P5 Presentation, 09.07.20
Charlotte von Meijenfeldt, 4209990
Mentors: Ulf Hackauf & Ellen van Bueren

Autonomous Oosterwold

Exploring the land-use intensity, environmental impact and environmental risks of local essential service provision on different levels of autonomy


Electricity production
Heat production
Wastewater treatment

The scale dilemma..

Main research question:

What are the land-use intensity, environmental impact and environmental risks associated with the provision of local essential services on different levels of autonomy in Oosterwold, and what recommendations follow from these insights for spatial planning?

1. Introduction

2. Oosterwold

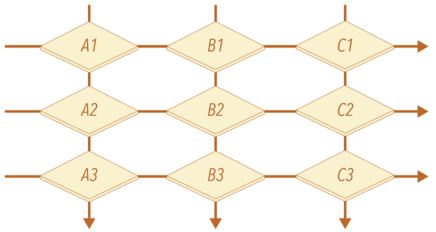
3. Analysis

Energy provision

4. Analysis

Wastewater treatment

5. Scenarios



6. Conclusions

7. Recommendations

1. Introduction

2. Oosterwold

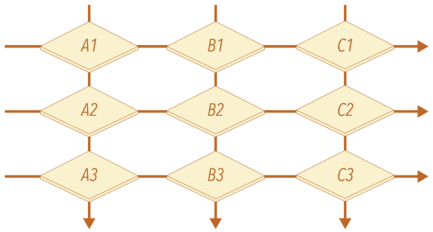
