**Atelier Bouwmeester**
**RAVENSTEINGALERIJ 54–59, 1000 BRUSSEL**

# small talk

17.09 2013 18:00

## SUSTAINABLE ENERGY LANDSCAPES

Sven Stremke

the near future the appearance and spatial ganization of urban and rural landscapes ll be strongly influenced by the generation of newable energy. One of the critical tasks for signers, planners and engineers will be the ntegration of renewable energy into the exist- g environment—which people value and want preserve—in a socially fair, environmentally und, and economically feasible manner. In der to get a grip on these issues the study nergy Landscapes" was launched by the Team aams Bouwmeester, Ruimte Vlaanderen, VLM d VITO within the framework of 'Labo Ruimte'.

ne of the external experts involved in this search project is Sven Stremke. He is sistant professor of landscape architecture Wageningen University and studies sus- nable landscapes, with special attention to e regional scale and renewable energy. In 12, Sven Stremke and Andy van den Dob- lsteen published a book entitled *Sustain- le Energy Landscapes: Designing, Plan- ng and Development* (Taylor & Francis) eturing the work of a dozen teams of ex- rts working on this topic across the world.

ecently, Sven Stremke and his colleague enée de Waal launched the NRGlab - a oratory devoted to research and de- gn of sustainable energy landscapes ww.NRGlab.net). Through a selection of ientific concepts and interdisciplinary projects remke will illustrate and discuss the challenge developing sustainable energy landscapes.

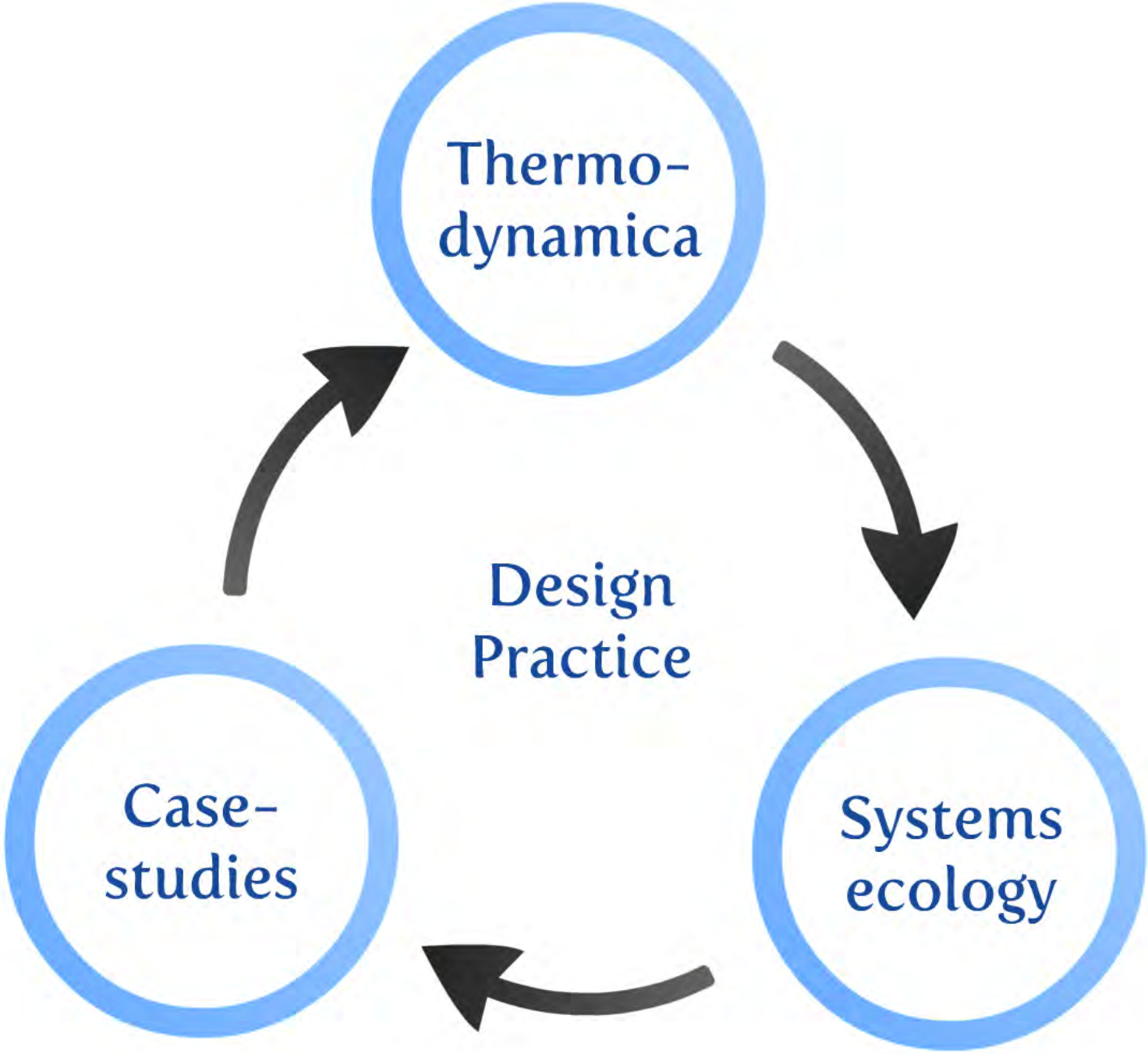
Reservatie verplicht op
**bouwmeester@vlaanderen.be**
Met vermelding
'SmallTalk – 17/09'

**ISCHRIJVEN (50 PLAATSEN)**

DAMCTD

NRG LAB

Sven Stremke, PhD, Assistant Prof. Landscape Architecture, Wageningen University, 130917, Brussels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intro (part 1)

# What is an energy landscape?







# What is a sustainable energy landscape?

> based on renewable sources (can be sustained forever)
> locally available energy sources
> not compromising other land uses e.g. food production
> no harm to biodiversity
> attractive and accepted by inhabitants
> ...

ENVIRONMENTAL SCIENCE

# SUSTAINABLE ENERGY LANDSCAPES

In the near future the appearance and spatial organization of urban and rural landscapes will be strongly influenced by the generation of renewable energy. A critical step will be the re-integration of these sustainable energy landscapes into the existing environment—which people value and want to preserve—in a socially fair, environmentally sound, and economically feasible manner.

**Sustainable Energy Landscapes: Designing, Planning, and Development** presents state-of-the-art knowledge in this exciting new field, bridging the gap between theory and fundamental research on the one hand, and practice and education on the other. The authors present a selection of interdisciplinary, cutting-edge projects from around the world, illustrating the inspiring challenge of developing sustainable energy landscapes.

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"This book is a wonderful opportunity to lift your view on sustainable design to a whole new level. ... a 'tour de force.' It fearlessly integrates a broad range of perspectives, disciplines and case studies. It re-frames the discussion on sustainable design by asking deep questions. How might the transition to renewable energy systems be accommodated in a crowded world? Does the integration of sustainable energy systems require that we redefine our approach to urban and rural planning and design? Does it help to see all landscapes as energy landscapes? The book is at once playful and revealing."

—**Sebastian Moffatt,** Executive Director of the CONSENSUS Institute, British Columbia, Canada

"Sven Stremke and Andy van den Dobbelsteen have done a splendid job to illustrate the breadth of ongoing research efforts and the relevance of diverse and interdisciplinary approaches to the energy-landscape nexus. This comprehensive book fills a gap in the literature and will be invaluable to a growing number of researchers, practitioners and educators engaging with this topic."

—**Dan van der Horst,** University of Birmingham, UK

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Stremke • van den Dobbelsteen

SUSTAINABLE ENERGY LANDSCAPES

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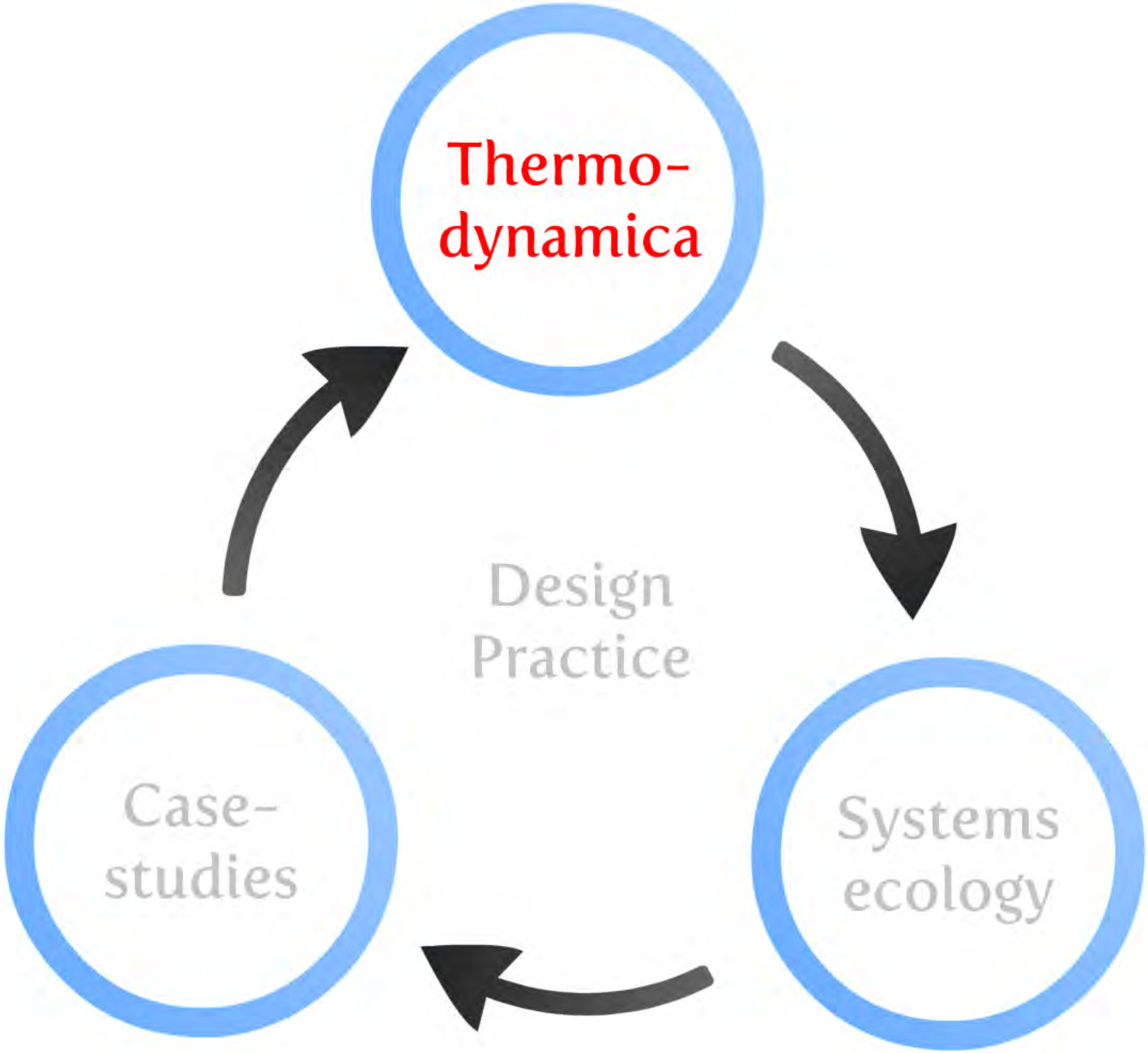
# SUSTAINABLE ENERGY LANDSCAPES

