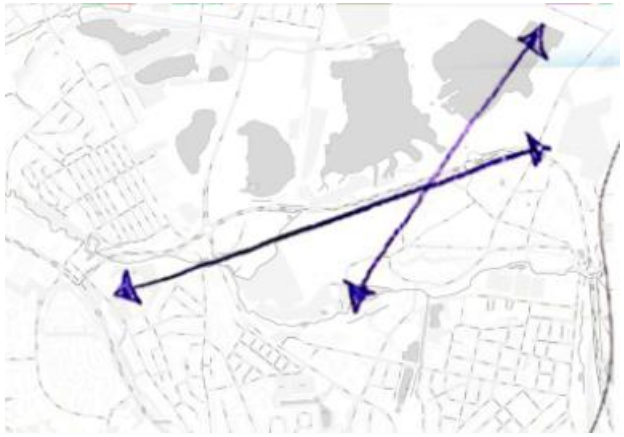
Apart from the dominant solar power cultivation, the biomass also has great potential in my focus area. The advantage of biomass is that it has economical interests as well as the ecological benefits, and it is often overlooked by people. A maze-shaped slope structure is proposed to combine the biomass and solar power recreationally.

The geothermal energy is mainly for the leisure purpose, and the wind energy is applied on the installations to show the energy utilizing at night, it's a way to show tell people how much energy has been collected on this place and it can be used on directly on the same place.

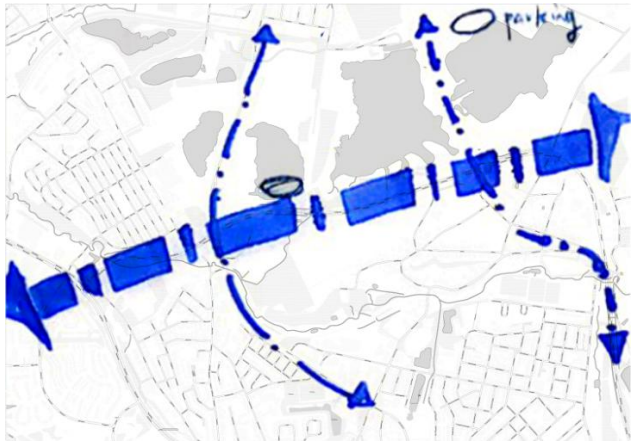
Moreover, energy is also an important way to promote land value. For a shrinking place like Parkstad, there are more spare spaces for energy generation; if this case shows the energy harvest could be a normal part of our life, there would be more chances for the energy transition. On that time, more jobs related to energy are available, and more people would like to live here and even move here. Energy landscape gives a reason for people to raise their awareness and have a new experience of landscape. And people will have faith in the energy landscape could improve their life.

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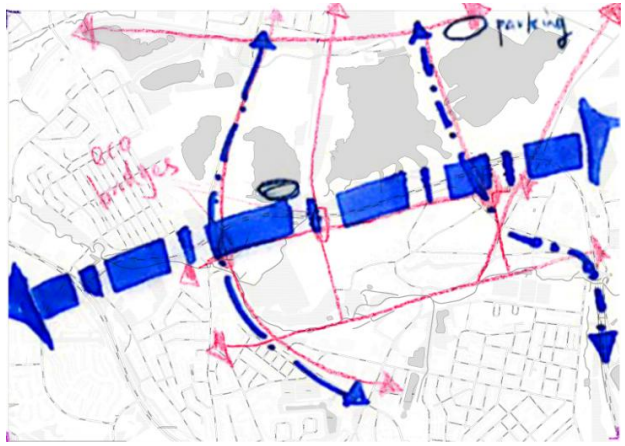




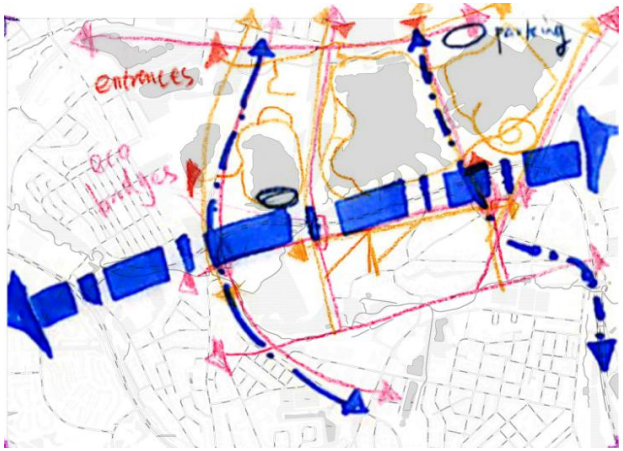
Abstracting the direction of the voltage line and using it as a leading structure of my design



