REFLECTION REPORT

Resilient Energy, Energetic City

Adaptive strategies for coastal system in transition

Name	Jie Wang
Student number	4578546
Main mentor	Dr.ir. Diego Sepulveda Carmona
Second mentor	Dr.ir. Hamed Khosravi

The project is about the reverse of risks from changing climate and transitional energy system into opportunities to become evolutionary resilient cities.

Climate change is happening globally and is becoming more and more serious now. The temperature rise, sea-level rise, land shifting, precipitation pattern change, extreme weather increase the potentiality of risks like coastal flooding, pluvial flooding, landslide, snow slide and so on. To mitigate the climate change, energy transition is put forward which is the most effective way to control greenhouse emission. But this kind of measure requires the change of energy system also including social, economic and spatial alteration, especially the country like Norway who benefits from the petroleum sectors since the years of history. The combination of climate change and transitional energy system will threaten the whole urban systems and the people will finally become the victims.

On the other side, considering the main climatic change and geographical condition of Norway, more water from sea, river and sky brings the opportunity to accelerate energy transition. Therefore, in this project energy sector in transition is utilized as the tool to explore how to diminish the impact of climate change, meanwhile to reduce the vulnerability of urban systems and even convert the risks into opportunity of evolutionary resilience. The transitional process is proposed towards 2050.

Aspect 1

- the relationship between research and design.

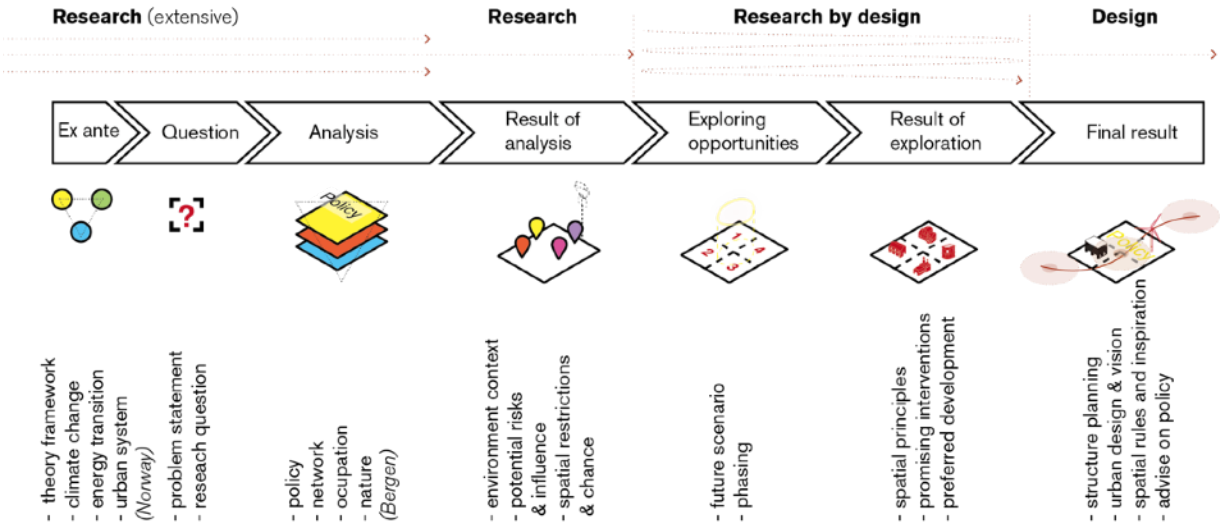

Fig.1 Research and design process.
Source: author

In the initial stage, the research provides the background for this project, including the context, the theoretical framework and the analytical framework. The original analysis of the North Sea region and Norway triggers my interest in the relation between climate change, energy transition and urban systems. The tremendous changes of climate and the strong ambition of energy transition happening on the complex urban systems led to the uncertainty of future with a high risk, and then this framed my main research question, "which adaptive strategies can be

applied in the coastal system of Norway assessing the climate change impact within the process of energy transition goals". So, as the ex ante, theories of vulnerability and risk, transformability, relevant delta urbanism, complex urban system and evolutionary resilience are constituted to the theoretical framework.

Then several research process were applied to deepen my understanding of the specific location Bergen city and build envisioned goals towards 2050 which will guid my design. By measuring the effects of climate change and evaluating the goals and possibilities of energy transition on the specific location, the risks and transitions on the urban systems which embedded in the urban structure can be concluded. A deeper understanding of possible risks in Bergen would have helped to proceed with the design easier. And scenario method helps to identify the current trends and set two extreme future situation by overlapping the low limit and high limit of temperature increase, the share of renewable energy and socio-economic growth, around which the expected situation can move and adapt. Combined with this, the research of involved stakeholders, cost and benefit are also included to propose new goals which are the guidance for spatial interventions.

