Graduation Plan
Architectural Engineering Graduation Studio
AR3AE015

GRADUATION PLAN

TOWARDS AN ENERGETIC FUTURE

AN ENERGY MAXIMIZED LANDMARK OF KERKRADE WEST,
AN EDUCATIONAL JOURNEY OF SUSTAINABLE FUTURE

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STUDIO

Name of Studio
Architectural Engineering

Teachers
Annebregje Snijders
Leo Gommans
Maarten Meijs

Choice of the studio
Architecture Engineering Studio researches and practices architecture with a perspective of building technology. Within the studio there are many research topics which are essential to qualities of realized architecture, such as construction engineering, environment system, energy flow, and so on.

From my point of view, building technology is the fundamental knowledge of architecture, because it determines the physical existence of architecture. Thus, any architect who wants to realize his or her concept in the real world, must be proficient in building technology first. Only after a thorough understanding of building technology, then he or she is qualified to discuss other architecture factors like space, form, context, and so on.

Since my architectural interest is to realize architecture efficiently and healthily, building technology has become the field I have to dive into. Because research topics of Architecture Engineering Studio provides great opportunities for me to absorb building technology knowledge, I choose Architecture Engineering Studio as my graduation studio.

PROBLEM STATEMENT

As a solution of global climate change and resource crisis, sustainability has become the trend of human civilization development. The application status of sustainability concerns the future existence of human race. Since the architecture industry occupies 40% of world’s total resource consumption, the world calls for better research and appliance of sustainable architecture and urban planning.

The south Limburg area used to be an important mining and industry area of the Netherlands. With population aging and industry infrastructures closing down, the area is shrinking now. In October 2013, the Parkstad municipalities and the Province of Limburg decided to launch an IBA, which collects innovative, future-proof projects to revive a town, city or region, economically, culturally and socially.

As a part of IBA Parkstad Limburg, Kerkrade West District has relatively complete town structures and natural landscapes, which makes it contain a rich potential of improvement. According to the planning of Parkstad Limburg, District of Tomorrow, and many other research facilities, this district is working on sustainable renovation approaches that focus on renewable and local resources with a zero-impact on environment. As the context of an architecture site, Kerkrade West District is able to provide an opportunity for architects to rethink and realise their works in a new perspective of sustainability.

A new sustainable architecture in Kerkrade West should not only be sustainable for itself, but also contribute to the improvement of Kerkrade West’s economic, cultural and social status under the sustainable planning of the district. From this point of view, the new sustainable architecture design should be an organic part, and a representative landmark of the Kerkrade West’s sustainable renovation approach.
Meanwhile, establishing a main topic is beneficial for the study and design of the new sustainable architecture. Because sustainability is a field with various developing directions, which makes the attempt to consider all factors in one design very complicate. Thus, it is necessary to set up a leading sustainable interest for the architecture design based on basic requirements of district planning.

Relating to all kinds of living and building activities, energy is an essential topic of sustainability. Researches about energy saving methods and renewable energy generation in architecture and urban planning are being more and more important nowadays. The European Union adopted Energy Performance of Buildings Directive (EPBD) in 2002, which required individual EU countries state national targets for energy savings in buildings. And the government of the Netherlands has proposed new buildings in 2020 to be energy neutral. Meanwhile, Parkstad Limburg, as a former energy production area, has spent a lot of effort analysing the energy consumption status and renewable energy potential for its sustainable renovation approach. Thus, an integrated system based on energy maximization should be the leading interest, not only for the new sustainable architecture design, but also for the sustainable planning of Kerkrade West District.

For the architecture design, the energy based sustainable system focus on constructing an energy maximized and environment comfortable building; for the district planning, the system focus on resource symbiosis and the environmental coordination between energy initiatives. The research of energy maximized architecture is the main focus of this project, and the study of district planning is to provide reliable context information to support the generation of the architecture design, as well as foreseeable guidance for the future development of the area.

Last but not the least, as an organic part and a representative landmark of the district, the new sustainable architecture design should not only use building technologies to establish energy based sustainable systems for itself and the district planning, but also use architectural factors to express the sustainable system, as an education of sustainability, to general public. Because the implementation of sustainable renovation requires lifestyle and idea changes, from the unawareness of sustainability into a common understanding of greener and healthier living possibilities, of general public. People deserve to receive better education about how their lives are supported by natural resources and what kinds of sustainable ideologies and technologies are available to improve their lives, so that they can play more active parts in the sustainable renovation of their living environment. And this kind of education should be provided in the new sustainable architecture design of this project.

**To summarize**

Context focus: Revive Kerkrade in sustainable way.

Program focus: Design an new sustainable architecture as an organic part and a representative landmark of the sustainable district planning of Kerkrade West.

Thematic focus: Create an energy maximized architecture with good indoor climate and outdoor environment, also contributes to the sustainable renovation of Kerkrade West District.