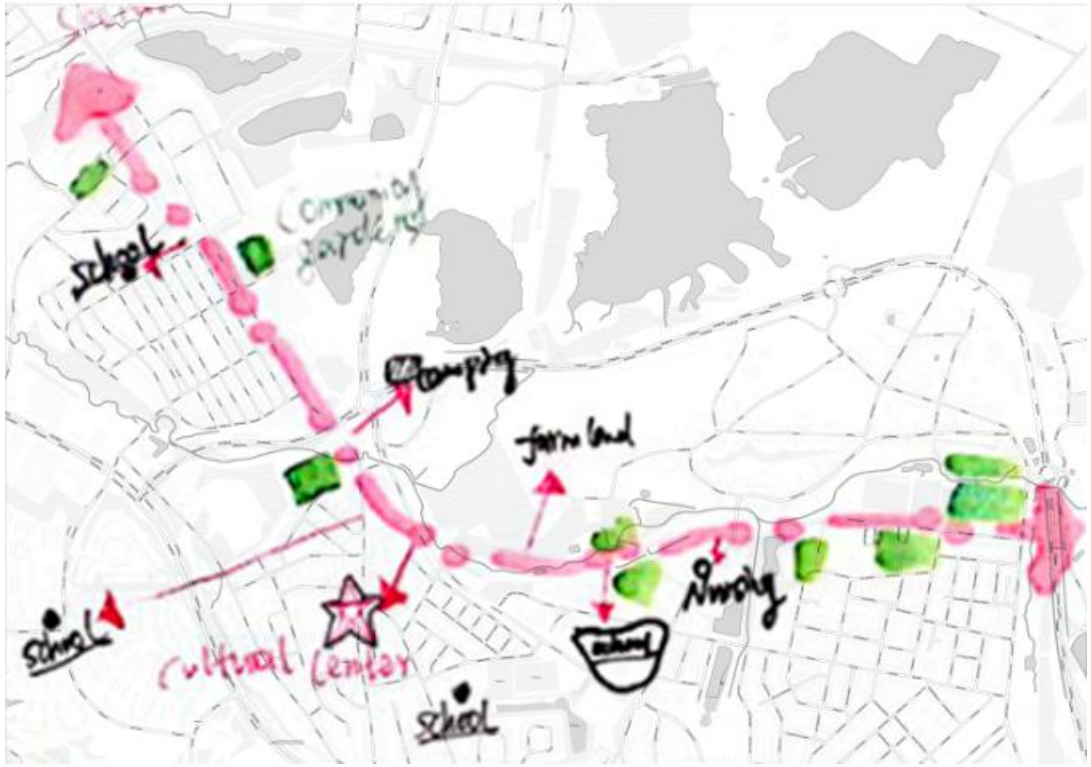
Highway and motorway



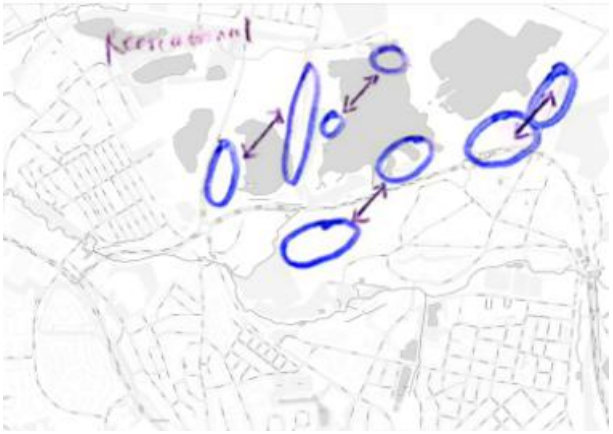
bike lane



walkway



Those community gardens help make the social axis, which connect to the cultural center, schools and nursing house.