## Designing, Planning, and Development

Edited by **Sven Stremke and Andy van den Dobbelsteen**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Thermo-
dynamica

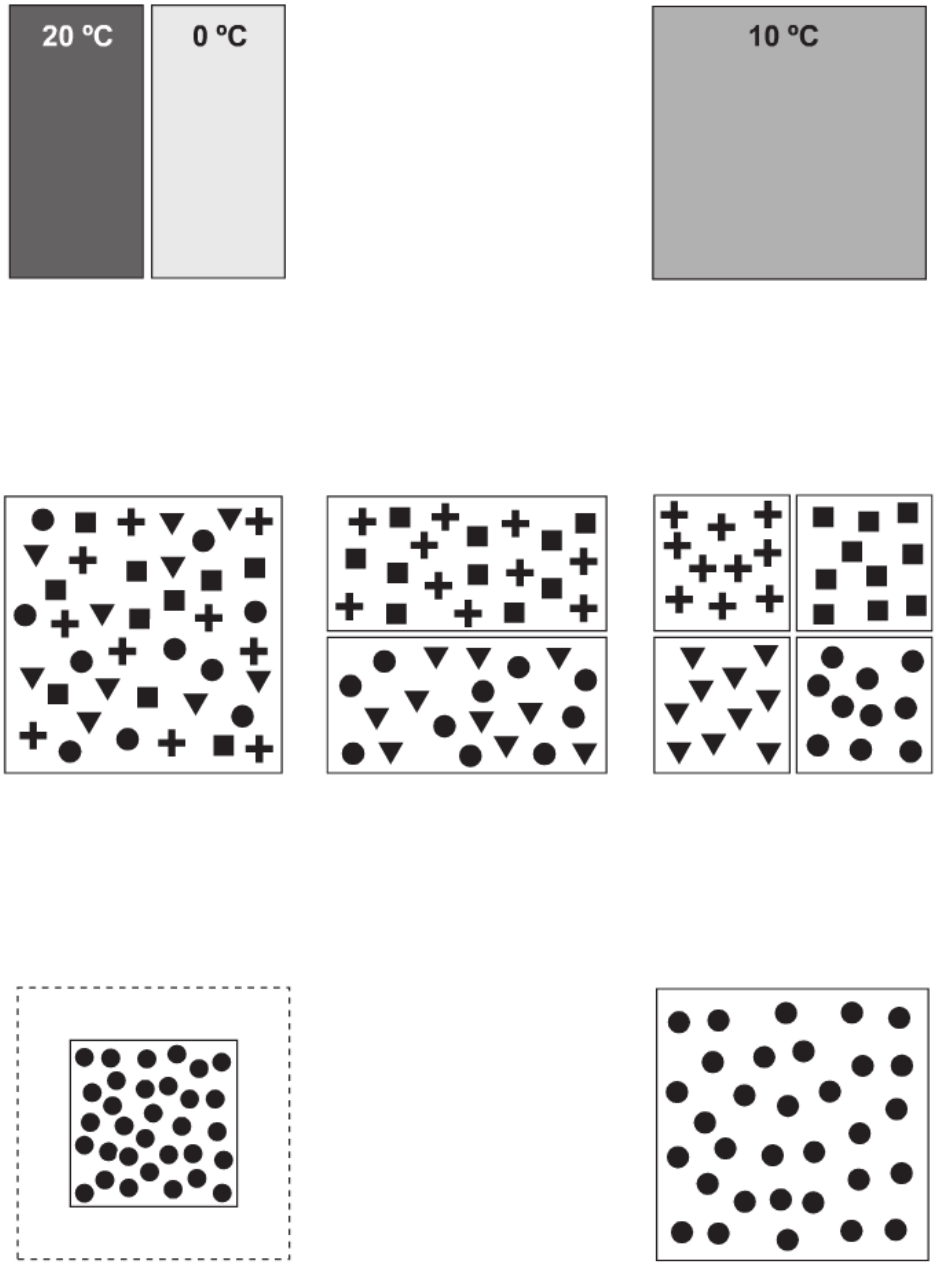
# Thermodynamica*

energy ≠ energy

→ Second Law of Thermodynamics?
→ Concept of exergy?
→ Concept of entropy?

* Stremke S, Dobbelsteen A van den, Koh J (2011) Exergy landscapes: Exploration of second-law thinking towards sustainable landscape design, International Journal of Exergy 8(2) 148-174

# High entropy vs. high exergy




Source: Stremke et al. 2011 (IJEX)

# Exergy Landscapes (slide 1)

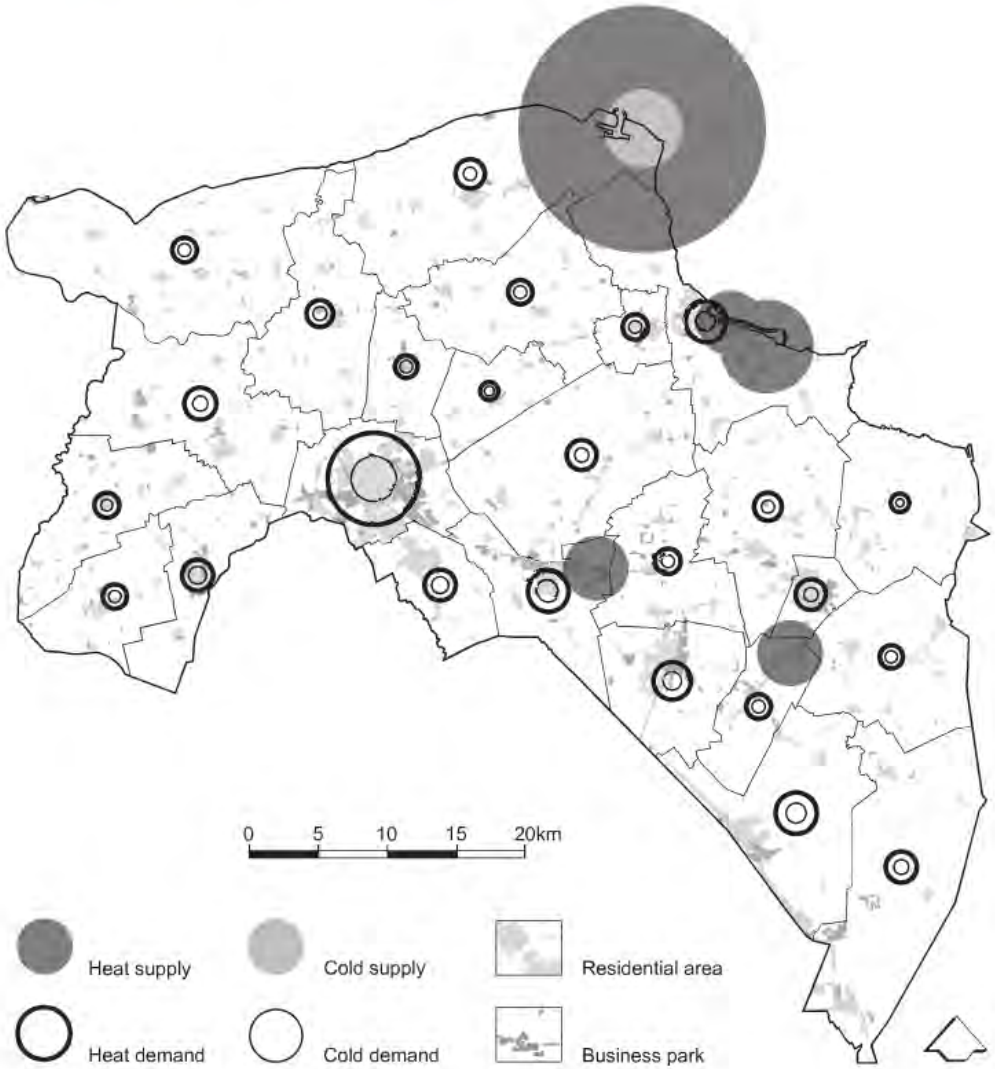
Engineering

▽

Industrial Ecology

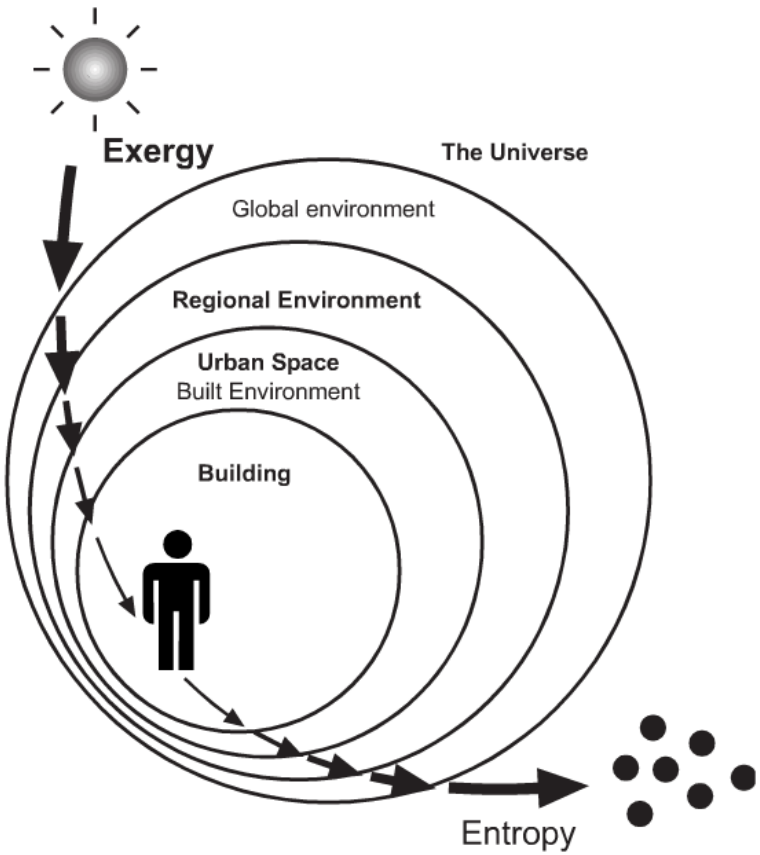
▽

Architecture and Planning




Source: Stremke et al. 2011; based on Dobbelsteen et al. (2007b)

# Exergy Landscapes (slide 2)




Source: Stremke et al. 2011; based on Shukuya, 2009b

**Table 7** Exergy-conscious strategies for planning and design of the physical environment

| *Exergy-conscious strategy* | *Building component* | *Building* | *Neighbour-hood* | *City* | *Region* |
|---|---|---|---|---|---|
| 1 Increase exergy efficiency (e.g., heat recovery systems) | *** | ** | * | * | * |
| 2 Decrease exergy demand (e.g., building orientation and passive house) | * | *** | *** | * | * |
| 3 Increase use of residual exergy (e.g., residual heat for room heating) | * | ** | *** | *** | ** |
| 4 Match quality levels of exergy supply and demand (e.g., cascade) | * | ** | *** | *** | ** |
| 5 Increase assimilation of renewable exergy (e.g., geothermal) | ** | ** | *** | *** | *** |