3. Analysis

Energy provision

4. Analysis

Wastewater treatment

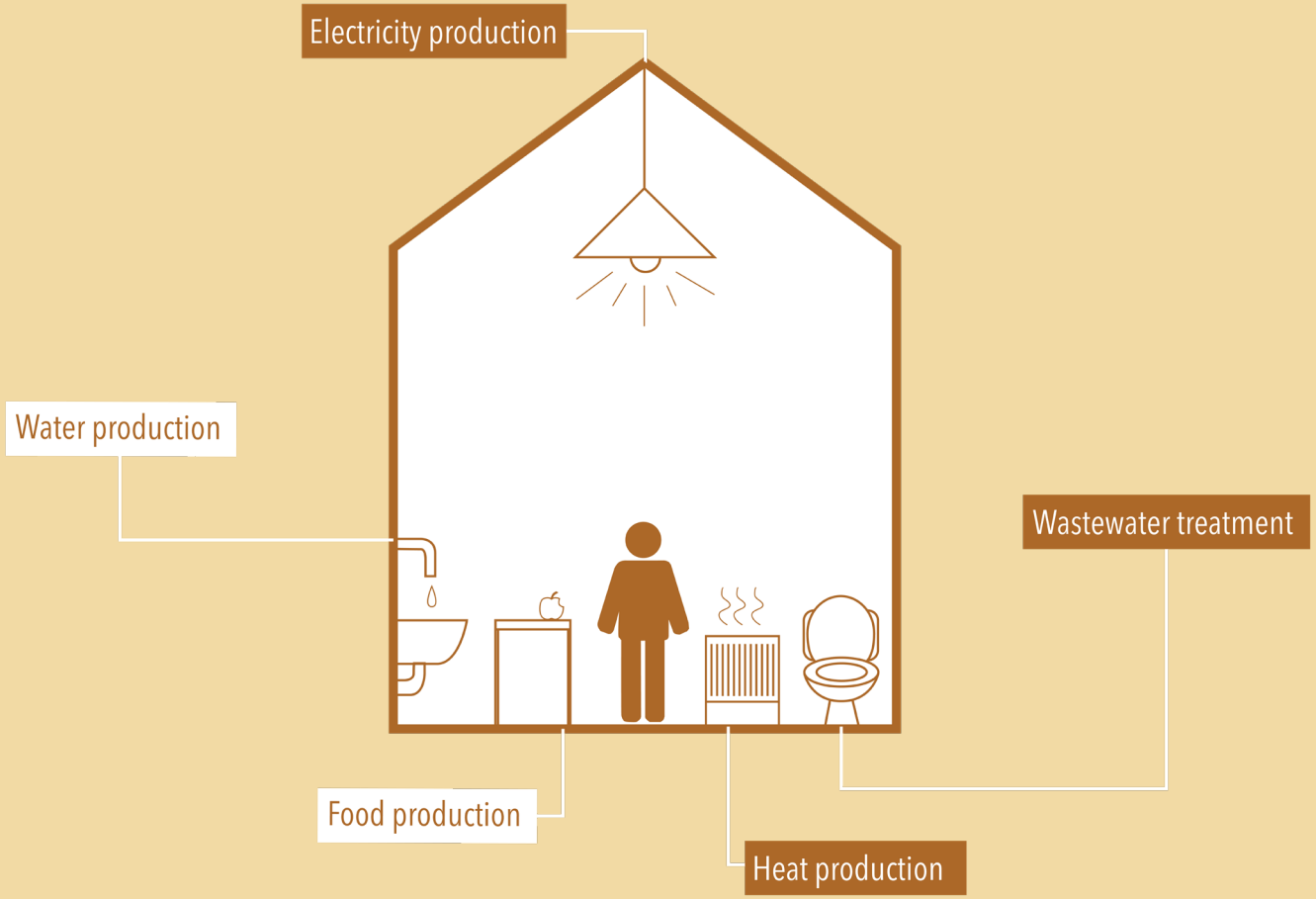
5. Scenarios



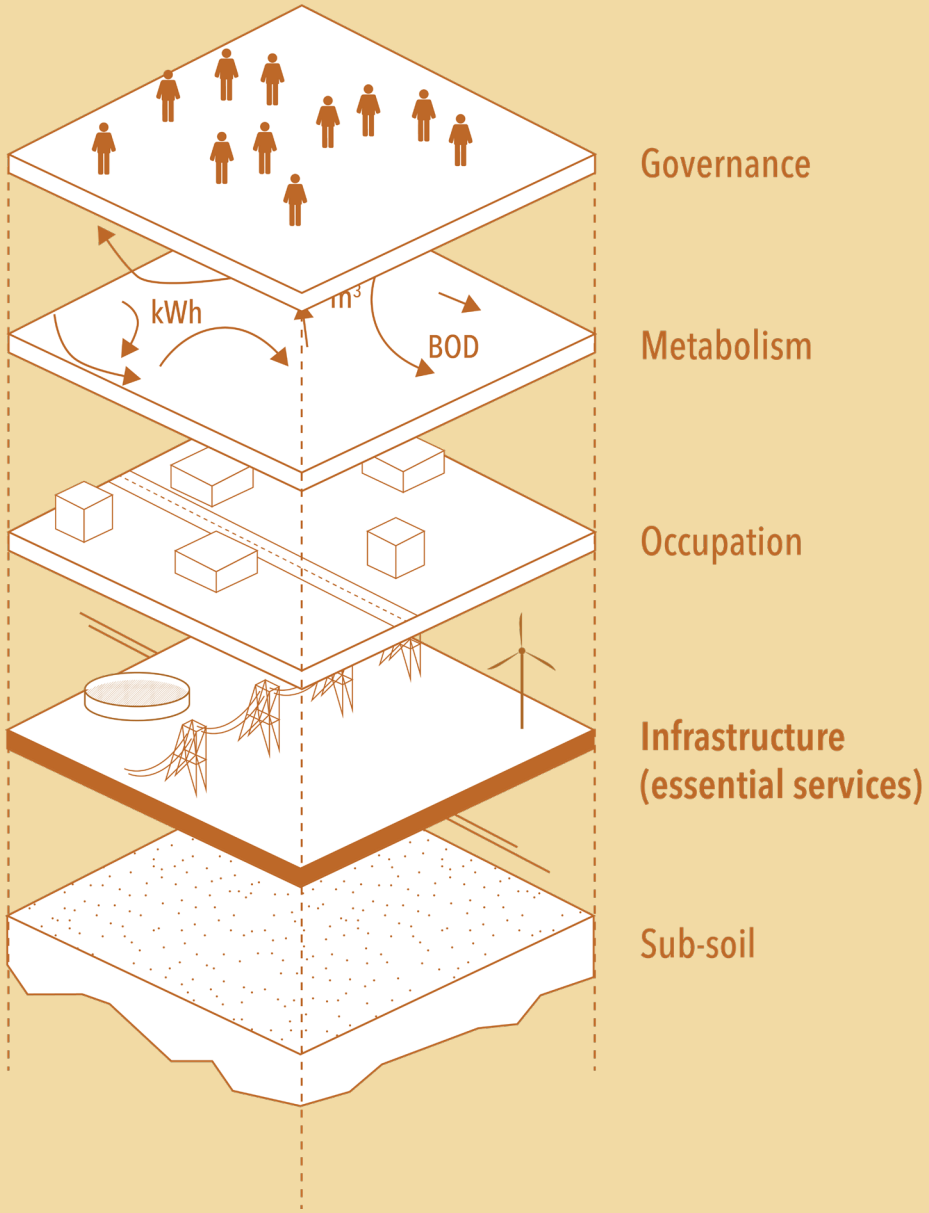
6. Conclusions

7. Recommendations

Essential service provision



Essential services and spatial planning



Traditionally: centralized essential service provision

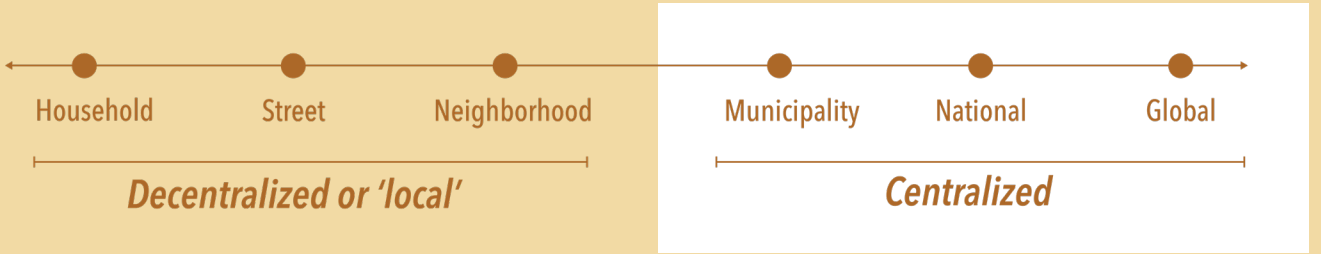
Wastewater treatment

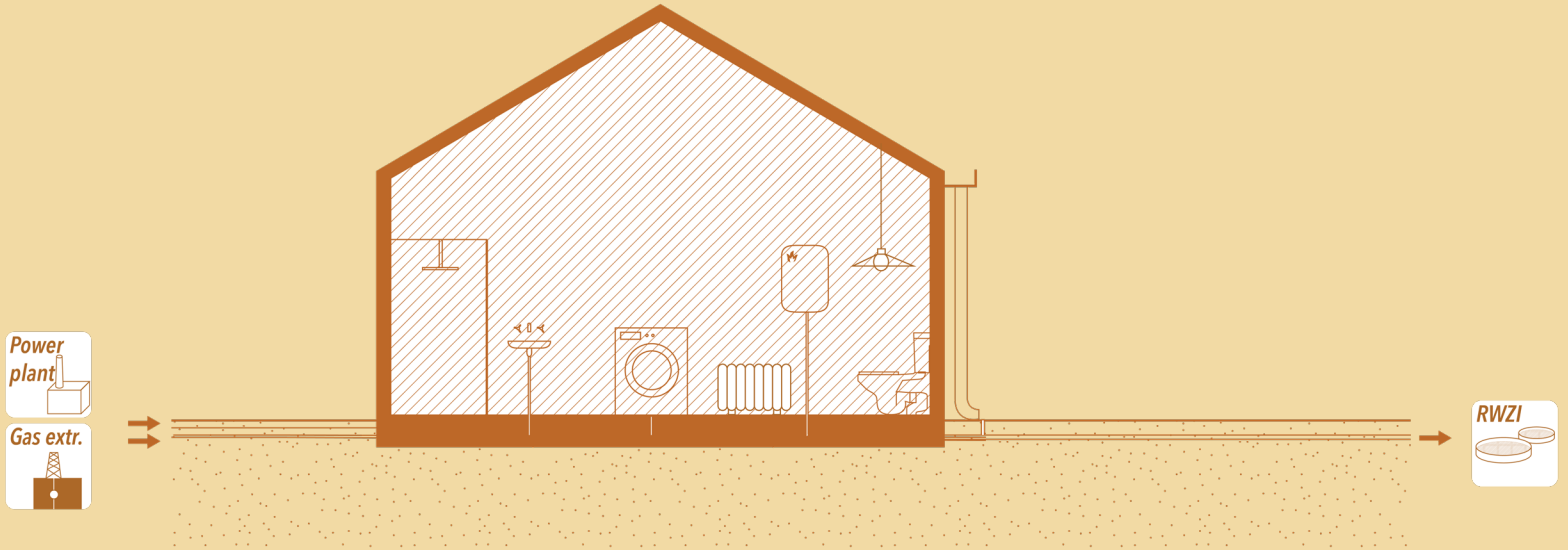
RWZI (source: NRC, 2019)

Energy provision

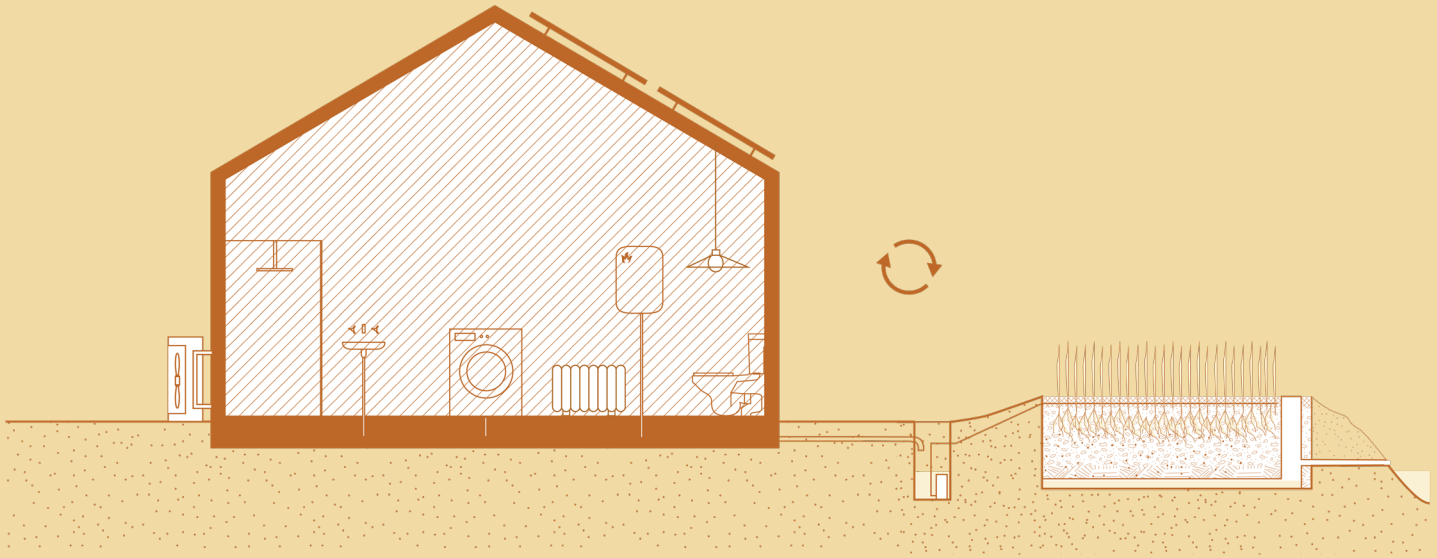
Gas abstraction (source: Trouw, 2018)

Centralized provision





Towards decentralized or 'local' essential service provision



Decentralized provision

Wastewater treatment

at least 150 local wastewater treatment facilities

Energy provision

600.000 households own solar panels

Local essential service provision will play **a pivotal role in the future** provision of essential services.