Recreational elements



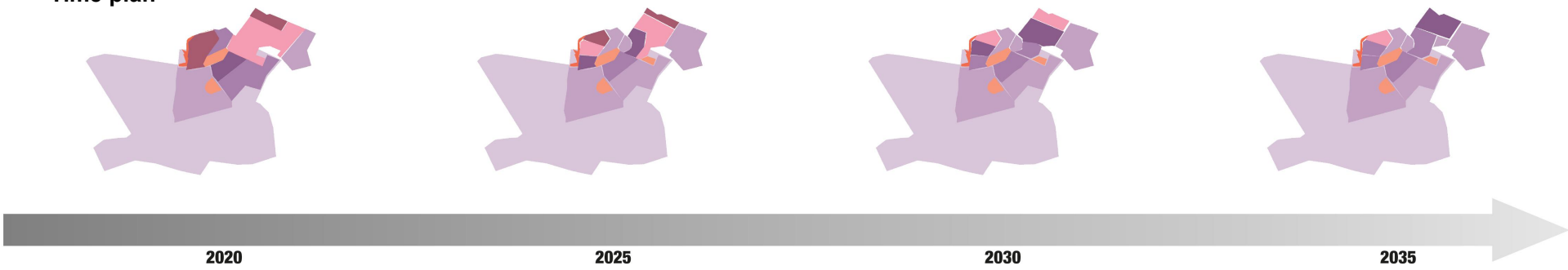
energy elements

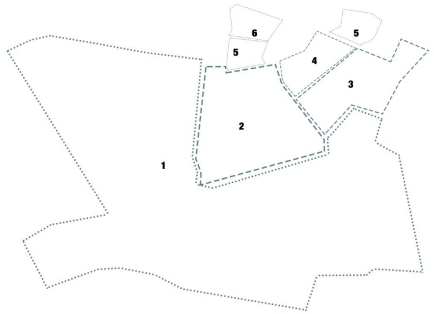


ecological elements(biomass crops)

5.2 Details

Time plan

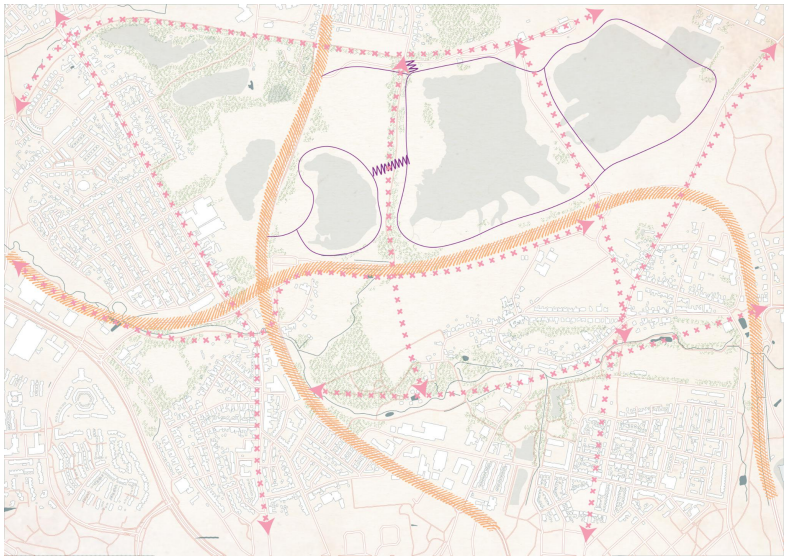


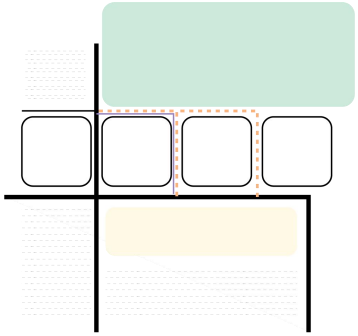


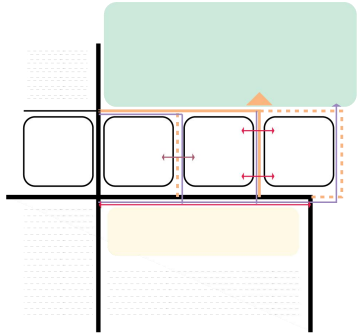
Phasing plans
- delivered
- furnished / ready for delivery
- mining ended
- wet extraction
- dry extraction
- mining has not yet begun
- factory zone / process pond / sand storage
- peel mine stone mountain; unstoppable zone

The excavation will take place in phases, and the excavation permint will end in 2035. Sibelco has a plan of refurbishment, which means after the completely excavation, a zone will be ready for delivery. This expected sequence have an impact on the order of approaches. From south to the north the whole area will be delivered step by step.