**OBJECTIVE**

The goal of this project is to create an energy maximized and environment comfortable architectural landmark, which improves Kerkrade West District with sustainable contributions, as well as provides general public with education of sustainability.
OVERALL DESIGN QUESTIONS

Context

1. What aspects of the site of Kerkrade needs to be improved?
2. How to use sustainable methodology to improve those aspects?

Program

1. How to design a new sustainable architecture which fits in Kerkrade West district planning?
2. How to use the new sustainable architecture design to represent the character of Kerkrade West District?

Thematic Focus

1. How to design an energy maximized architecture?
2. What contributions can the energy maximized architecture provide for its context?
3. How to apply architectural expressions to present sustainable values to general public?

THEMATIC RESEARCH QUESTIONS

1.1 How to use standards or regulations to quantify and value working performances of an energy maximized architecture design?

1.2 What are the energy consumption factors in a building?

1.3 What strategies are able to reduce energy consumption in a building?

1.4 How to balance energy consumption for building climate qualities with energy saving strategies?

1.5 What kinds of renewable energy can be applied in a building?

1.6 What kinds of architectural form or space are required by applied renewable energy technologies?

1.7 How to integrate different renewable energy technologies into a symbiosis system?

1.8 Are those ideal renewable energy generation technologies realistic, considering time and economic factors?

1.9 How to calculate the values and simulate the performance for an energy maximized architecture design?

2.1 What is the goal of sustainable renovation plans related to Kerkrade West District?

2.2 What is the current energy consumption status of Kerkrade West District?

2.3 What strategies are needed for Kerkrade West District’s energy consumption goal in the future?

2.4 What role can the new energy maximized architecture play in the energy consumption goal of Kerkrade West District?

3. How to express the integrated sustainable system to general public, so that they are able to receive the education of sustainability and live greener and healthier?

3.1 What values should visitors receive in this education of sustainability, which is provided by this architecture design?

3.2 What is the relationship between visitors and sustainable ideologies?

3.3 What kind of function is needed?

3.4 What kind of space is needed?

3.5 What kind of construction is suitable?
**Methodologies**

**Discussion / Interview**
Discuss with tutor and related specialist of energy research or green building design.

Purpose: Listen professionals' opinions of the field and require their guidance of my research. (Is it too board / narrow; is it realistic; does this research lead me to the knowledge I want to receive;…)

**Literature**

Search and analysis relevant articles / books / essays / conference documents through Internet and library.

Purpose: Basic means to receive the knowledge about integrated sustainable systems that I want to study and develop from previous researchers.

**Case Study**

Search and analysis relevant built energy neutral architecture design and eco-town planning cases.

Purpose: Study cases to understand what are integrated sustainable systems like in reality. (How they operate; what are their advantages and what factors need to be improved…)

**Field Trip**
Visit the site and observe its characteristics.

Purpose: To have a more realistic understanding and collect first-hand information of the site

**Research by Design**

Use sketching, diagrams, 3d models to analysis, test and present the research progress and results.

Purpose: To organize and convert the knowledge of sustainability I learned into design of the graduation project.

**Relevance**

The sustainable construction and renovation of buildings and districts are not only matters of consideration for the Netherlands, but also for the world. As for this project in Kerkrade West, socially, the project will create chances of green economy development and sustainable lifestyle education for the site; technologically, the project will provide specific integrated systems of energy-efficient network and environment-comfortable designs. However, the framework of social improvements and technical systems are generically applicable for other shrinking industrial areas like IBA Parkstad.


**LITERATURE**

**Papers**

Seveb Stremke, Andy van den Dobbelsteen. (Feb 2011). Exergy landscapes: Exploration of second-law thinking towards sustainable landscape design: INTERNATIONAL JOURNAL OF EXERGY


Andy van den Dobbelsteen. (Dec 2004). Space use optimisation and sustainability -Environmental assessment of space use concepts: JOURNAL OF ENVIRONMENTAL MANAGEMENT

Andy van den Dobbelsteen, A. Van Timmeren. (Sep 2008). SMART AND BIO-CLIMATIC DESIGN: AN EFFECTIVE APPROACH TO THE SUSTAINABLE USE OF RESOURCES AND DEPLOYMENT OF LOCAL QUALITIES


**Books**


## Graduation Plan: Towards an Energetic Future

### Planning

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### Presentations / Hand in

- Research Paper P2

### Research

- Discussion / Interview
  - Discuss with Tutors
- Literature
  - Former Students' Works
  - Sustainable Building / Planning
  - Energy System Structure
  - Environment & Climate Control
- Case Study
  - Building Life Cycle
  - BREEAM / LEED Standards
  - Educational Sustainable Architecture
- Site Information
  - Information Collection Methods
  - Information Analysis Methods
  - Determine the size of context area

### Presentation / Hand in

- Research Plan P1

### RESEARCH

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