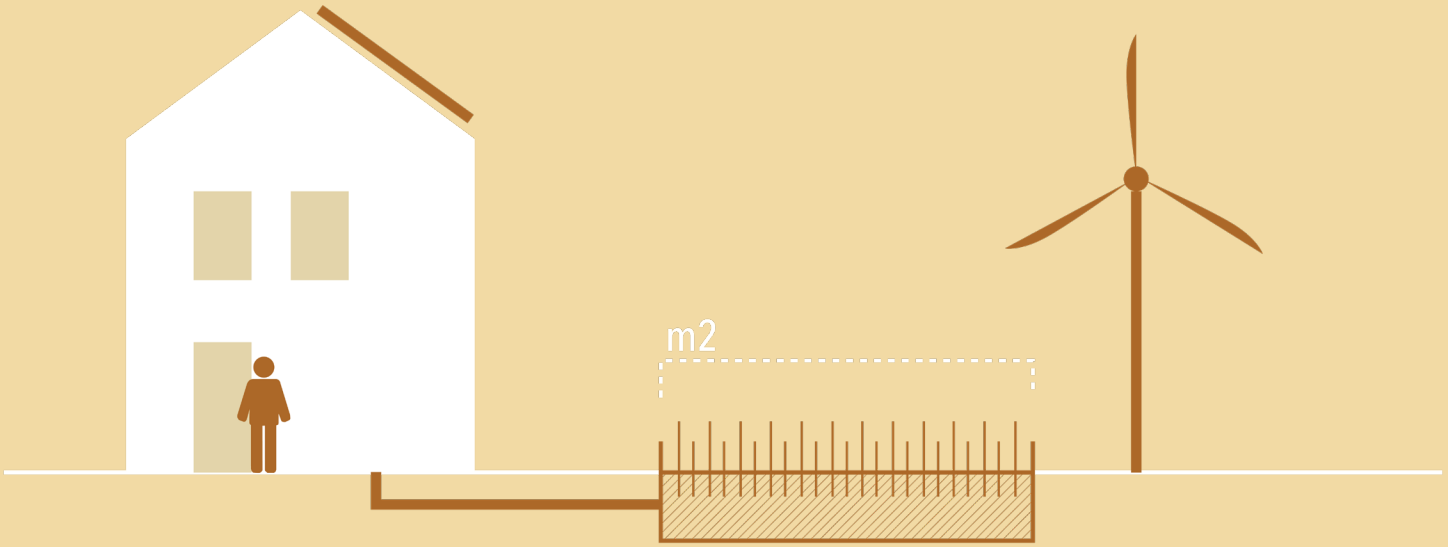
In order to successfully and sustainably implement essential service systems on a local scale it is vital **to understand their impact** on the built environment and **the consequences of different 'levels of autonomy'**.

1. **Land-use**

2. **Environmental impact**

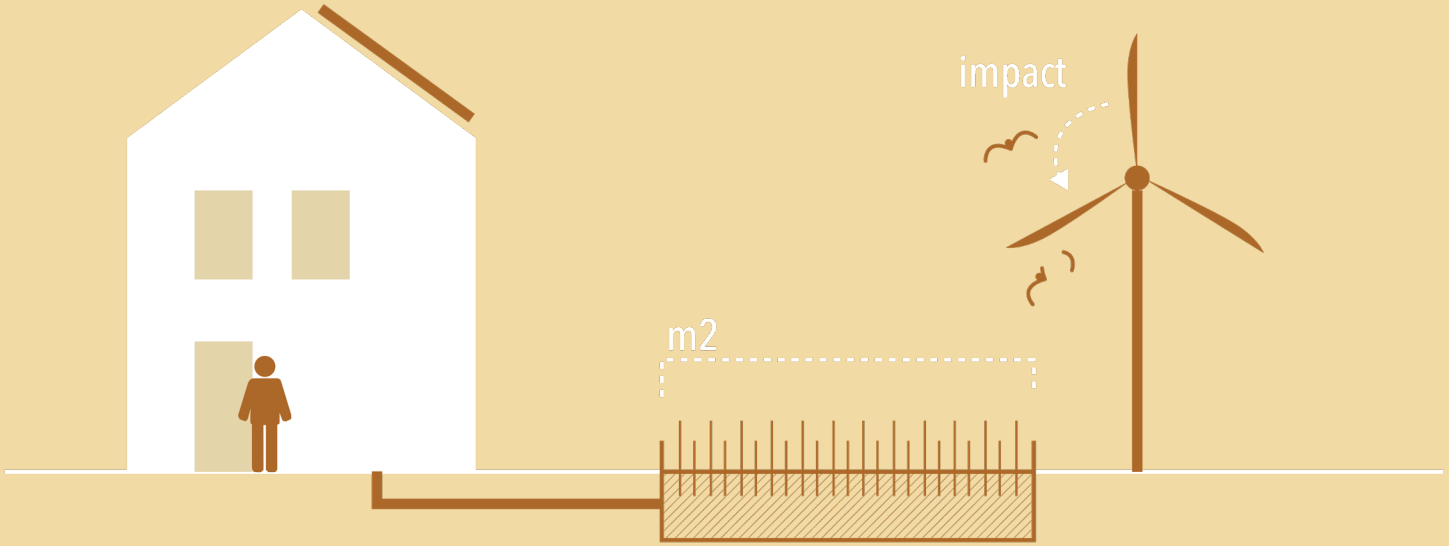
3. **Environmental risk**

1. Land-use



1. Land-use intensity

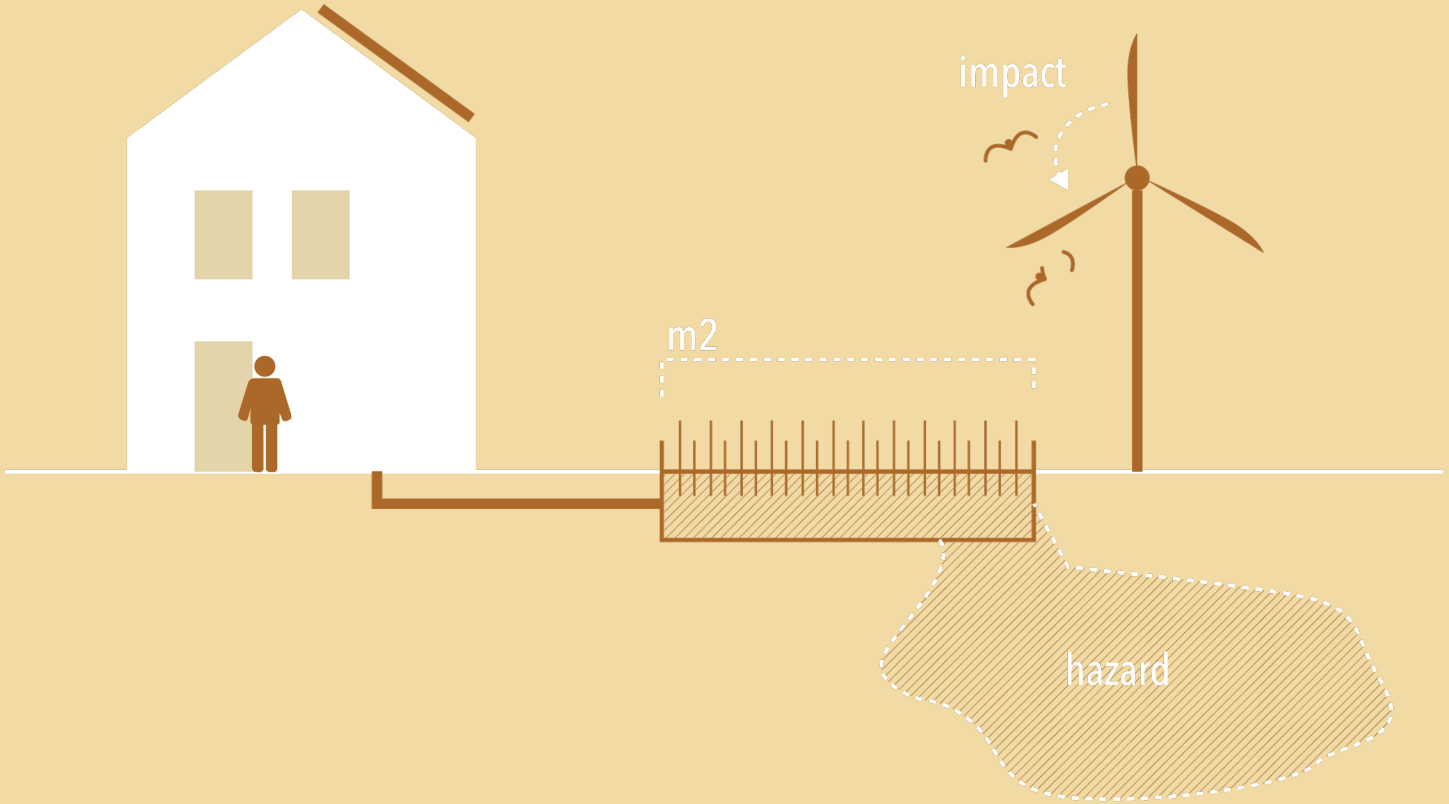
2. Environmental impact



1. Land-use intensity

2. Environmental impact

3. Environmental risk



Main research question:

What are the land-use intensity, environmental impact and environmental risks associated with the provision of local essential services on different levels of autonomy in Oosterwold, and what recommendations follow from these insights for spatial planning?