Accessibility approach

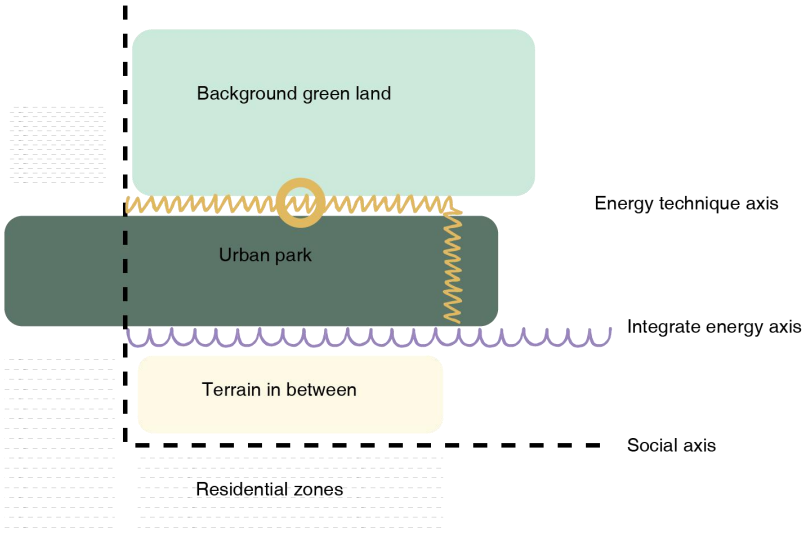






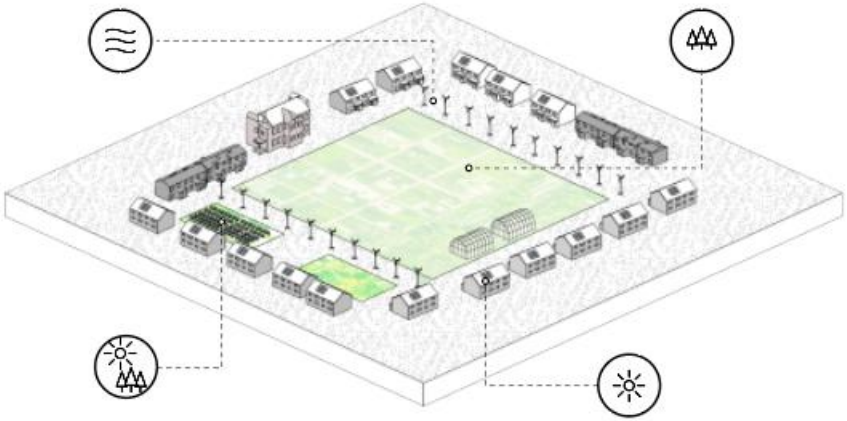
Three axies approach



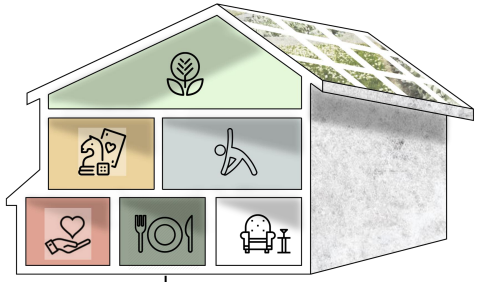


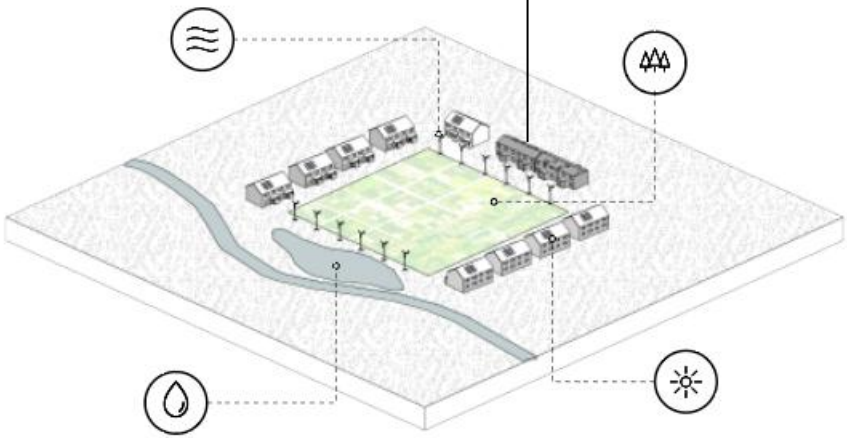
Community garden

Nursing house, energy generation facilities and community garden



Activity center





On elaboration design proposal, the mutual connection of energy infrastructure and landscape design are more visible and solid.