Based on these research, the structure in the region scale will be reorganized. But it is quite hard to make a clear distinction between right and wrong on this level. So the urban design in the center of Bergen can be seen as the test of the ambition on the regional scale by showing how to deal with the issues of urban composition according to the climatic mitigation, energy transition and socio-economic variation. Then the evaluation of the Bergen center is also used to reflect validity of regional structure. If it works, this kind of structure and urban design can be applied more extensively to the similar-conditioned regions. Otherwise, this need to be revised. This method of formulating design strategies through research and verifying the possibility of research through field of design (research by design) helps to integrate progressive strategies and build a new vision for Norway coastal area to reach better resilience level by adapting the coastal urban system considering climate change effects integrating with the potentiality of the requested energy transition.

Aspect 2

- the relationship between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS).

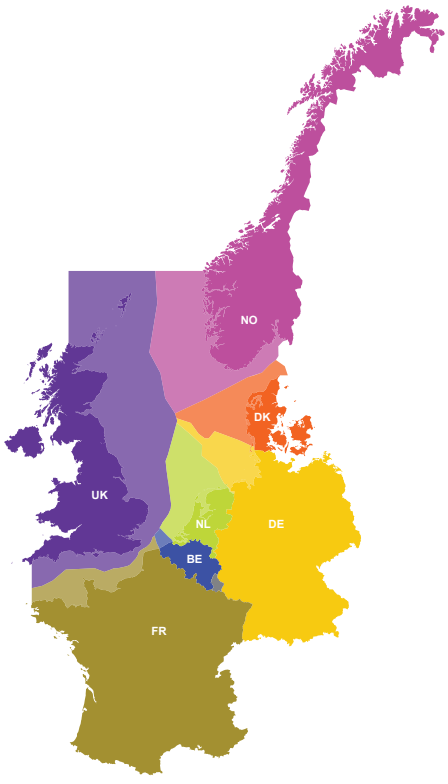

Fig.2 *Territorial entitlement*
Source: OMA

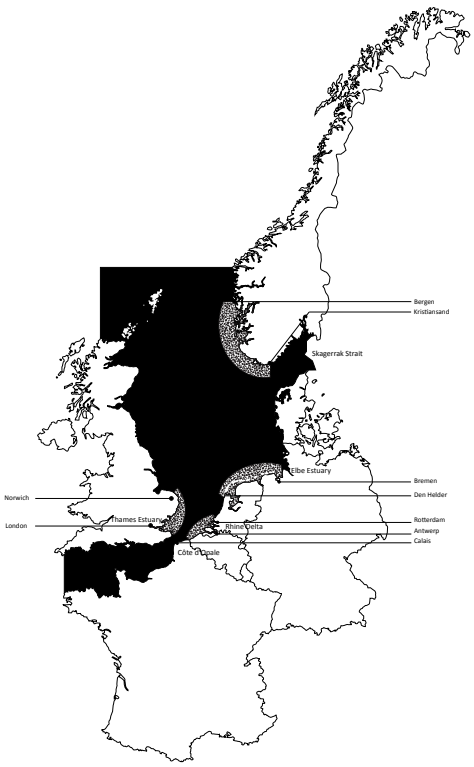

Fig.3 Important cities in the North Sea Region
Source: Delta Intervention Studio

The Delta Intervention studio concentrates on the impact of spatial interventions to the dynamic delta environment according to the global climate change. The North Sea as the chosen site for this year in the studio is greatly influenced by changing climate, with much uncertainty, where delta urban design is not only a mean of spatial improvement but also a way of research to explore the future potentials and reframe the current approaches. My graduation project was designed to find an adaptive pathway to balance dynamic natural system and manual activities corresponds well to the focus of Delta Intervention Research Group. Meanwhile, the graduation project contributes to the topic of Delta Intervention studio as well by exploring the way of using transitional energy sector to diminish the risk of climate change and reverse the risks into opportunity of reaching evolutionary resilience. The research and tentative design may be the example in the similar-condition area and build a new resilience structure in the North Sea region with low climatic risks and high share of renewable energy.

Considering the particularity of Delta Intervention studio who convene the master students in Architecture, Urbanism, Landscape and Engineering together, this graduation project is influenced by various fields. The research and design process is based on the diverse aspects. While, as a student major in Urbanism, the emphasis in put on the integrated progressive strategies towards evolutionary resilience and a new vision for the Norway coastal region even the North Sea region. However, I learnt a lot from this studio and the lectures organized. The lecture of 'Becoming-Infrastructure' by Ross Exo Adams elaborates the concept of 'Resilient Urbanism' by introducing the relation between nature, bodies and infrastructure from past to now, which help me to thinking from the aspect of the balance between environmental and infrastructural performance and the risks and opportunities brought by changing climate in Norway. The self-organized workshops also contributes to facilitate communication between different trajectories in graduation studios and support our own projects within the main scope of resilient design.

