Liveable Port, Passive Zone

The Regeneration of Old City Port in Rotterdam Brought by Sustainable Transformation

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Mentor team: Henco Bekkering, Egbert Stolk, Engbert van der Zaag

Zhuowei Liu | 4123239

Studio: Urban Regeneration

Department Urbanism
Faculty of Architecture
TU Delft
INTRODUCTION

RESEARCH

DESIGN

CONCLUSION

PROBLEM FIELD

R'dam 2030

CO2 → CO2
OBJECTIVE

The objective of this project is to search for a possibility of transforming and regenerating a port area into a Passive Zone with high quality of living, which is based on the concept of ‘Passive homes’.

REGENERATION

- To improve the accessibility of the port area.
- To enhance the living quality.
- To realize the local identities.
- To promote the local economy and social activeness.
"A Passive House is a building, for which thermal comfort (ISO 7730) can be achieved solely by post heating or post cooling of the fresh air mass, which is required to fulfil sufficient indoor air quality conditions (DIN 1946) - without a need for recirculated air." (Feist, 2006)

**33 kWh/(m2a)**

**PASSIVE ZONE**

- To reduce the energy consumption for living from building level to neighbourhood level, by introducing the model of Passive House.
- To introduce better transport system with lower energy consumption.
- To generate energy sustainably.
RESEARCH QUESTIONS

The **main research question** which the project addresses is:

What can be the spatial condition of the transformation area of the former port area in Rotterdam which is based on passive homes and low-energy mobility?

Several **sub-questions** are presented as follow:

- What kind of social measures could activate the living environment and improve the living quality for the people in the former port area?
- What kind of spatial solutions could activate the living space in terms of space and urban life?
- What sustainable objective can be achieved in terms of energy?
- How can be social, spatial and energy issues combined together?
METHODOLOGY

Main question

- Liveable space
  - Public space
  - Accessibility
  - Public transport

- Passive Homes
  - Renewable energy
  - Passive zone
  - Solar access

Spatial dimension
Social dimension
Technical dimension

strategy and planning

Design of details

REFLECTION

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Theoretical Framework

Empirical Framework

Research of Site

Spatial, Social and Technical Dimension

Case Study

Literature and Background Research

PRODUCTS

EXPECTED PRODUCTS:

A VISION OF WAALHAVEN-OOST
A SPATIAL DESIGN FOR THE SITE
AN IDEAL MODEL FOR PASSIVE ZONE
INTRODUCTION

Case study analysis on regional scale

Analysis on city-port scale

Analysis on Waalhaven-Oost scale

RESEARCH

Social
Spatial
Technical

DESIGN

Social
Spatial
Technical

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Conclusion
CASE STUDY: HAFENCITY @ HAMBURG
HafenCity is a quarter in the district of Hamburg-Mitte in Hamburg, Germany. It is located on the Elbe river island that was formerly called Kehrwieder and Wandrahm.
Improved accessibility:

underground lines and stations
Attractive facilities and landmarks:

- HafenCity University
- Concert Hall

source: HafenCity
CO2 emissions produced by heat supply

- HafenCity: 175g/kWh
- Conventional gas-based heat supply: 240g/kWh

- Decentralized heat supply network
- Conventional heat supply network
**Strengths:**
- Close to the city center
- Waterfront
- Attractive facilities
- Historical heritage
- Local identity

**Weaknesses:**
- Finger-structure

**Opportunities:**
- Reducing CO2 emission
- Brown field for utilizing

**Threats:**
- Flooding
Rotterdam is one of the main cities in Europe. It plays a significant role within the transport network as well as the economic network in this land. Daring and new styles of apartments, office buildings and recreation facilities resulted in a more 'liveable' city centre.
Energy Supply in 2050 (High RES Pathway)

- 40% RES
- 60% RES
- 80% RES
- 100% RES

Trend of energy supply
Source: KWHM2 STUDIO
100% of energy consumption in NL

<table>
<thead>
<tr>
<th>Year</th>
<th>Renewable Energy</th>
<th>Fossil Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4%</td>
<td>96%</td>
</tr>
<tr>
<td>2020</td>
<td>14%</td>
<td>86%</td>
</tr>
<tr>
<td>2050</td>
<td>54%</td>
<td>46%</td>
</tr>
</tbody>
</table>

**Sustainable energy sources**
- Wind: 44%
- Biomass: 54%
- Sun: 1%
- Water: 1%

Source: CBS

Solar energy in the NL
Source: KWHM2 studio
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ANALYSIS - CITY AND PORT

Future

1957 - 1970

1920 - 1940

1400 - 1800

1800 - 1900

1955 - 1966

1967 - today

history of Rotterdam Port
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hospitals

schools

PORT

cinemas and studios

hotels
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typology and space

industrial area

urban neighbourhood

urban garden

business area
Rotterdam Energy Approach and Planning (REAP)

The methodology of REAP demonstrates three strategies which are applied in different levels from building, neighbourhood, district to city.