Energy is no longer merely a technical approach in this case, in terms of the generation and metabolism processes. Energy park is the nuclear of integrated energy landscape, while community gardens are the expansion of energy parks in urban areas, helping to permeate from green spaces to residential zones. These micro systems blur the boundary and help re-shape the function of the terrain-in-between.



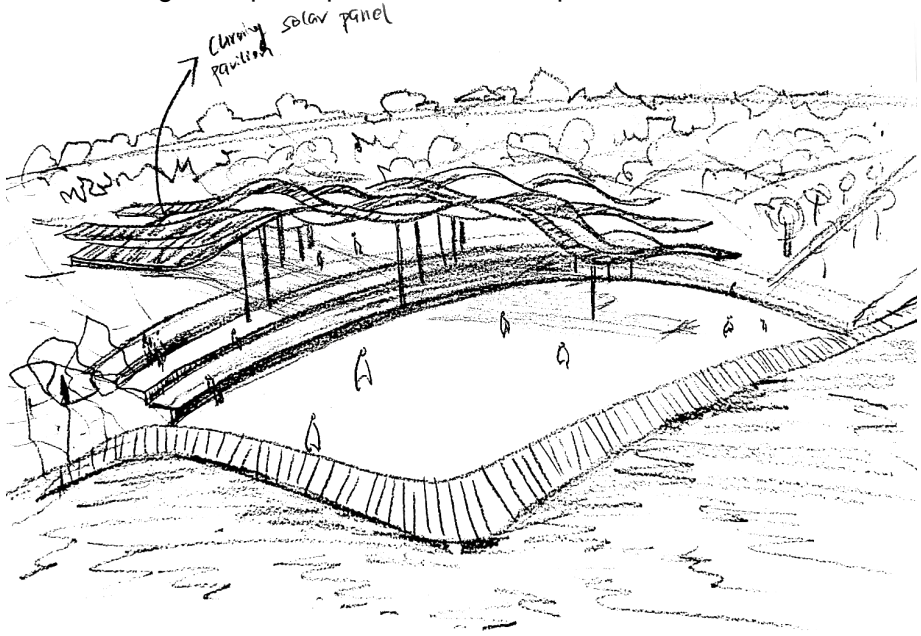
Master plan


Legend
1. Protected natural area
2. Agricultural area
3. Energy crops
4. Geothermal hot spring pool & sauna
5. Camping area
6. New ecological residences (nursing house)
7. New holiday houses
8. Expanded camper areas
9. Eco parking lots
10. Lane in forest and forest cabin
11. Open air theather and solar panel pavilion
12. The pier
13. Orchard
14. Bird island and fishpond
15. Energy museum
16. Green house
17. Community garden
18. Curvy footpath &wetland & micro wind turbine
19. Solar panel-- the earth art
20. The Slopes
21. Floating solar panel
22. Algae farming
0
100
200 m

Forest cabin



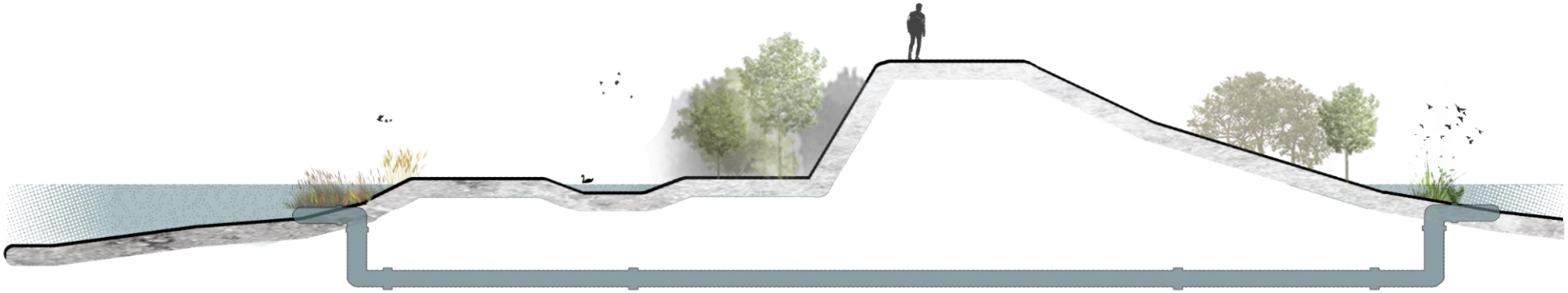
Curving solar panel pavilion with the square underneath