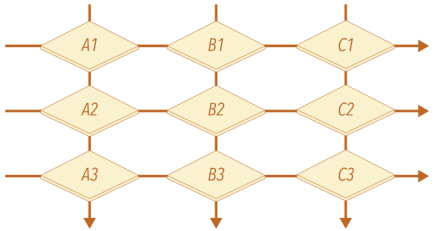
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

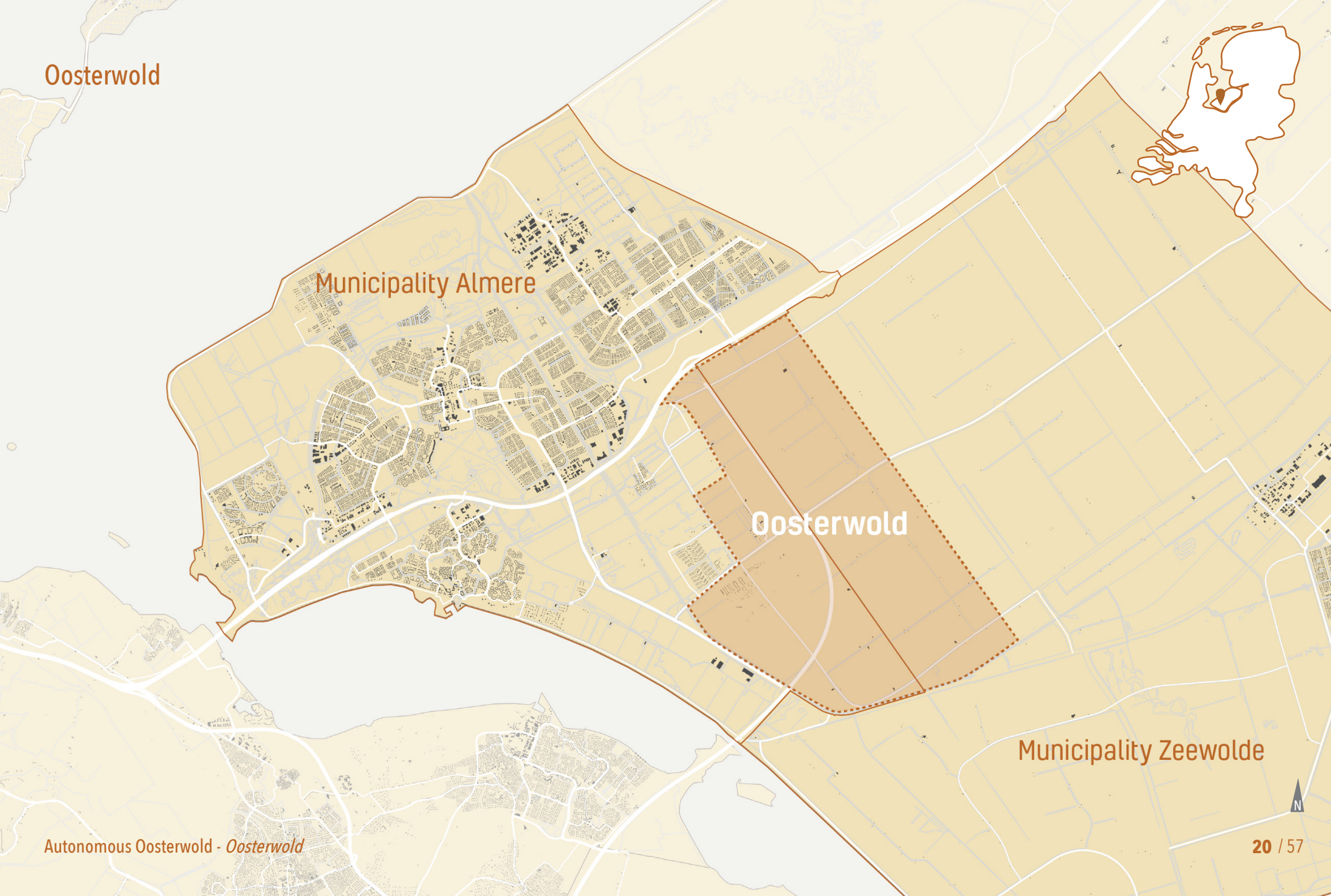
4. Analysis
Wastewater treatment

5. Scenarios



6. Conclusions

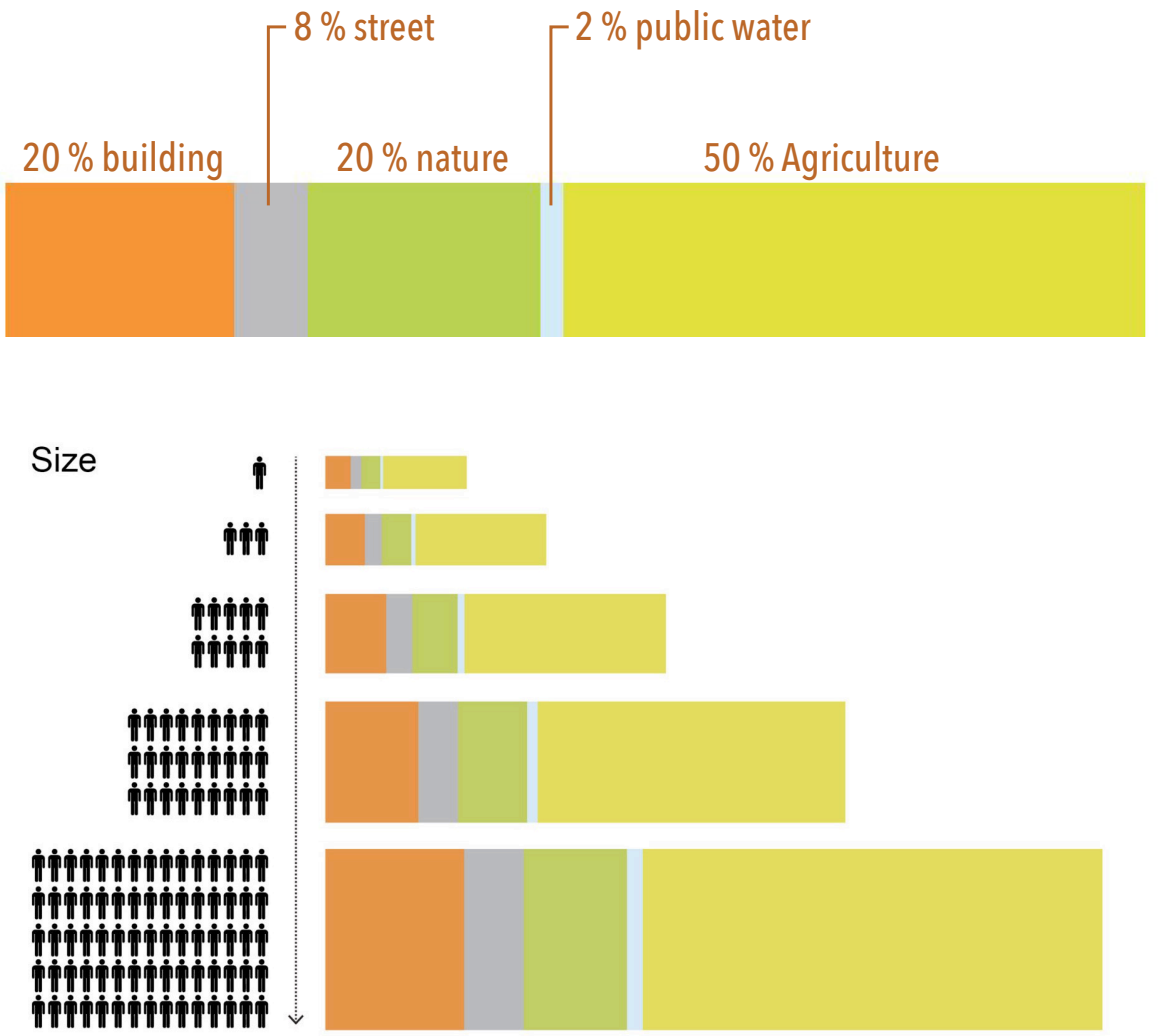
7. Recommendations


Oosterwold
Municipality Almere
Oosterwold
Municipality Zeewolde
N

In Oosterwold inhabitants design their own home, plot and streets

