REFURBISHING SHRINKING VRIEHEIDE

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ENERGY SHAPED THE EUROPE WE ARE LIVING IN

An open coal mine
TRANSITION to RENEWABLE ENERGY & BUILT ENVIRONMENT

20% of total energy consumption is construction related
66% related to buildings if the operations and services are also considered (Birkenland)

Refurbishment Weltquartier IBA Hamburg
SHRINKING

A shrinking area in Green Metropolis

Thierry Grossens
SYSTEMS THINKING

Dynamic System

Variety in scale
Time
Flexibility

Dynamic System
REFURBISHMENT

New Buildings / Old Buildings: 1% (each year)
Existing Embodied Energy and CO₂
Present Social Structure

SiD Rocket by Except (redeveloped for shrinking scenario)
VRIEHEIDE heritage of the former energy era

Coal mines were shut down in 1974 - 33,5% vacancy rate
Changing demographic situation: more single people and more elderly people
VRIEHEIDE one of the five shrinking neighborhoods in Heerlen
SCENARIO SPACE ABUDANCE

claim the empty space for introducing new system elements

1. New Functions

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<td>OFFICES</td>
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<td>public functions</td>
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GARDEN | START-UP OFFICE | SHORT TERM STAY | SINGLE | SINGLE FAMILY

MEETING ROOM | PASSAGE | ELDERLY
SCENARIO SPACE ABUDANCE

claim the empty space for introducing new system elements

2. “Energy” Constituents
PHASE 1 the project
connect the existing functions
revitalize the center of the neighborhood

ENERGETICAL GOAL
self sufficiency & initiating the connections

solar energy (heat & electricity)
lake as heat & cold storage
biological waste water treatment (living machine)
connect the lake to the neighborhood as a recreational space
larger scale business (construction material recycling facility)

ENERGETICAL GOAL
lake as a potential for integrating neighborhood scale interventions

recycling facility
increased biomass production: greenhouses
PHASE 3

whole neighborhood is connected to the city

ENERGETICAL GOAL
the lake region is connected to Minewater project as backup and the green areas at the north border are integrated in the system
cogeneration plant
ENERGY POTENTIALS of NEIGHBORHOOD  
total number of houses 836

**HEAT**

- **Mine Water**
  - HEAT PUMP required
  - 28°C hot water well 1km distance
  - 18°C cold water well

- **Biomass / Biowaste**
  - 70% green: 322,000 m²
  - European energy crops energy density = 1.80 kWh/m²
  - 62% heating
  - 360,352 kWh : 23 houses

**WIND**

- **3MW wind turbine (Energy Atlas)**
  - 1,080,000 kWh : 338 houses

**PV Panels**

- flat roof: 52,832 sqm
- 30% potential. 15% efficiency PV panels
  - 1,088,472 kWh : 341 houses

**ELECTRICITY**

- **Biomass / Biowaste**
  - 70% green: 322,000 sqm
  - European energy crops energy density = 1.80 kWh/sqm
  - 28% electricity
  - 162,288 kWh : 51 houses
CLOSER LOOK at the SITE
Revealing the existing qualities
Activating potentials
Achieving self-sufficiency

FINAL FANTASY #1 by PINK PONY EXPRESS
SITE PLAN
BUILDING SCALE Building Layers

- Structure
- Location
- Furniture
- Building Envelope
- Access
- Dividing Elements
- Services
Energy Layers

**space**
- layout
- circulation
- wet areas

**surface**
- facade
- roof

**flows**
- services
- materials

**REDUCING**
- STORING
- REGENERATING
- REUSING
empty units

expand towards empty units

incorporate empty units in public space

use the space of empty units for energy generation
UNITS

Short term stay
- Single units: 32 m²

Housing for single people
- Single units: 46 m²

Housing for elderly people (Ground Floor)
- Combined units: 92 m²
- Combined units: 32 m²
- Combined units: 94 m²