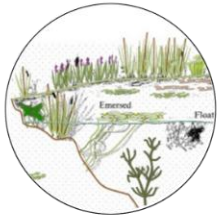




Floating island and fish pond



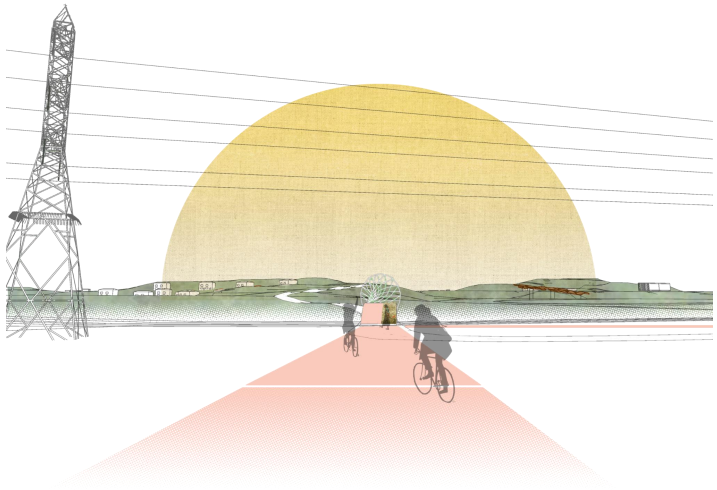


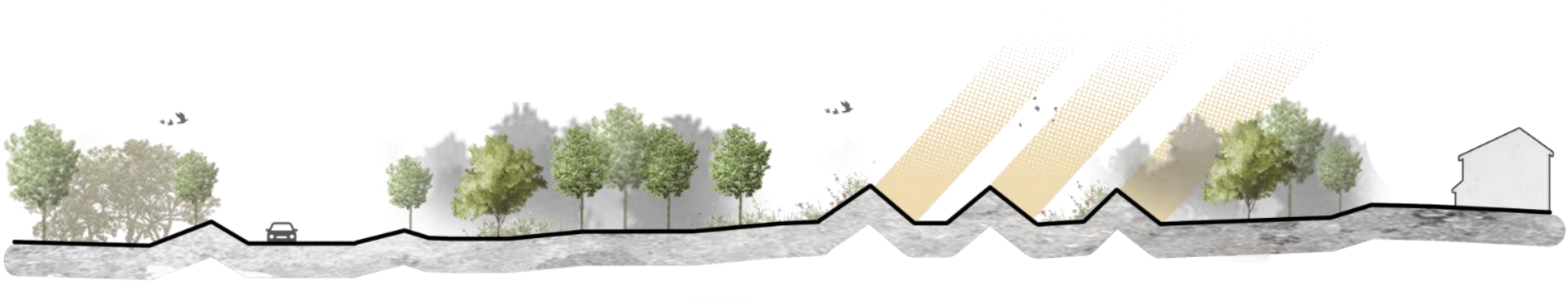




The slopes (main structure of energy production and grazing combined)