*Less relevant

**Relevant

***Focal scale.

Source: Stremke et al. 2011

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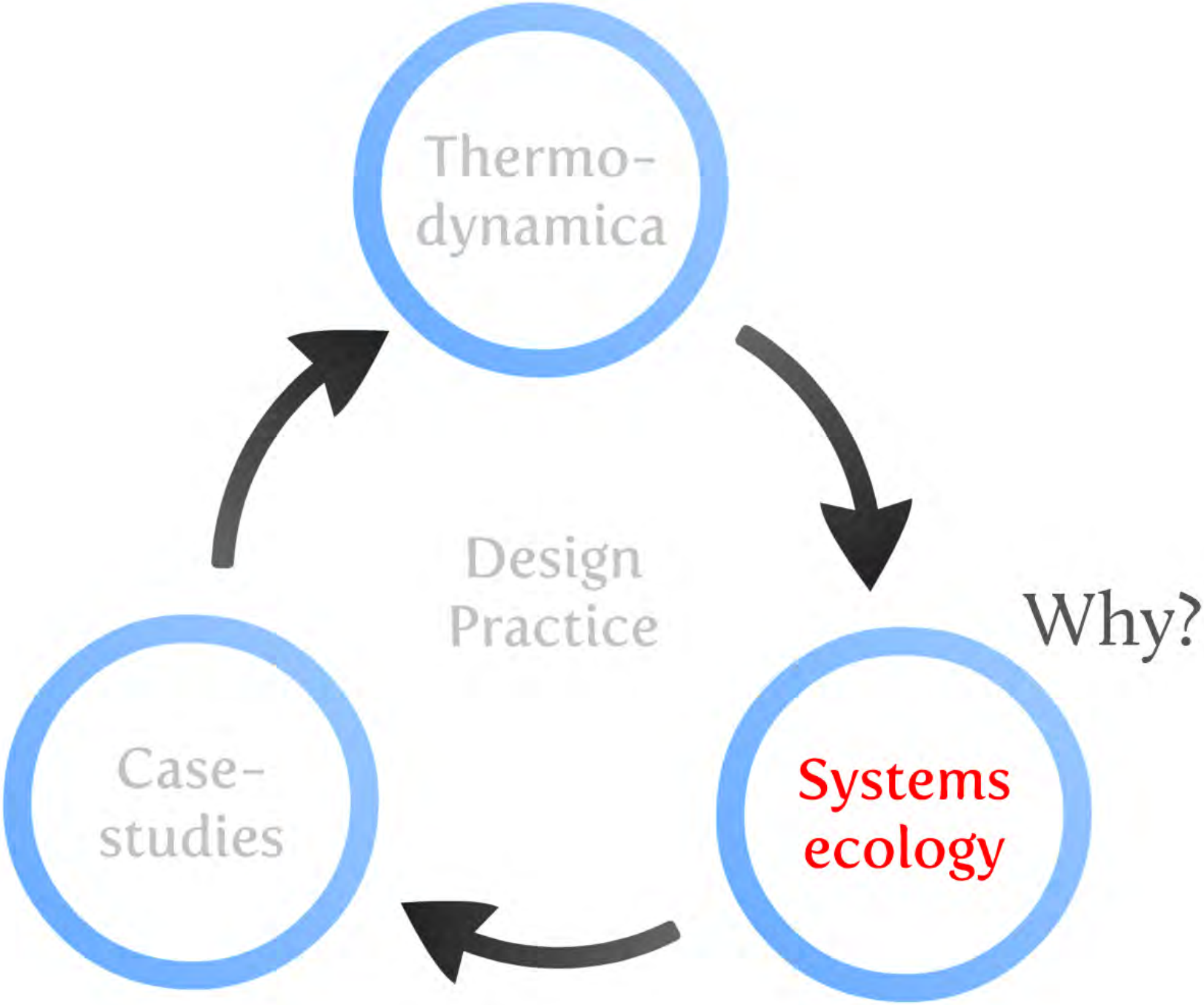
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Ecology
Biology

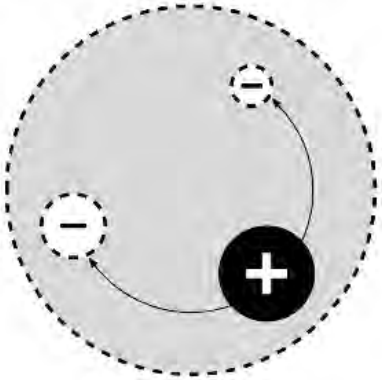
# Concepts from systems ecology *

→ Source-sink
→ System size
→ Food chain
→ Biorhythm
→ Symbiosis
→ Diversity
→ Niches

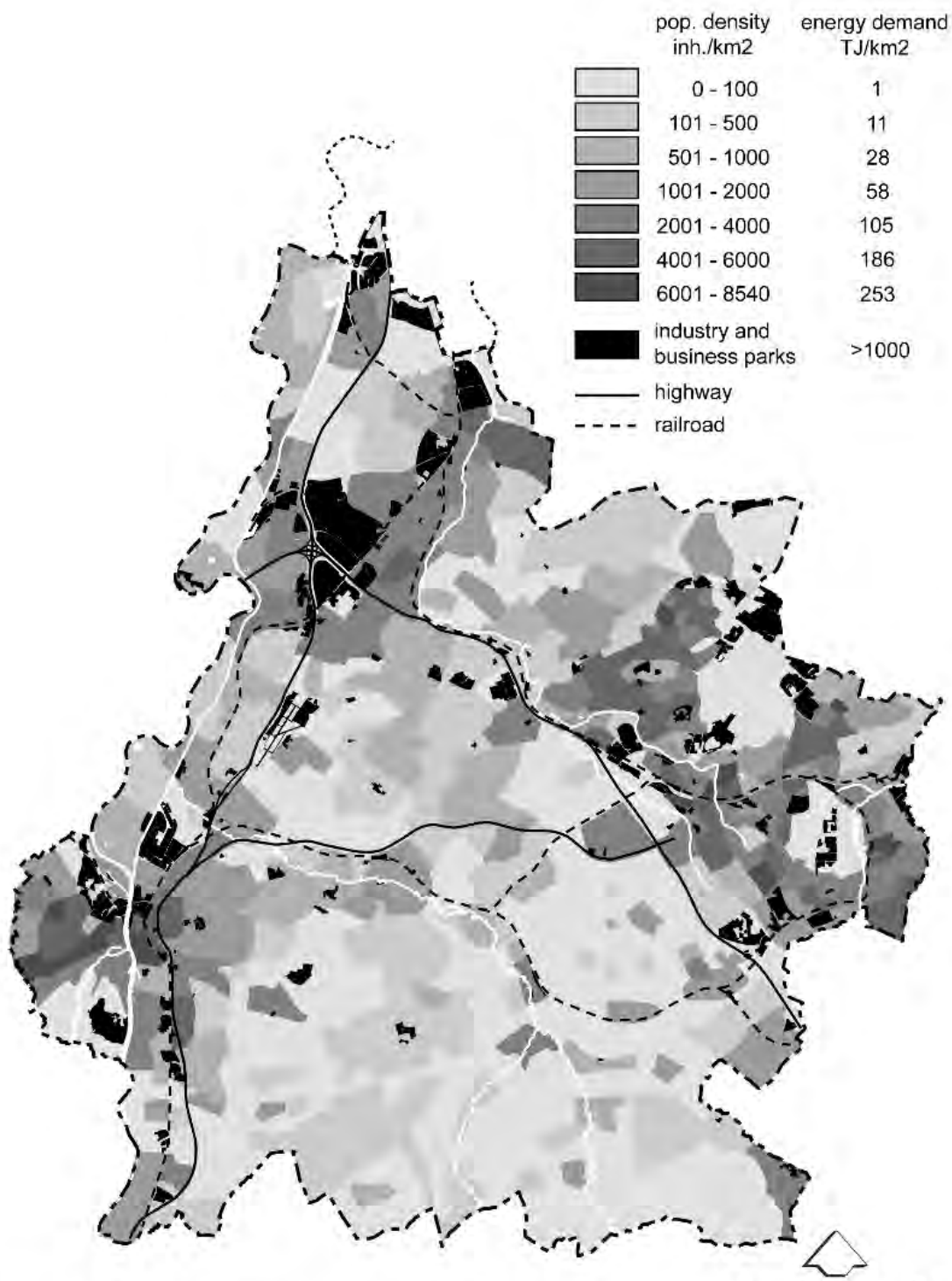
...

* Stremke S, Koh J (2011) Integration of ecological and thermodynamic concepts in the design of sustainable energy landscapes, Landscape Journal 30(2) 194-213

# Source-sink

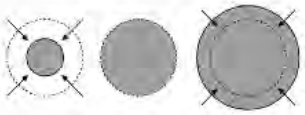


Application
> source = landscape (+)
> sink = city (-)
> connections between sources and sinks!
> proximity between sources and sinks!