Aspect 3

- 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 Delta Intervention studio focus on integrated approach towards a balance of economy ecology and safety through works throng times, scales and layers to understand the dynamic delta region, build scenarios to deal with the uncertainties and consider design as a way of research to imagine potential futures and to reframe current approaches with the aim to find the balance between landscape and urban. Similarly, in my graduation project, I firstly analysis the climate change impacts and energy transition impacts on different layers within different scales to know the risks and potentials. Explanatory scenarios are built to define the trends and set goals, which guides the design of structure in regions and urban regeneration in small scales. Urban design in detail serves as the test of the ambition on the regional scale. Through continuous adjustment of urban composition according to the climatic mitigation, energy transition and socio-economic variation to reach the goal of controlling temperature increase under 1.5 degree and reach 80% share of renewable energy in Norway. This stimulates the research oriented approaches which is always closely related to specific site, scale and space and address urgent issues.

Aspect 4

- 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 climatic control is a difficult but urgent task. According to COP21, all the countries are responsible to keep the increased temperature below 2 degree centigrades. Thus, energy transition is regarded as an efficient tool to reduce greenhouse gas and mitigate climate change. However, the high dependence on weather and environment makes the renewable energy more vulnerable. So the research project is quite essential and urgent to the society, which is trying to find a resilient solution of accelerating energy transition under the increasingly serious climate change impact while meeting the demand of future population.

In Norway, considering the main climate change impact, increasing precipitation and sea level rise, and the special geological features, there is great potential to revise the climate change risk into potential of producing more energy. Actually, Norway has already devoted himself to low-carbon energy. New tech-knowledge system are applied to energy generation for example using electricity exclusive hydropower to generate energy and access to new energy like wind power and flexible hydropower. Norway has a good beginning in the production and usage of energy in the new field and is likely to serves as a paragon that other countries can copy the success on resilience energy system under climate change. But it should be mentioned that in the new sites with similar conditions, the patterns and the solutions still need to be tested again on the location.