Day and night of the bike lane

Micro wind turbine shining on the night

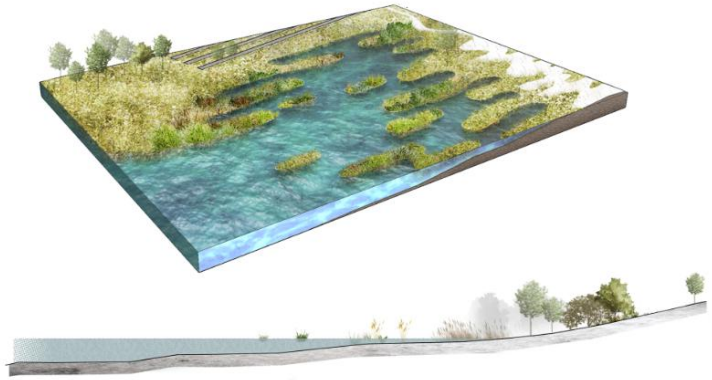
Luminescent bike lane

Light on pylons

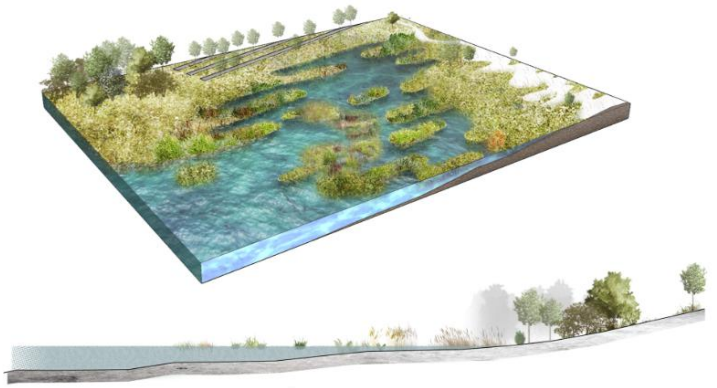


5.3 Development in time

2020



2030



2040

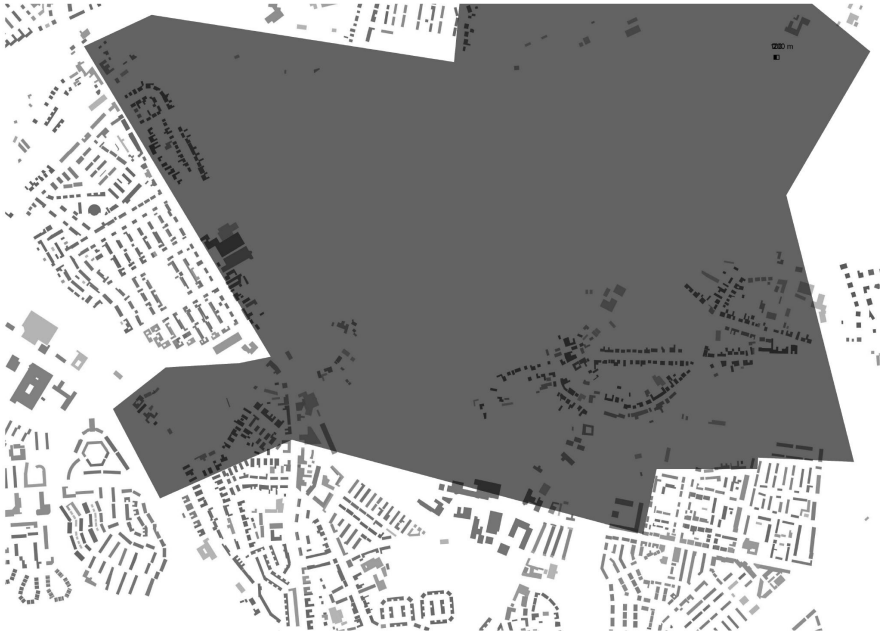




5.4 Capacity analysis

In the region, includes 378 houses and 53 company or industrial buildings.

Type	Quntity	comsumption
House	378	470,548 kwh/yr
Company	53	149,059 kwh/yr
Total	431	610,607 kwh/yr



Energy type	category	Quantity/unit		value	Quantity PJ/year（in 5 years）	Quantity PJ/yearh（in 10 years)	Quantity PJ/yearh (in 20 years) 100%
Solar	floating	26,300 m²		0.0054 PJ/ha/yr	0%	0%	0.014202
	roof	975 m²	15% heater	0.0126 PJ/ha/yr	50%	100%	0.00078975
			85% photovoltaic	0.0054 PJ/ha/yr			0.000447525
	land	27,760 m²		0.0054 PJ/ha/yr	30%	60%	0.0149904
Biomass	livestock manue (1000)	138000 m²		23 MJ/m³	20%	65%	0.003174
	forest	40,000 m²		37.05 GJ/ha	60%	85%	0.0001482
	energy crop	61230 m²		100 GJ/ha	15%	45%	0.0006123
	other arable land	57,700 m²		60 GJ/ha	80%	100%	0.0003462
	algae farming	280 m²	691.895kg	37 MJ/kg	0%	100%	0.0000256
Geothermal	cold heat storage	36,900 m²		1,3 TJ/ha/yr	50%	50%	0.0048
wind	wind turbine	-		-	-	-	-
Total	0.034735975 PJ/yr = 10,982,215 kWh/yr						

Site energy capacity: 9,648,881.94 kWh/yr
Surrounding building consumption: 619,607 kWh/yr
Heerlen demand: 8.35 PJ/yr
Parkstad demand: 20.37 PJ/yr

6. REFLECTION

The relationship between research and design.

The research about the spatial component of the energy transition makes the project quite complicated. Parkstad Limburg is a place with extreme and contrasts, which means I have to be sensitive to those complexities on the research process. Before making use of advantages like the historical identity and unique geology in design, a lot of research works should be done. When energy is a tool to help improve the landscape value, it must be quantified, and the results will become more concrete. On research, I need to analysis the current energy production and consumption, and then decide which areas are more potential. After that, the capacity and efficiency should be considered. The research part helps to be aware of how to make clear what the spatial impact can be, and how they can be part of the design process. The design part is based on the outcome of the input of those statistics and makes them visible and acceptable.