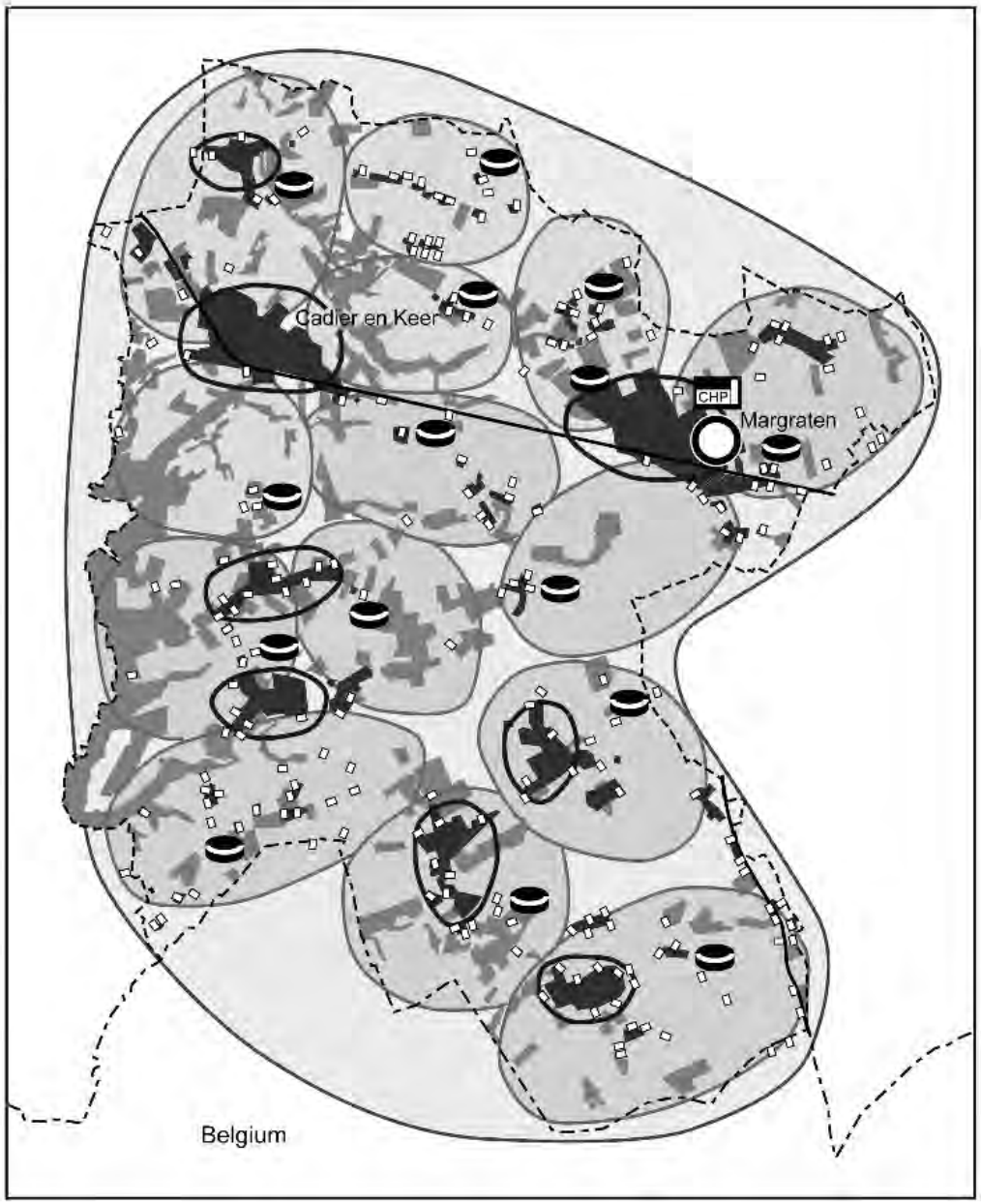


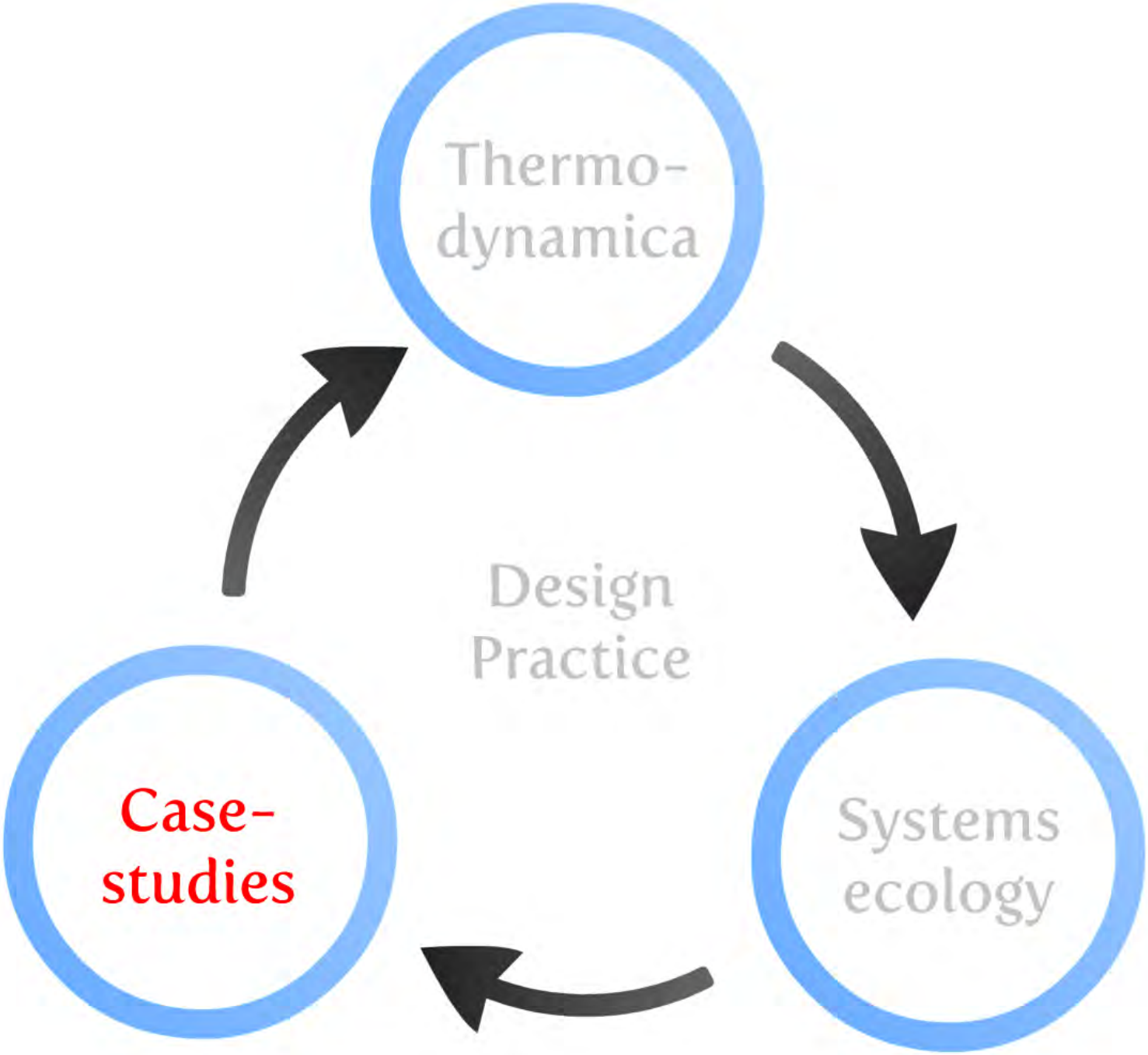

energy sinks and approximate energy use/km2 in South Limburg

# System size



Application
> identify optimum system size!
> quality energy carrier ▸ maximum system size
> technical requirements ▸ minimum system size

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studies

Case-studies

# international case studies

Güssing (AU) Jühnde (DE) Samsø (DK)

A town, a village and an island; three rural areas with low population density

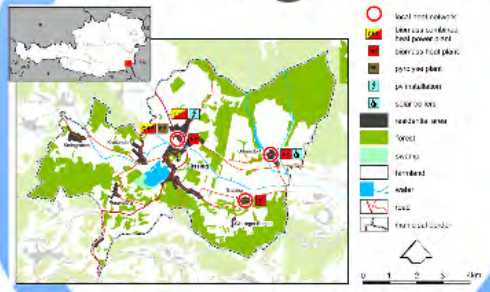
*Desk study
*Field observation
*Interviews stakeholders, experts & lay people

# Samsø

112 km2
4000 inhabitants
36 inhabitants/km2
Started 1997

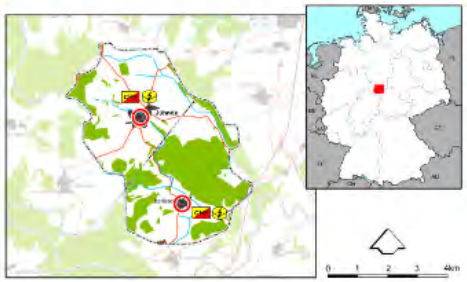
# Güssing

50 km2
3800 inhabitants
72 inhabitants/km2
Started 1990



# Jühnde

25 km2
1100 inhabitants
44 inhabitants/km2
Started 2000



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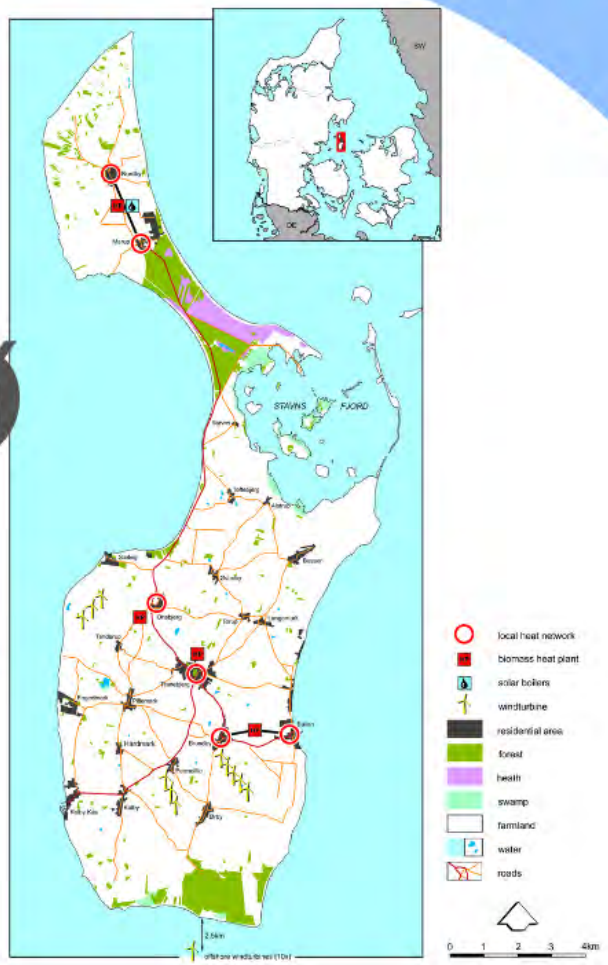


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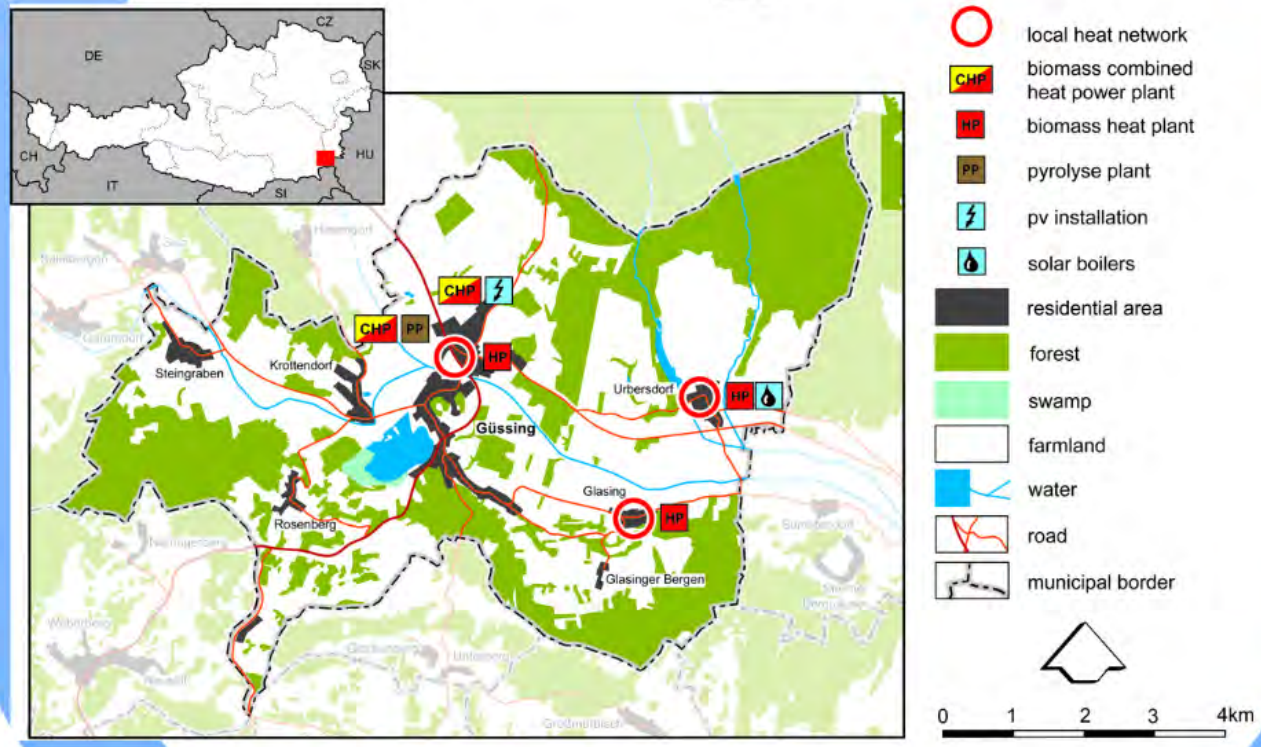