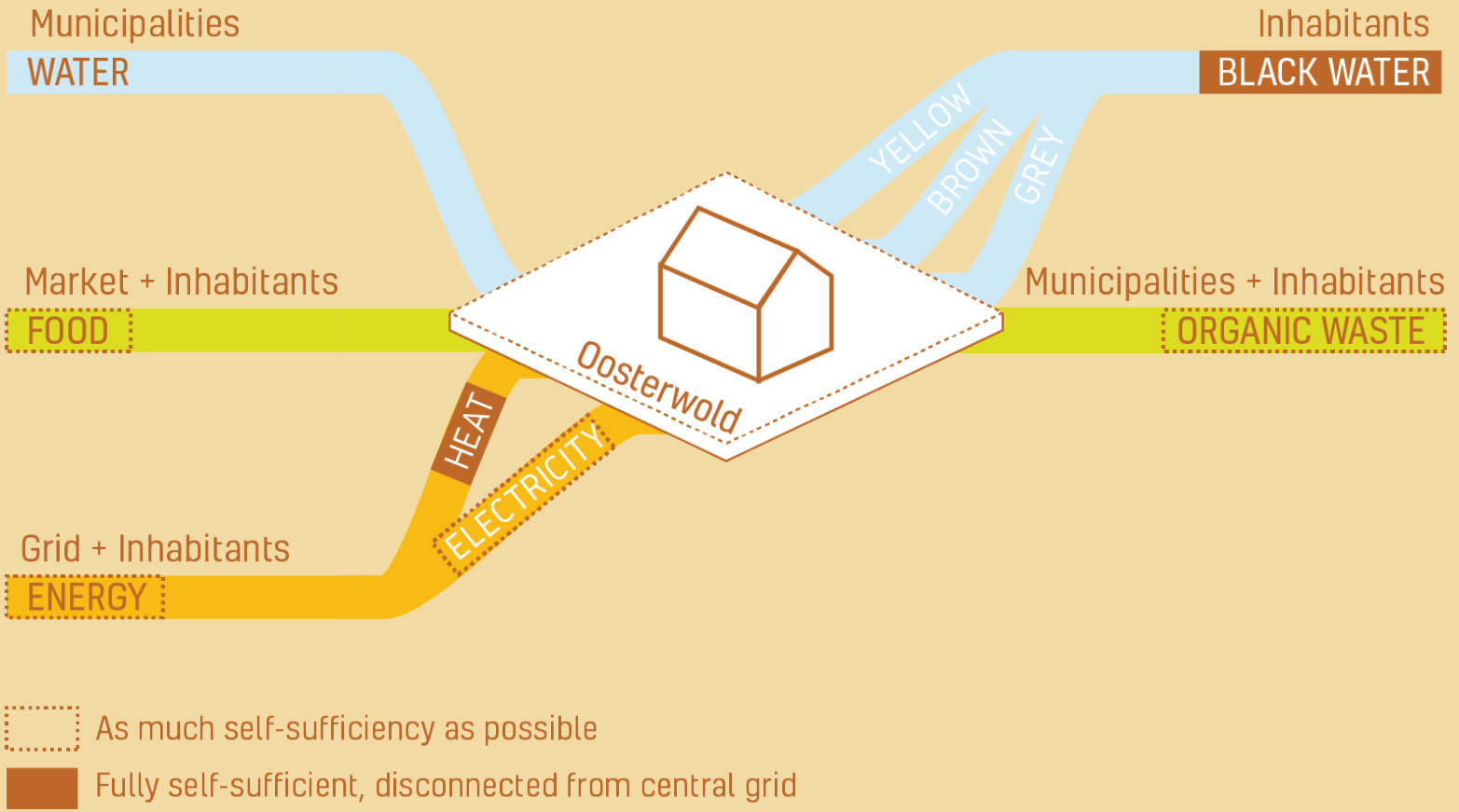
'Organic Urbanism' (source: MVRDV)

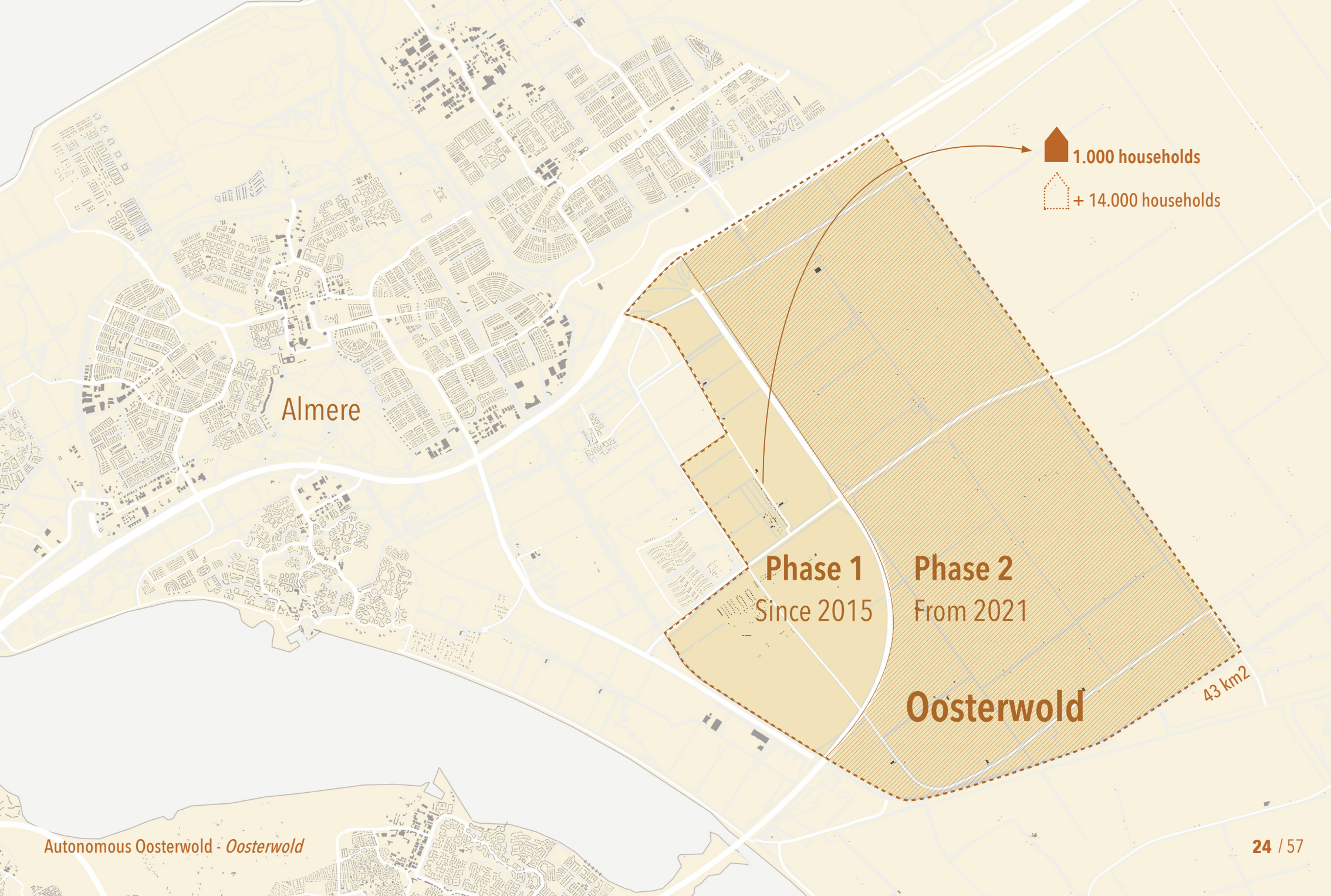
A fixed distribution of land



Land-distribution Oosterwold (source: MVRDV)

Essential service provision in Oosterwold




1.000 households
+ 14.000 households
Almere
Phase 1
Since 2015
Phase 2
From 2021
Oosterwold
43 km2

Oosterwold currently...