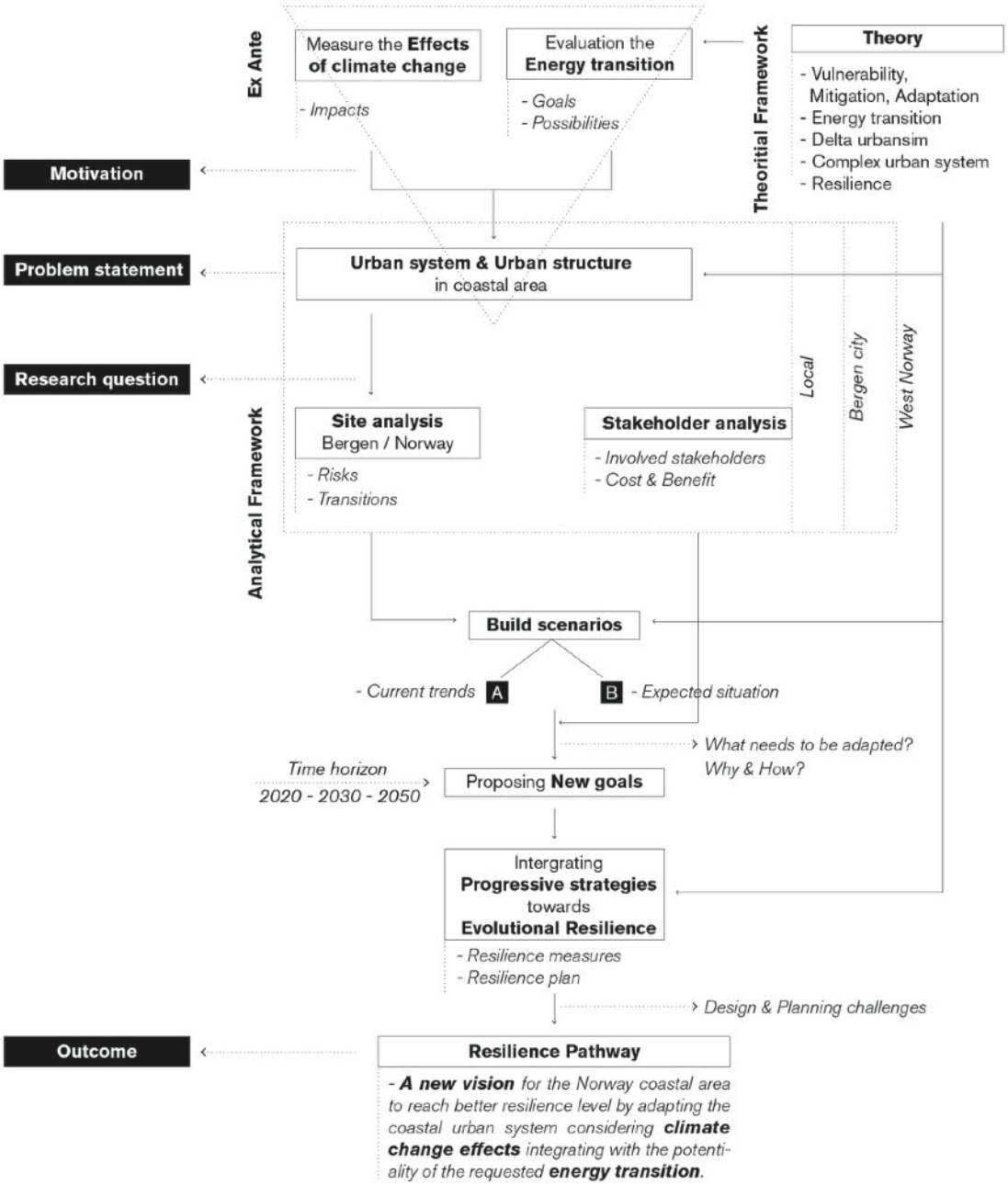

Fig.4 Methodology
Source: Author

Aspect 5

- Discuss the ethical issues and dilemmas you may have encountered in (i) doing the research, (ii, if applicable) elaborating the design and (iii) potential applications of the results in practice.

The main challenge in this project is involved with the unemployment of petroleum workers and related people caused by the great deal of transition from carbon-based economy to green-based. In 2016, there are 185 300 people were employed by the petroleum sector and related industries, , either directly or indirectly, accounting for almost 7 percent of the total number of employment in Norway (MPEMPD, 2018). The increased share of renewable energy and a lower level of vitality in the oil and gas industry recently has already caused 47 000 people in Norway unemployed compared with 2013, a decrease of about 20%. For decades, Norway is known as a prosperous country in the world relying on the offshore exploitation of petroleum and the petroleum workers, engineerings are quite popular. But now, they are unwanted. They are facing an uncertain future. In other words, the employment needed by other economic industries are due to the demands of the oil and gas industry. Furthermore,

considering the aging effect, there is a tendency of raising proletariat in the job market. And, as largest contribution in terms of appended value, government revenues, export revenues and capital inflows, the oil and gas sector in Norway is also facing the uncertainty, and even influence the global market. This encourages us to think about the future lifestyle, the social-economy structure, daily demand of energy, living and working environment according to the climate change and the way of development of the city.

However, in general, my research provides a possibility of utilizing energy transition as a tool to mitigate climate change and even general more energy through this change, and finally reach the evolutionary resilience of the city. Especially, as a major energy nation in Europe, Norway has the unique set of resources of 20% hydropower, 40% gas, 60 % oil and new renewable energy sources such as wind power and biomass, and has already devoted himself to low-carbon energy and new technology system. In addition, 90% of exported energy in Norway is exported to European country, if Norway can play his strength in clean energy and be the pioneer in the energy transition process under climate change situation, the road towards climate neutral will be much easier. This approach can not only be applicable in the North Sea region where the countries has similar situation, but also relevant to the global society in a broader context.

This graduation project can be seen as the exploratory research by design. There are three key steps during the process. The first is to make it clear what is the climate change and what is the relation between climate change and energy transition. In my case, the water from sky and sea is the crux, which brings the water risks but also the opportunity for renewable energy. The second key step is the systematic process of utilizing the transitional energy system as the tool to mitigate climate change and increase opportunity. It is essential to clarify how the process of transformation should be executed and what needs to be done more urgent. The last is to illustrate this idea both on regional structure and local design. The regional structure shows the reconstruction of task distribution and the detailed urban design is to test and evaluate the aim on the regional scale. The research and design consistently correlate to contribute to a convincing and practical project. Meanwhile, the logic of unfolding this project's idea is also important. A clear and persuasive narrative will make the communication more efficient and the audience will be easier to understand. This is appropriate to both written report and oral presentation.

Reference

1. MPEMPD (Ministry of Petroleum and Energy, the Norwegian Petroleum Directorate) (2018) , Employment in the Petroleum Industry. Norway. See https://www.norskpetroleum.no/en/economy/employment (accessed 22/05/2018).