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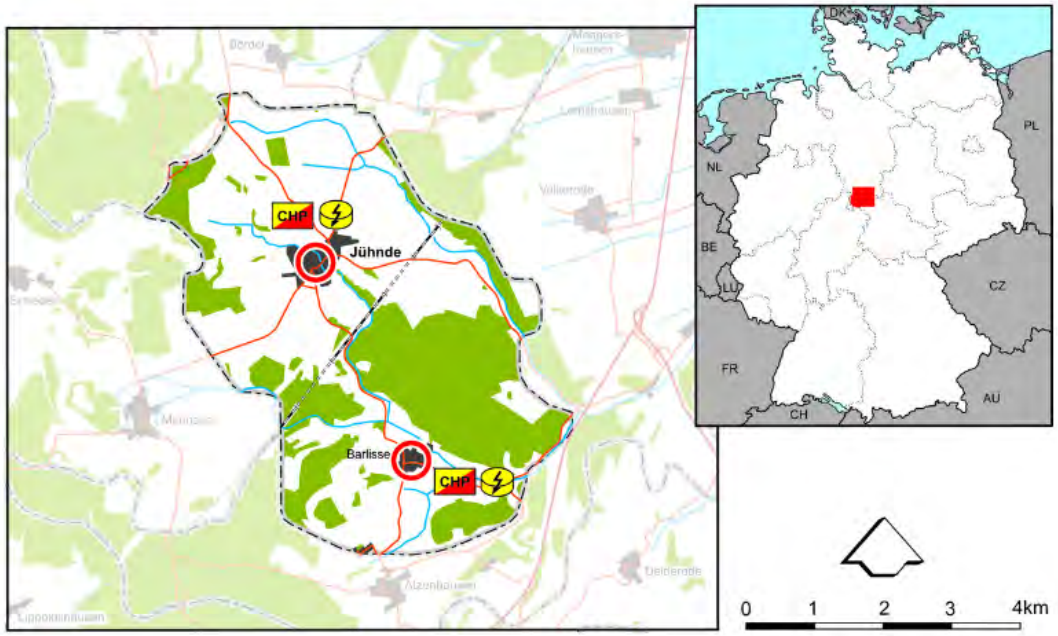
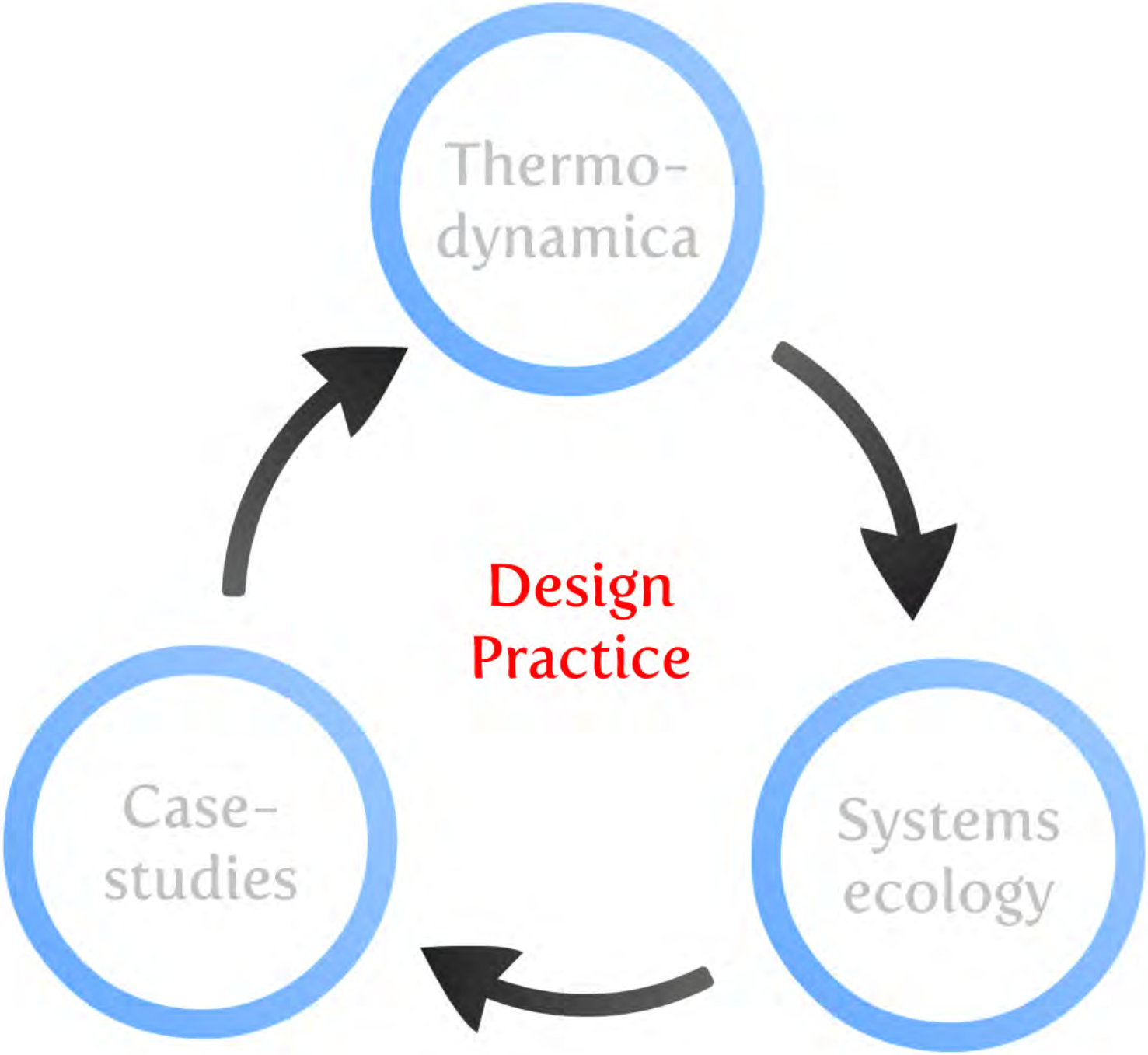



local heat network
biomass combined heat power plant
biogas installations
residential area
forest
farmland
stream
road
railroad
municipal border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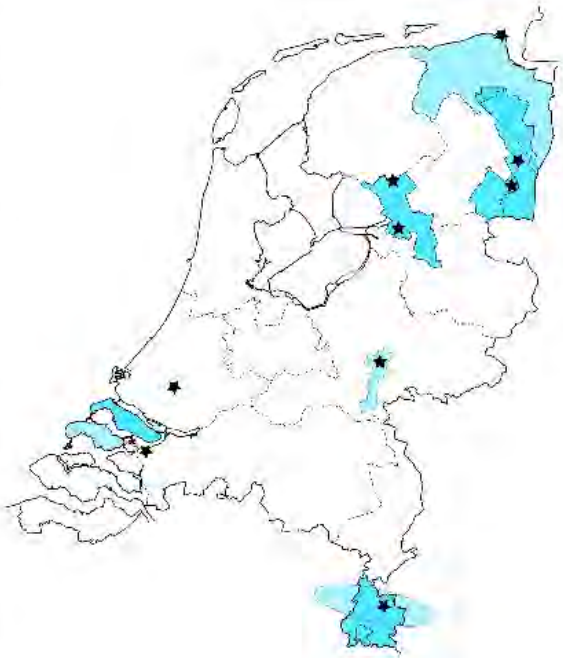
Case-
studies
Design
Practice

Design Practice

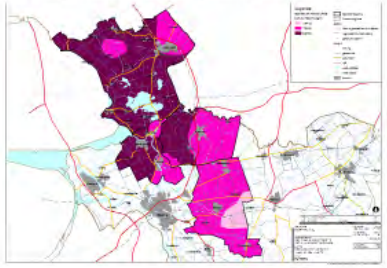
# design practice Netherlands

| | | ***Spatial scale: Large to small*** | | |
|---|---|---|---|---|
| | | **Macro-scale**<br>Region, several municipalities | **Meso-scale**<br>Single municipality | **Micro-scale**<br>Neighbourhood, site |
| ***Time horizon: Short to long*** | **Short-term**<br>1-10 years | • North West Overijssel: Steenwijkerland, Staphorst, Dalfsen & Zwartewaterland<br>• Goeree-Overflakkee island/a | • Groene Compagnie in Hoogezand-Sappemeer<br>• *Lauwersmeer blue energy* | • *Emmen/Angelslo*<br>• *Polder Mastenbroek/Overijssel*<br>• *Oldemarkt/Overijssel* |
| | **Medium-Term**<br>10-30 years | • Veenkolonien region<br>• *Groningen province*<br>• *Veenkolonien kWh/m2*<br>• *Drentsche aa energy history* | • *Eemshaven kWh/m2*<br>• *Arnhem kWh/m2* | • *Rotterdam Stadshaven kWh/m2*<br>• *Mijnstreek kWh/m2*<br>• *Heerlen/South Limburg* |
| | **Long-term**<br>30-50 years | • COROP region South Limburg<br>• COROP region SE Drenthe<br>• *Schouwen-Duiveland island*<br>• *Goeree-Overflakkee island/b* | • *Margraten/South Limburg* | |

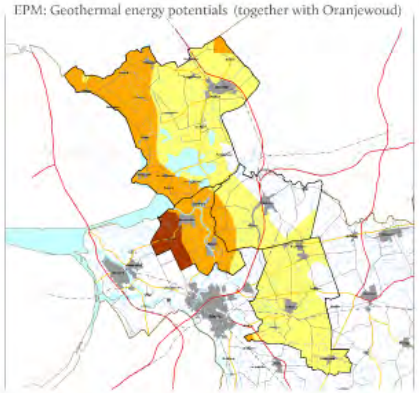


# Macro-scale: North West Overijssel

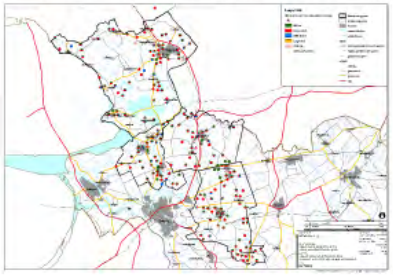
EPM: Average windspeed 100m above ground (together with Oranjewoud)