(source: Oosterwold uit de lucht)

(source: Oosterwold uit de lucht)


94

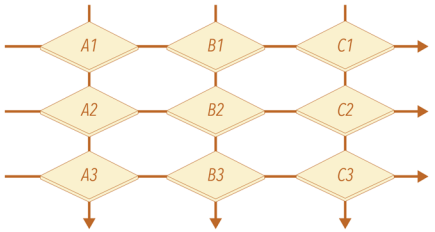
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

4. Analysis
Wastewater treatment

5. Scenarios



6. Conclusions

7. Recommendations

Possible energy provision systems in Oosterwold

Production

- **E1** Photovoltaic panels
- **E2** Thermal solar energy systems
- **E3** Wind turbine
- **E4** Geothermal energy systems
- **E5** Thermal energy from air
- **E6** Energy from biomass (CHP)

Storage

- **E7** Lithium-ion battery
- **E8** Vanadium Redox Flow Battery
- **E9** Mechanical storage
- **E10** Seasonal thermal energy storage

Transport

- **E11** (Smart) Low-voltage electricity grid
- **E12** (Smart) Low temperature heat grid

High-voltage electricity grid

E1 Photovoltaic panels

E2 Thermal solar energy systems

E5 Thermal energy from air

E6 Energy from biomass (CHP)

100 % of energy production is individual

Now
- No storage
- Electricity grid functions as back-up

Challenges
- Covering full demand and creating energy autonomy

Future
- Communal energy storage ?

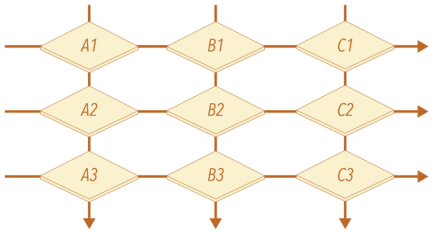
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

4. Analysis
Wastewater treatment

5. Scenarios



6. Conclusions

7. Recommendations

Possible wastewater treatment systems

Treatment

- **W1 Composting chamber**
- **W2 Septic tank**
- **W3 Biogas Reactor / Digester**
- **W4 Wetland**
- **W5 Living machine**
- **W6 Mechanical treatment**

Collection

- **W7 Cistern Flush Toilets**
- **W8 Dry toilet**
- **W9 Vacuum or pressure toilet**

Transport

- **W10 Conventional sewer**
- **W11 Solid-free gravitational sewer**
- **W12 Vacuum sewer**

Wastewater treatment systems in Oosterwold

W2 Septic tank

W4 Wetland

W6 Mechanical treatment

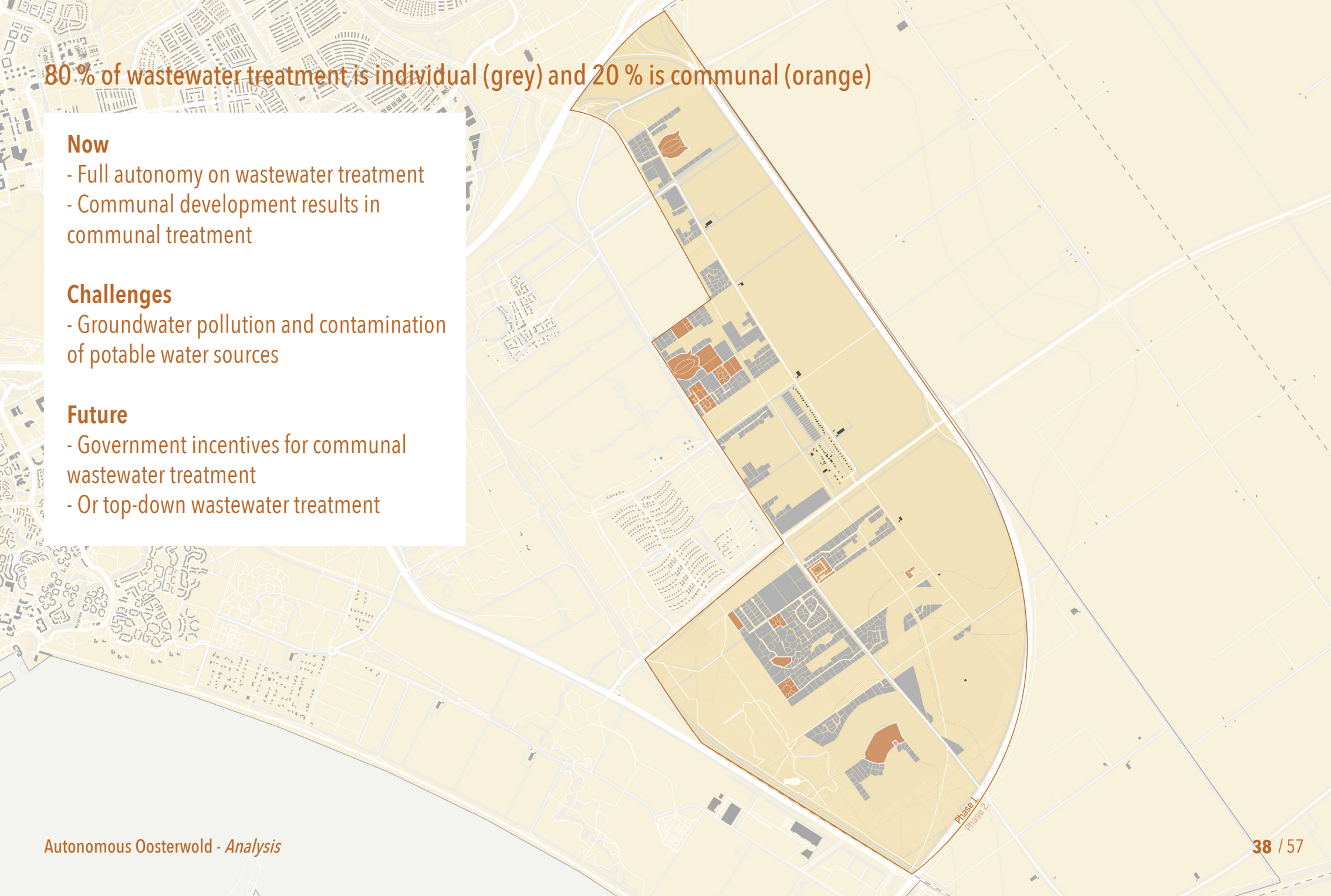
W3 Biogas Reactor

80 % of wastewater treatment is individual (grey) and 20 % is communal (orange)

Now
- Full autonomy on wastewater treatment
- Communal development results in communal treatment

Challenges
- Groundwater pollution and contamination of potable water sources

Future
- Government incentives for communal wastewater treatment
- Or top-down wastewater treatment



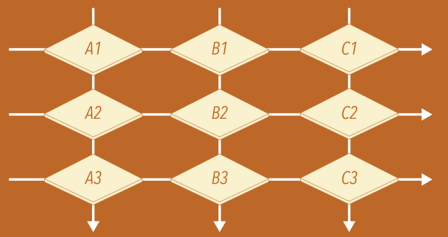
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

4. Analysis
Wastewater treatment

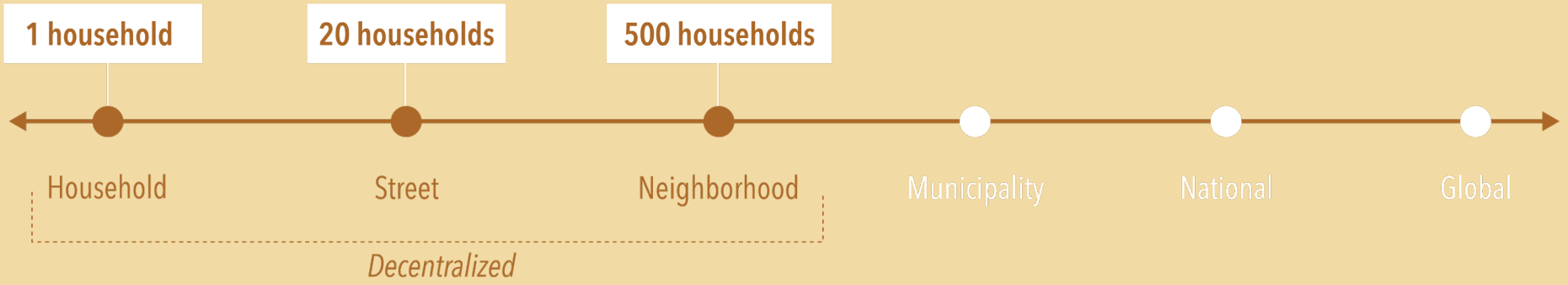
5. Scenarios



6. Conclusions

7. Recommendations

Scenarios: 3 different levels of autonomy



Maximizations: 3 different system iterations

1. Current

Based on the most common essential service systems found in Oosterwold.