Single family housing
- Combined units: 102 m²
UNIT MATRIX

SHORT TERM STAY

student housing

hotel room

HOUSING

single person

elderly

single family house

ground floor

upper floors

COMMON AREAS

upper floors

ground floor
First floor
Second floor

garden

short term stay
office space
single family housing
single unit

garden

single family housing

short term stay
office space
single unit
Roof terrace
SURFACE GENERATING

EXISTING BUILDING

ADJUSTMENT

REPLACEMENT

aluminum frames
aluminum panels
glazing
uninsulated cavity wall
wooden doors

NEW ENVELOPE

glazing
metal balustrades
wooden doors
wooden frames
uninsulated cavity wall
TWO FAÇADES  TWO REFURBISHING APPROACHES

façade facing the neighborhood

------------------------------------------------------

extending towards the open area adding functions that would reinforce the existing surrounding functions

change the image

North Façade

more private balconies / overhangs material

keeping the proportions open space modular units

South Façade
FLOWS REUSING

- electricity
- heat
- warm water
- drinking water
- clean water
- food

- waste heat
- organic waste
- municipal waste
- inorganic waste
- urine
- sewage sludge
- grey water

consumer goods
construction materials
reuse
remanufacture
recycle

demolished buildings
MATERIAL FLOW

Timber vs Steel (NIBE basis werk)

Glass vs Polymers (Polycarbonate)

Reuse/Recycling
ENERGY PRINCIPLES

SUMMER WINTER

100 W/m² 700 W/m²

thermal mass

summer cooling

summer energy storage

PV PANELS

WIND

SOLAR COLLECTORS

CHP

FOSSIL FUELS

MINEWATER (heat & cold storage)

THE LAKE (heat & cold storage)

WARM BASIN

SAND MINES

summer cooling

WINTER

SUMMER

100 W/m²

700 W/m²

thermal mass
SOLAR ANALYSIS

21st December

16.00
14.30

21st March

16.00
15.00

21st June

15.30

23rd September

63°
SHAPING THE SOLAR SKIN

North Façade
HEAT & ELECTRICITY

West Façade
ELECTRICITY

Shaping the envelope

Exterior elements

Interior elements
INNER SOLAR ENERGY SKIN heat
OUTER SOLAR ENERGY SKIN electricity bipv

fully tempered low-e double glazing
8mm + 22mm + 12mm

heliostat

240 x 200mm glulaminated timber column

240 x 120mm glulaminated timber beam

steel connector with ball joints 9.50m
ENERGY DEMAND existing
167kWh/m²

3.194 kWh/year

1793 m³/year natural gas

15.465 kWh/year

2.334 kWh/year

778 kWh/year

- electricity
- heating
- warm water
- cooking
ENERGY DEMAND buffer
133kWh/m² (%20 reduced)

3.194 kWh/year — electricity

10.988 kWh/year — heating

2.334 kWh/year — warm water

778 kWh/year — cooking

Hans van Heeswijk
architecten

Heeswijk - Noordwachter
Heren 5 - Leeuw van Vlaarderen

municipal waste
inorganic waste
organic waste
waste heat
sewage sludge

consumer goods
remanufacture
construction materials
reuse

black water

recycle
ENERGY DEMAND complete insulation
118kWh/m² (%30 reduced)

- 3.194 kWh/year for electricity
- 9.077 kWh/year for heating
- 2.334 kWh/year for warm water
- 778 kWh/year for cooking
ENERGY REUSE & ENERGY GENERATION POTENTIAL upgraded installation
60kWh/m² (%35 reuse & total electricity consumption can be provided by the PV panels)

141kWh/year biomass
3.870 kWh/year (BIPV 7% efficiency)

6.650 kWh/year (stored)
950 kWh/year (BIPV 7% efficiency)

198kWh/year biomass
141kWh/year biomass

municipal waste
inorganic waste
organic waste
waste heat
sewage sludge
black water

consumer goods
remanufacture
construction materials
recycle
STRUCTURAL DIAGRAM of the FAÇADE

DIAGRID STRUCTURE

FLAT GLASS PANELS
CONNECTION DETAIL DETAIL A

- Fully tempered low-e double glazing: 8mm + 22mm + 12mm
- Ball joint
- 240 x 120 mm glulaminated timber beam
MODULAR UNITS with different material infills

- Exterior module with timber boarding layer
- Exterior module with timber boarding layer (wall heating)
- Fixed glazing
- Operable glazing
- Interior module with polycarbonate
- Basic interior module with gypsum boards
THANK YOU