The relationship between your graduation topic and the Lab topic.

Parkstad is described as a shrinking place; it is suffering from the aging population and losing job opportunities. This lab aims to revitalize the economy to attract young people to move in and work here. At the same time, I am giving this place a new identity apart from the historical mining area. Nevertheless, this region is determined to see the decline as an opportunity, and must develop a new "story". A promising direction is to use energy transition as an economic and spatial engine.

The region has traditionally been defined by energy transition - both the "highs" and the "lows" - energy and economy fit the area. My project aim is to follow the trend of the energy transition to improving the quality of the landscape in Parkstad, using this instrument to build more infrastructure and green spaces, to make this place become a real tourist destination and ideal home for local people.

Elaboration on research method and approach chosen by the student in relation to the graduation studio methodical line of inquiry, reflecting thereby upon the scientific relevance of the work.

The methodology of my research report includes the principles, theoretical backgrounds, framework, and criteria. To begin with, I use Rowe's modes of inquiry to elaborate the demands at the design proposal; they are deduction, induction and abduction. In this research paper, the logical deduction is applying energy-conscious urban design principles like from the energy potential map to the energy park hot point. Induction is to formulate the generally applicable design strategy based on case-studies and summarize it into three approaches: imbalanced, disconnected, and delaminated Parkstad. The third inquiry in my proposal is to translate the spatial energy application into the landscape language, to show the energy transition in this region, The third inquiry in my proposal is to translate the spatial energy application into the landscape language, to show the energy transition in this region. I am using the three strategies as guidance on the regional scale.

The methodology framework of my proposal is starting from the existing knowledge of landscape as process and energy transition as a language. Then according to the theoretical modes mentioned before to come up with the design principle: energy-conscious urban design. This principle leads to three different design strategies. These strategies interact with each other and effect to the design proposal.

As the energy-conscious design is related to practical approaches, there are four aspects of the technical energy criteria: sustainable technical, environmental, the economical, the socio-cultural criteria. A decent energy landscape design should meet these requirements.

Elaboration on the relationship between the graduation project and the wider social, professional and scientific framework, touching upon the transferability of the project results.

The energy transition is a pathway toward a transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO2 emissions to limit climate change ("Energy Transition", 2019).

The European Commission calls for a climate-neutral Europe by 2050, which means a long-term vision should be considered when making the energy landscape proposal. There are already some incentive policies here; for example, the government in Parkstad encourages citizens to put solar panels on their roofs and gives them allowance and loads. Some attempts, such as reusing abandoned mine water to heat and cold the houses.

The most efficient way to accommodate this change here is to strengthen the advantage of solar power and cooperate with other renewable energy like geothermal and biomass. Furthermore, building several districts by the demand and make it expand step by step. In this case, more job opportunities are available here, which give a reason for people to stay and even move in.

As my focus area is next to Brunssummerheide, where is a silver mining area now, it is a terrain in between the nature area and urban structure. Since this area has a unique location, it can be seen as a gradation that emerges during the transition from green to gray. When it is proposed to be a stepping stone, it should have multiple identities and functions. As a city park, it is a recreational place gathering people who live nearby and tourists. However, as an energy landscape, it also has the characteristic of energy harvest and exhibition. The quantified energy shows the technical capacity and potential. And provide a possibility for the bigger area to become an energy supplier and make more jobs opportunities.

Discuss the ethical issues and dilemmas you may have encountered in doing the research, elaborating the design and potential applications of the results in practice.

First of all, it is a place consisting of eight municipalities, there is a fuzzy region on the boundaries, as each one is restricted to their policies and strategies. And this limitation impact on both research and design part, for example, the data source acquisition, it may be unmatched from the different municipality. Then the researchers need to tell the accuracy of them.

Another problem that may occur during the research or design part is about the local governments. On this case, the governments are willing to change the function of the quarry as the IBA has some plans for the whole Parkstad area. But if an energy-engined park is the best choice for them, how about the policies.

A possible challenge for the implementation is the emotional aspect of the residents and the stakeholders. The silver mine factory has a contract with Heerlen till 2020, but if it turns to the city park, the industry needs to close down or find another place to further their business. For the people who live nearby, if they want a park instead of it, especially for those who were working on the quarry now. The risk of change could be greater than leaving everything as it is(Schuler, 2019).

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