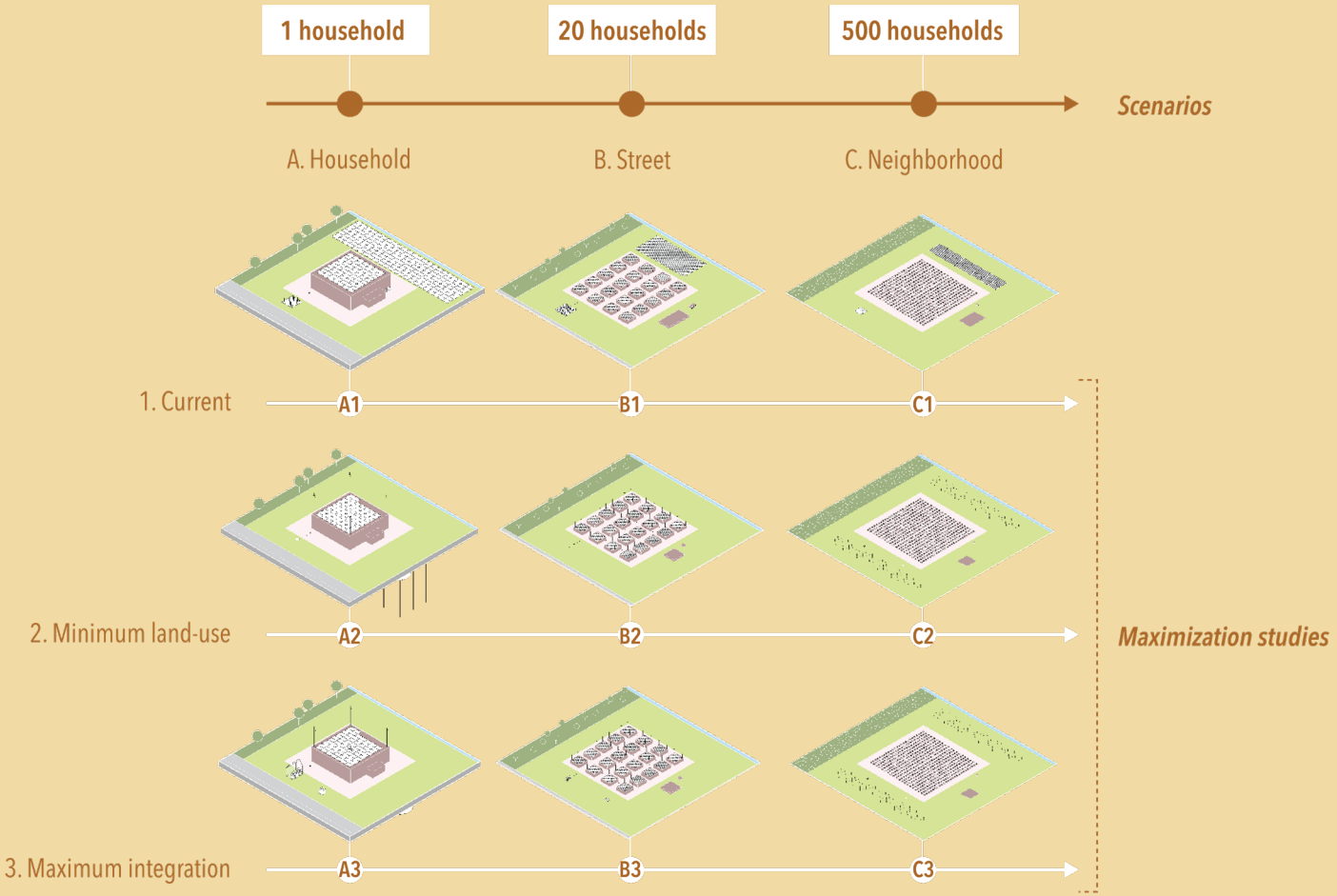
2. Minimal land-use

Based on the techniques with the lowest land-use.

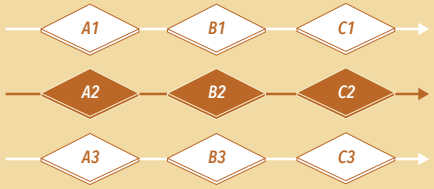
3. Maximum spatial integration

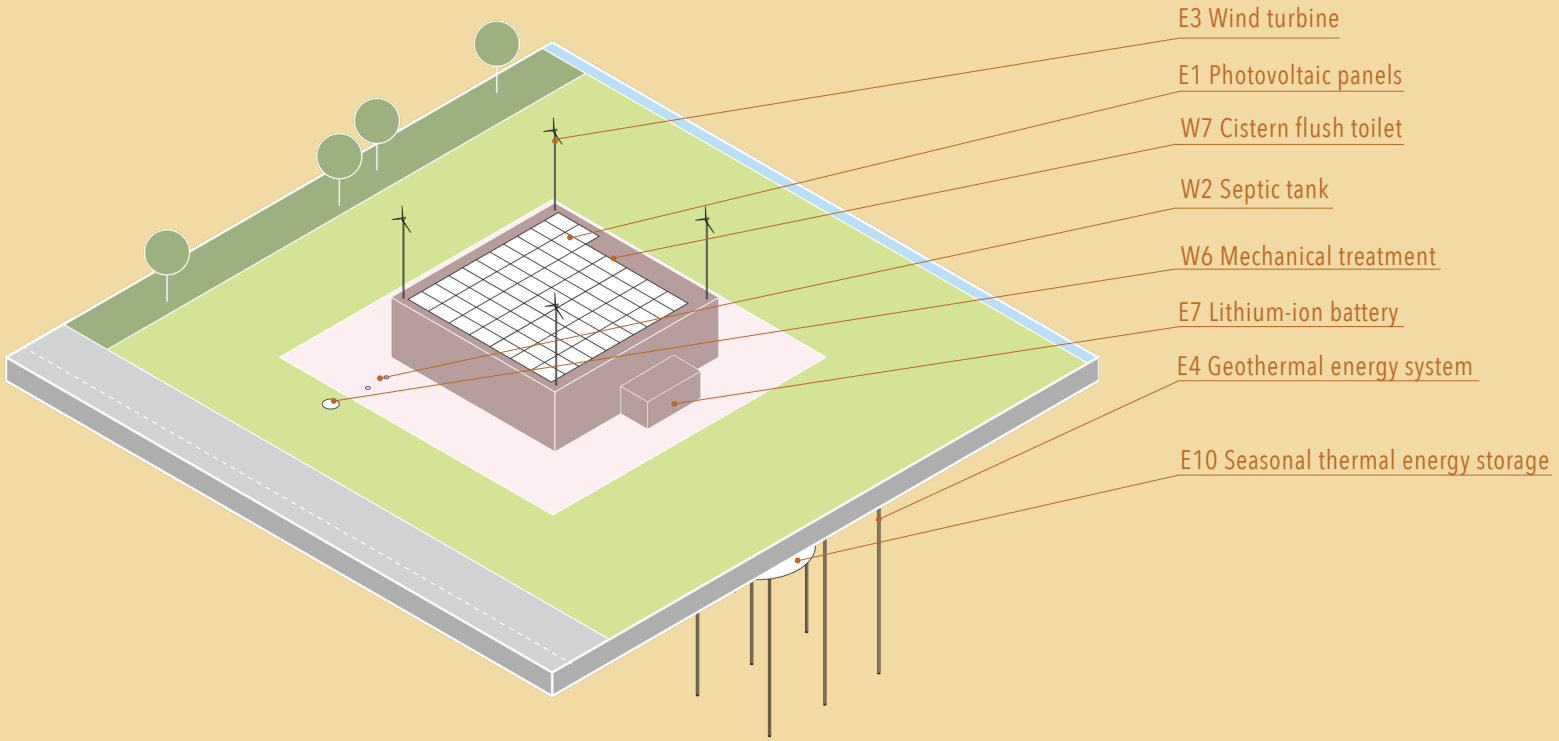
Based on the techniques that are easiest to integrate within Oosterwold.