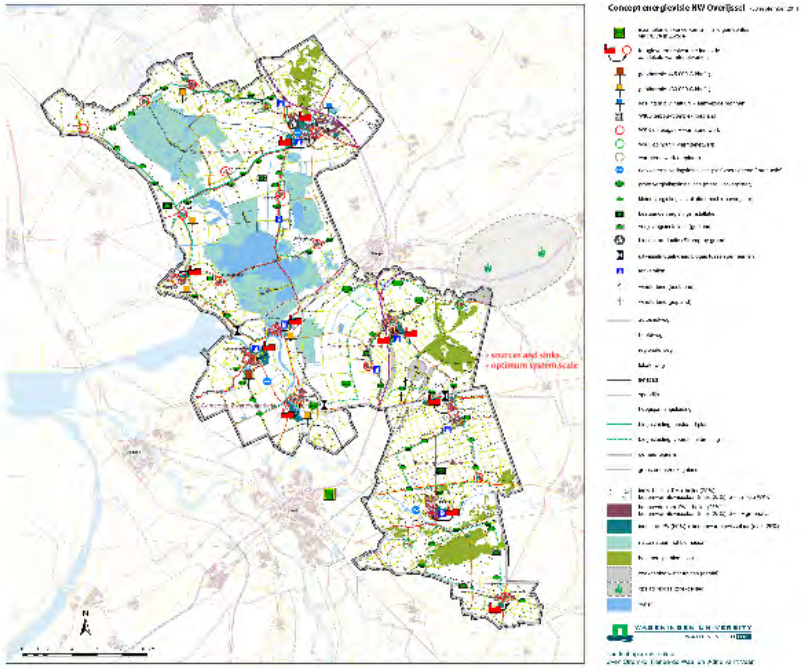


EPM: Geothermal energy potentials (together with Oranjewoud)



Survey motivation use of renewable energy (together with Oranjewoud)






**4. Visualisatie erf met nieuwe co-vergistingsinstallatie**

Inpassing van een co-vergistingsinstallatie op de boerderij van H. Riezebosch, Nieuwe Wetering 27a (Gemeente Zwartewaterland et al, 2011). Aan de rechterzijde de bestaande stal en boerderij, daarnaast twee grijze betonnen ronde opslagen en aan de linkerzijde is de nieuwe opslagloods voor co-producten te zien. Aan de achterzijde van het erf is nieuwe erfbeplanting geplant die het zicht vanuit de polder op de nieuwe co-vergistingsinstallatie wegneemt.

**3. Visualisatie ervaring openheid door linten heen**

Zicht op Genemuiden (standpunt: Kerkwetering). Rechts op de voorgrond zorgboerderij "De Rietstulp" aan de Nieuwe Wetering 18, daarachter de Groene Steeg en de Nieuwe Weg. Nieuwe erfbeplanting ontneemt het zicht op de achterkant van de erven. Bij de zorgboerderij is te zien hoe een open voorkant van een erf met boerderij en siertuin eruitziet.

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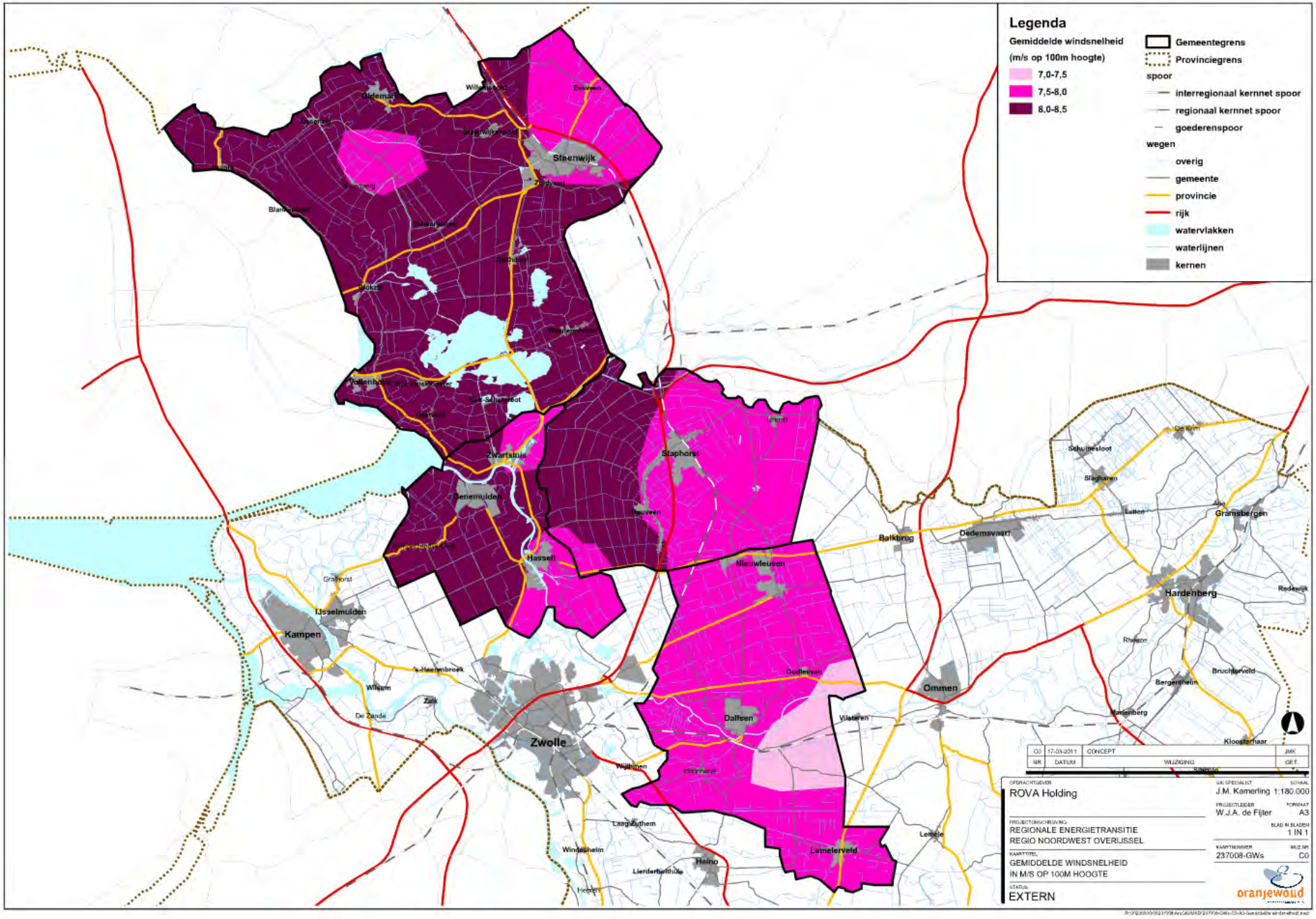

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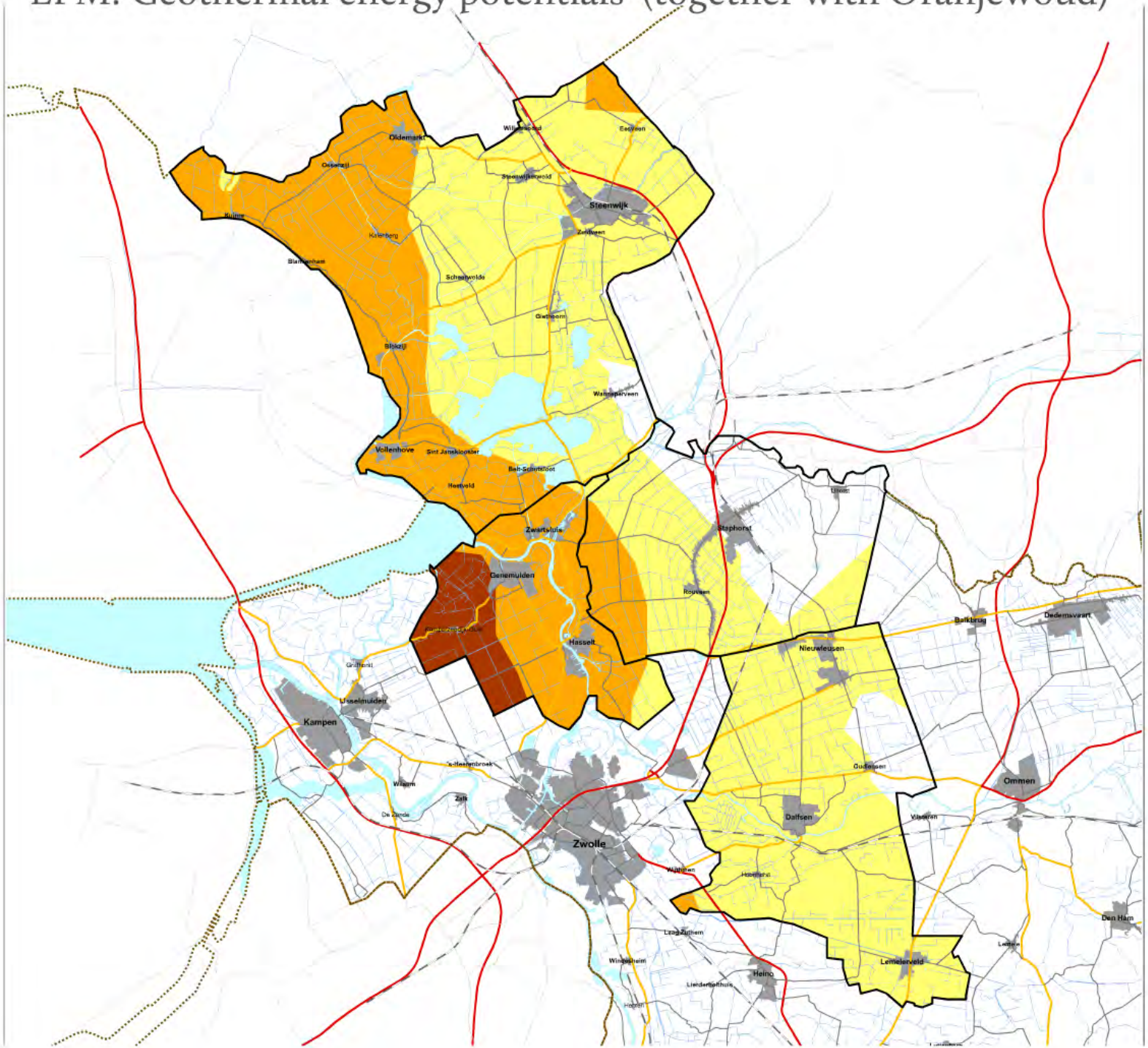