- Reduce the consumption (using intelligent and bio-climate design)
- Reuse waste energy streams
- Use renewable energy sources
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- historical buildings
- industrial buildings
- office buildings

LIVEABLE PORT, PASSIVE ZONE
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infrastructure

accessibility by bus
accessibility by tram

accessibility by waterbus
building block > 150m
90m < building block < 150m
building block < 90m

scale building blocks

public space
CONCLUSIONS

- Case study
- Analysis on regional scale
- Analysis on city-port scale
- Analysis on Waalhaven-Oost scale

- Social
- Spatial
- Technical

Simplex function urban fragment
Lack of connections
Low quality
Waste

Requirement of reducing energy consumption
Advantage of solar
mixed-use development

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facilities

- school
- shop
- hotel
- office building
- museum
- cinema
new metro line and stations

planning metro
planning bikesharing points

bike sharing project in NY
source: Jim Vayo
grid 2 of streets

source: solar envelope
Three different block orientations

source: solar envelope

orientations of building blocks with summer sunlight
orientations of building blocks with summer sunlight @ 9.00

example section

orientations of building blocks with summer sunlight @ 16.00

design
three building block typologies
example section
shadow in summer and winter in the block
the sunlight and shadow in the example block in summer from 8.00 to 17.00

the sunlight and shadow in the example block in winter from 8.00 to 15.00
GENERAL CALCULATION OF ENERGY CONSUMPTION

Some key forms of energy consumption:
- **Transport:** cars, planes, freight
- **Heating and cooling**
  - lighting
  - information system and other gadgets
  - food
  - manufacturing

Comparison of conventional and passive energy consumption:

<table>
<thead>
<tr>
<th><strong>Conventional</strong></th>
<th><strong>Passive</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating &amp; Cooling: 40 kWh/d</td>
<td>Heating &amp; Cooling: 5 kWh/d</td>
</tr>
<tr>
<td>Cars: 30 kWh/d</td>
<td>Eco-cars: 16 kWh/d</td>
</tr>
</tbody>
</table>

Source: withouthotair.com
Basic data:

Overall area: 215 ha
Land area: 120 ha
Water area: 95 ha
Gross floor area: about 920,000 sqm
Homes: about 4000 homes
New waterfront: 10 km

Proportion of GFA:

- Living space: 48%
- Commercial and public amenity uses in ground floors (i.e. retail, catering, exhibition space and service): 9%
- Office space: 30%
- Education, culture, leisure, hotels, other: 13%
bird's eye view
Project objectives achieved?

The objective of this project is to search for a possibility of transforming regenerating a port area into a Passive Zone with high quality of living, which is based on the concept of ‘Passive homes’.

**Expectations:**
- To improve the accessibility of the port area.
- To enhance the living quality.
- To realize the local identities.
- To promote the local economy and social activeness.

**Achievements:**
- The accessibility of the port area is improved by better public transport system and friendlier accesses.
- The living quality is enhanced with more green, public space, good accessibility and improved facilities.
- The local identities are clarified.
- More economic and social activities.

**Expectations:**
- To reduce the energy consumption for living from building level to neighbourhood level, by introducing the model of Passive House.
- To introduce better transport system with lower energy consumption.
- To generate and utilize sustainable energy.

**Achievements:**
- The energy consumption for heating and cooling is reduced by about 85%.
- The utilization of slow mobility and public transport reduces the energy consumption of transport by about 50%.
- More solar energy is generated and used.
Is the plan realistic?

Yes...

- It is coincident to the vision 2030 of Rotterdam, with the demand of reducing energy consumption and improving living quality.
- The technology is being improved.

Limitation:

It might be difficult to put the project into effect because current financial crisis.
CONCLUSIONS:

- Sustainable urban design especially related to the concept of ‘passive house’ can be a possible standpoint for the urban transformation project.

- In the context of energy and environmental crisis, this attempt combining social, spatial and energy issue is moveable. It can be applied in other places which have similar situation.

- Passive zone in a reasonable situation can reduce at least 70% of the energy consumption in terms of heating, cooling and transport.