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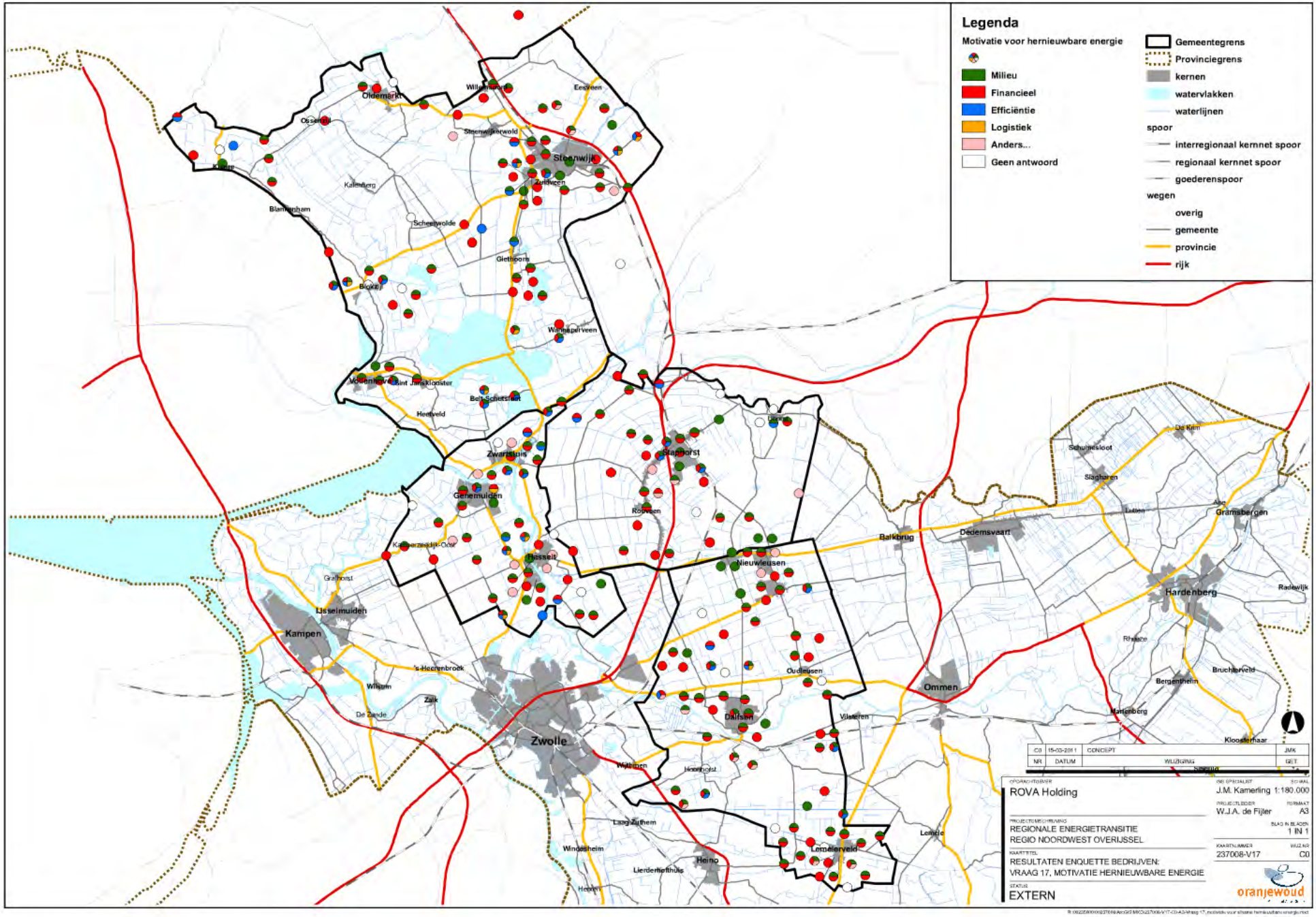

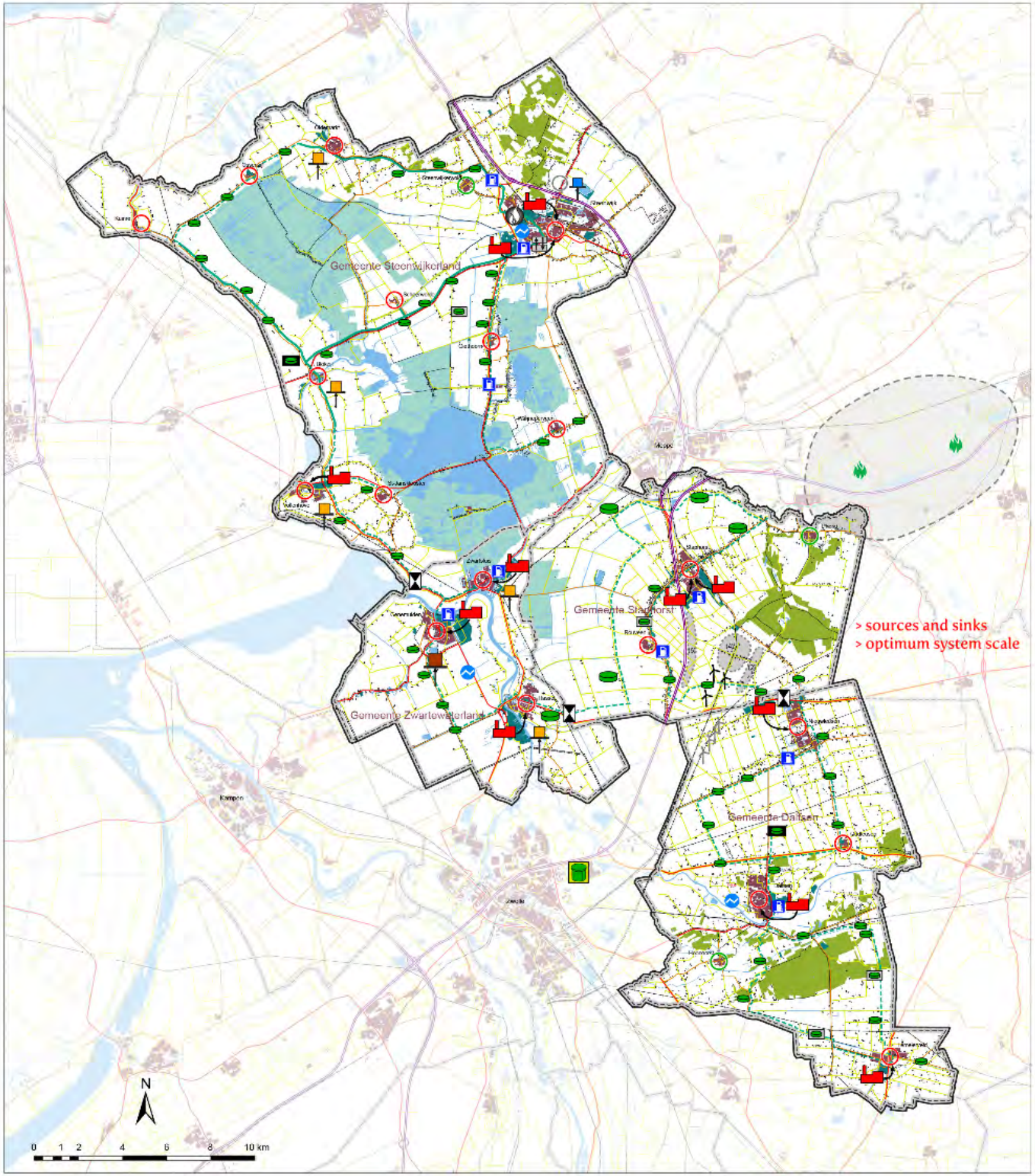


## Concept energievisie NW Overijssel (30 september 2011)

- inzamelen en verwerken GFT alle gemeentes via ROVA in Zwolle
- terugleveren restwarmte industrie aan lokale warmtenetwerken
- geothermie (45.000 GJ/ha/jr)
- geothermie (30.000 GJ/ha/jr)
- koeling m.b.v. natuurlijk aanwezige bronnen
- WKO gebouwcomplex (gepland)
- WKK op biogas + warmtenetwerk
- WKK op hout + warmtenetwerk
- warmtenetwerk (gepland)
- rioolwaterzuiveringsinstallatie (zelf-voorzienend / productie)
- grote vergistingsinstallatie (mest + covergister)
- kleine vergistingsinstallatie (mest + covergister)
- bestaande vergistingsinstallatie
- vergistingsinstallatie (gepland)
- biocoal productie (Stramproy green)
- uitwisselmogelijkheid biogas tussen gemeenten
- tankstation
- windturbine (bestaand)
- windturbine (gepland)
- autosnelweg
- hoofdweg
- regionale weg
- lokale weg
- fietspad
- spoorlijn
- hoogspanningsleiding
- biogasleiding: bestaand plan
- biogasleiding: voorstel uitbreiding
- gemeentegrens
- grens onderzoeksgebied
- indiv. huizen: PV + boiler (25%), bodemwarmtewisselaar (max. 25%), GFT, micro WKK
- bebouwde kern: PV + boiler (25%) bodemwarmtewisselaar (max. 25%), GFT + groenafval
- industrie: PV (50%) + bodemwarmtewisselaar (max. 25%)
- natte natuur: net biomassa
- bos: houtige biomassa
- zoekgebied windturbines (aantal)
- opslag biogas (zoekgebied
- water

WAGENINGEN UNIVERSITY
WAGENINGEN UR

Landschapsarchitectuur
Sven Stremke, Renée de Waal en Adrie van't Veer

# 4. Visualisatie erf met nieuwe co-vergistingsinstallatie


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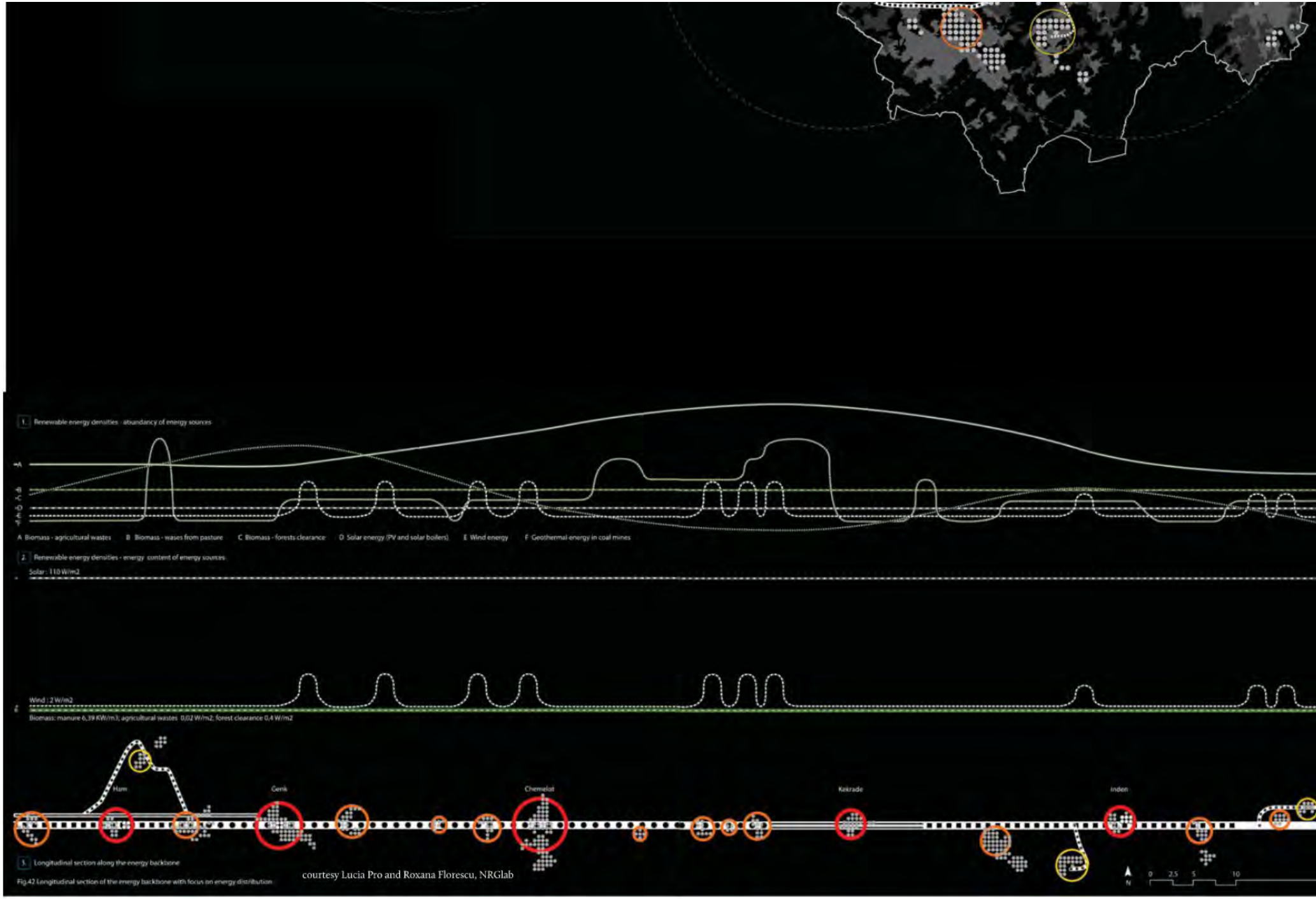



Fig.42 Longitudinal section of the energy backbone with focus on energy distribution

courtesy Lucia Pro and Roxana Florescu, NRGlab

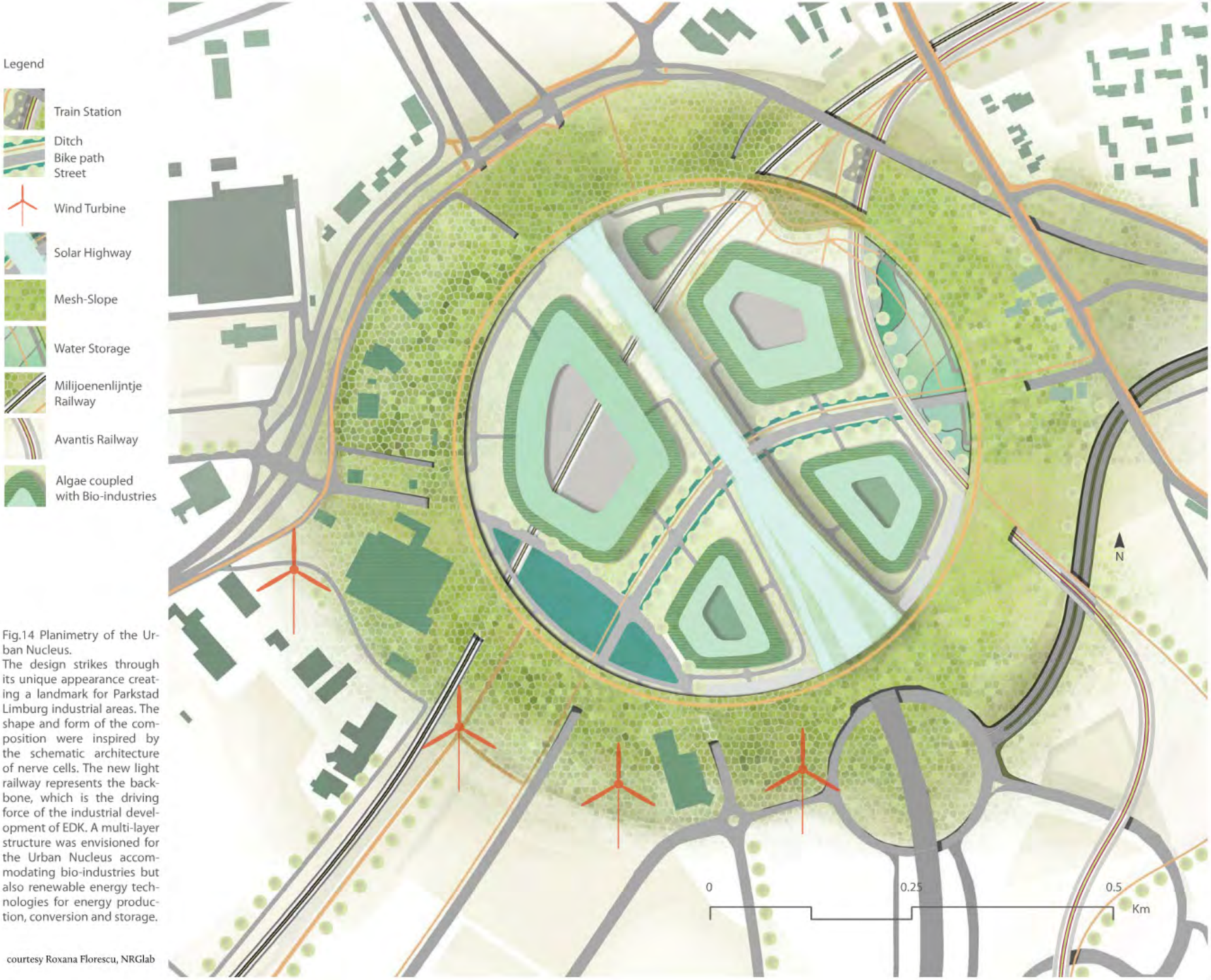


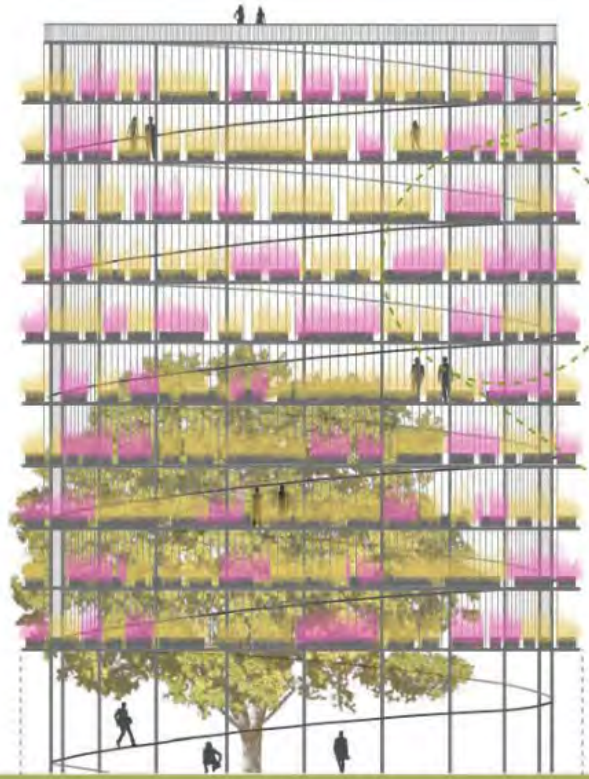

Fig.14 Planimetry of the Urban Nucleus.
The design strikes through its unique appearance creating a landmark for Parkstad Limburg industrial areas. The shape and form of the composition were inspired by the schematic architecture of nerve cells. The new light railway represents the backbone, which is the driving force of the industrial development of EDK. A multi-layer structure was envisioned for the Urban Nucleus accommodating bio-industries but also renewable energy technologies for energy production, conversion and storage.

courtesy Roxana Florescu, NRGlab

courtesy Roxana Florescu, NRGlab

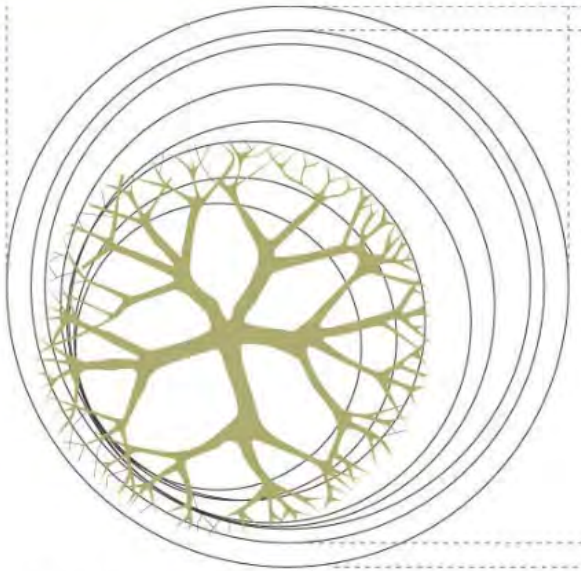

Historical center
Parallelweg
Maples
Spekholzerheide train station
Logistic park
Retention pond
Tower and plaza
Birches
Solar panels
Beeches and oaks
Outer ring
Gracht neighborhood
Pferdelander Park
courtesy Lucia Pro, NRGlab
N
0
30
60
100
m

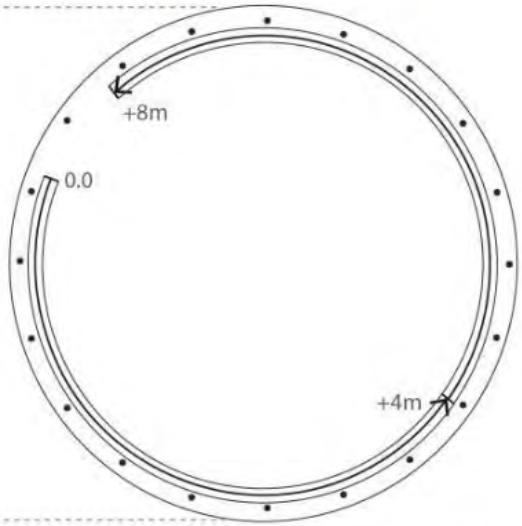
5 Tower

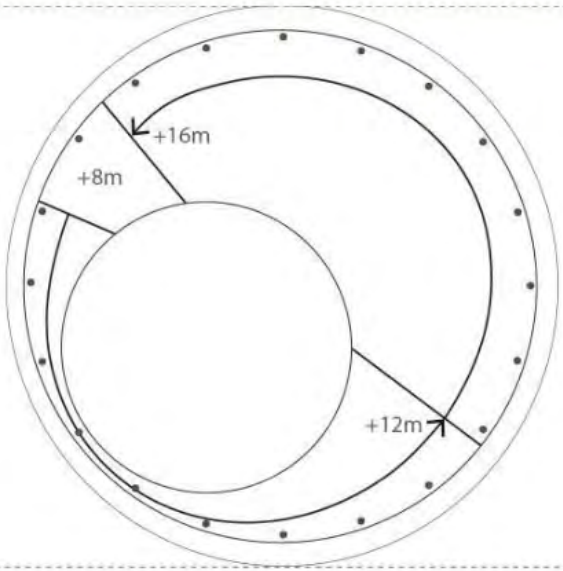


ILE - autumn visualization

Switchgrass and giant miscanthus are grown in plant boxes wrapping the bulding.
Biomass is harvested and converted into energy in the CHP.






1:500 0 5 10 15 20 25 m

courtesy Lucia Pro, NRGlab

ground floor

01-02 floors

home

(1) introduction

> sustainable vs. renewable energy landscapes

(2) thermodynamica

> energy is not energy: quality, time and location

(3) systems ecology

> relevant strategies; descriptive & inspirational

(4) international case studies

> genius loci/landscape, energy and people!

(5) design practice

> transition to RE possible/depending on density

Sven@NRGlab.net
Brussels, 130917