A total of 9 designs

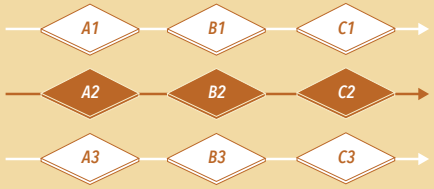


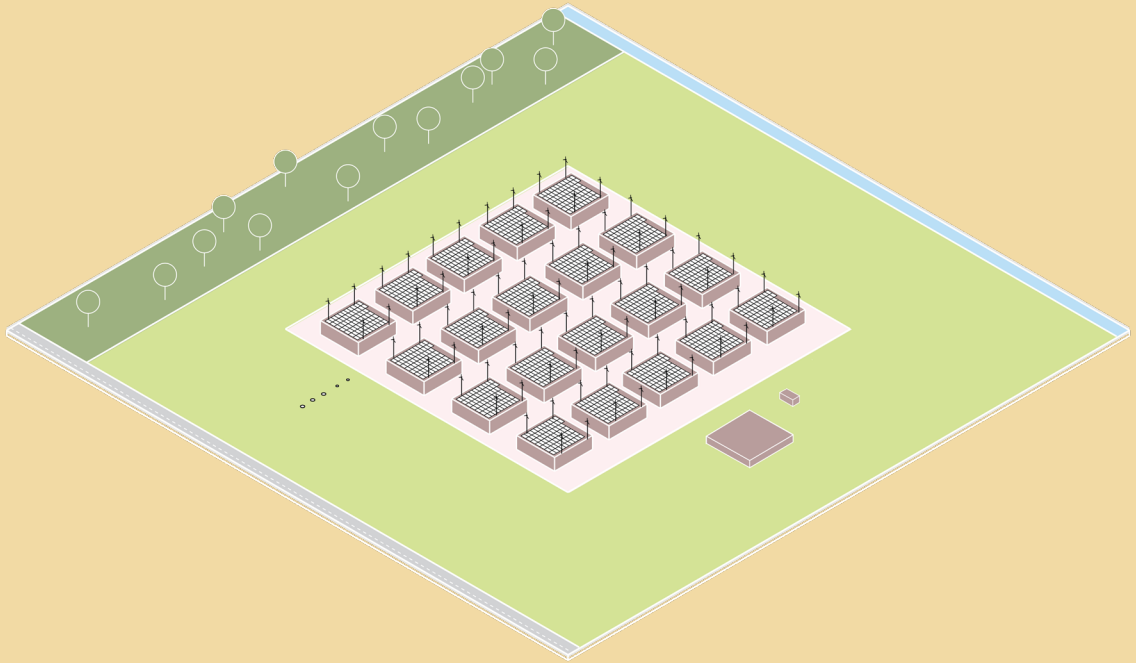
Autonomous Oosterwold



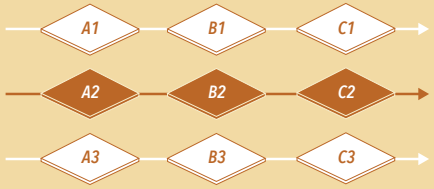


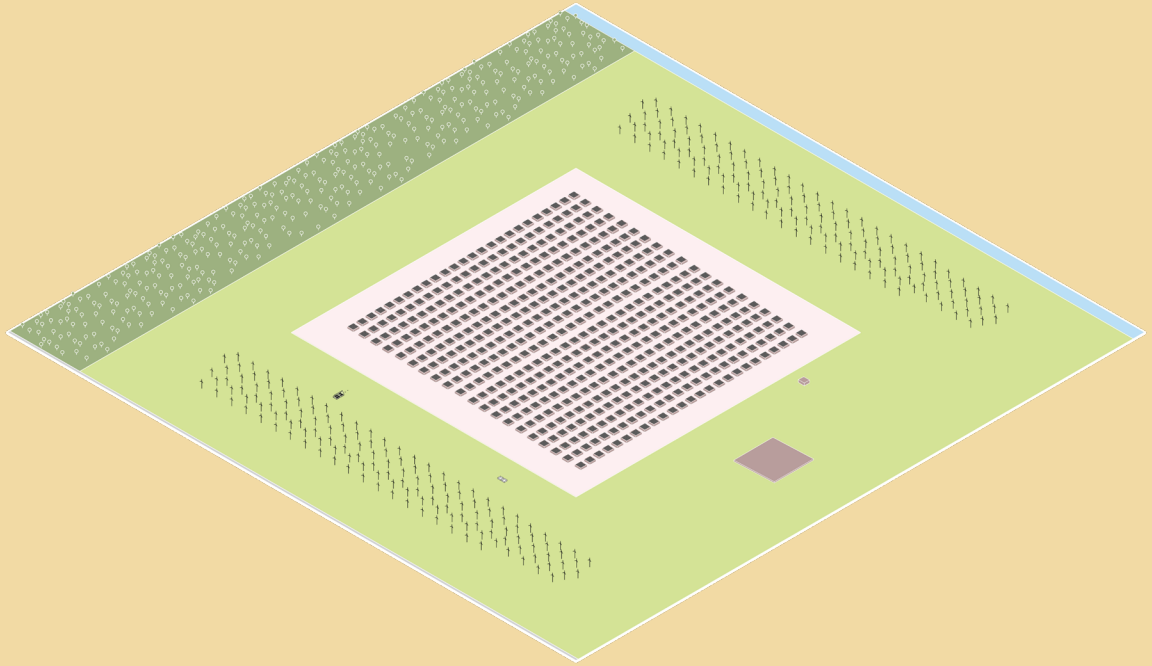
Autonomous Oosterwold





Autonomous Oosterwold





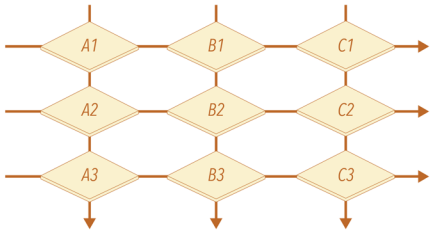
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

4. Analysis
Wastewater treatment

5. Scenarios



6. Conclusions

7. Recommendations

Trends

	Land-use	*Environmental impact*	*Environmental risks*
1. Current	▼ Wastewater treatment *Note: The total land-use is greatly effected by energy fluctuations due to seasonal weather changes*	▲ Noise thermal air heat pumps ▲ Odour septic tanks	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries
2. Minimal land-use	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and mechanical treatment ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines
3. Maximum spatial integrations	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and compost pile ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines ▲ Increased risks of composting

▲ *Increase from household to neighborhood level*

▼ *Decrease from household to neighborhood level*

Trends

	Land-use	Environmental impact	Environmental risks
1. Current	▼ Wastewater treatment *Note: The total land-use is greatly effected by energy fluctuations due to seasonal weather changes*	▲ Noise thermal air heat pumps ▲ Odour septic tanks	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries
2. Minimal land-use	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and mechanical treatment ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines
3. Maximum spatial integrations	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and compost pile ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines ▲ Increased risks of composting

▲ *Increase from household to neighborhood level*

▼ *Decrease from household to neighborhood level*

Trends

	Land-use	Environmental impact	Environmental risks
1. Current	▼ Wastewater treatment *Note: The total land-use is greatly effected by energy fluctuations due to seasonal weather changes*	▲ Noise thermal air heat pumps ▲ Odour septic tanks	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries
2. Minimal land-use	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and mechanical treatment ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines
3. Maximum spatial integrations	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and compost pile ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines ▲ Increased risks of composting

▲ *Increase from household to neighborhood level*

▼ *Decrease from household to neighborhood level*

Trends

	Land-use	*Environmental impact*	***Environmental risks***
1. Current	▼ Wastewater treatment *Note: The total land-use is greatly effected by energy fluctuations due to seasonal weather changes*	▲ Noise thermal air heat pumps ▲ Odour septic tanks	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries
2. Minimal land-use	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and mechanical treatment ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines
3. Maximum spatial integrations	▼ Wastewater treatment ▼ Seasonal thermal heat storage	▲ Odour septic tanks and compost pile ▲ Increased shadow formation of wind turbines	▼ Wastewater treatment ▲ Risk of fire from lithium-ion batteries ▲ Increased risks of wind turbines ▲ Increased risks of composting

▲ *Increase from household to neighborhood level*

▼ *Decrease from household to neighborhood level*

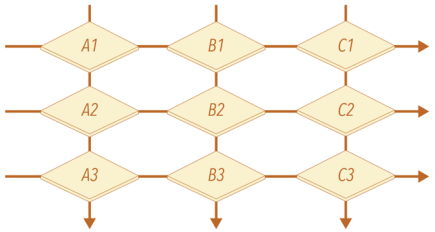
1. Introduction

2. Oosterwold

3. Analysis
Energy provision

4. Analysis
Wastewater treatment

5. Scenarios



6. Conclusions

7. Recommendations

Recommendations for spatial planning

Minimizing land-use:

- Communal wastewater treatment

- Shared heat storage (further research into the averaging effect)

Minimizing environmental impact

- Septic tanks and mechanical treatment should be carefully planned (create spatial policies)

- Air heat pumps (create spatial policies) and wind turbines should be carefully planned

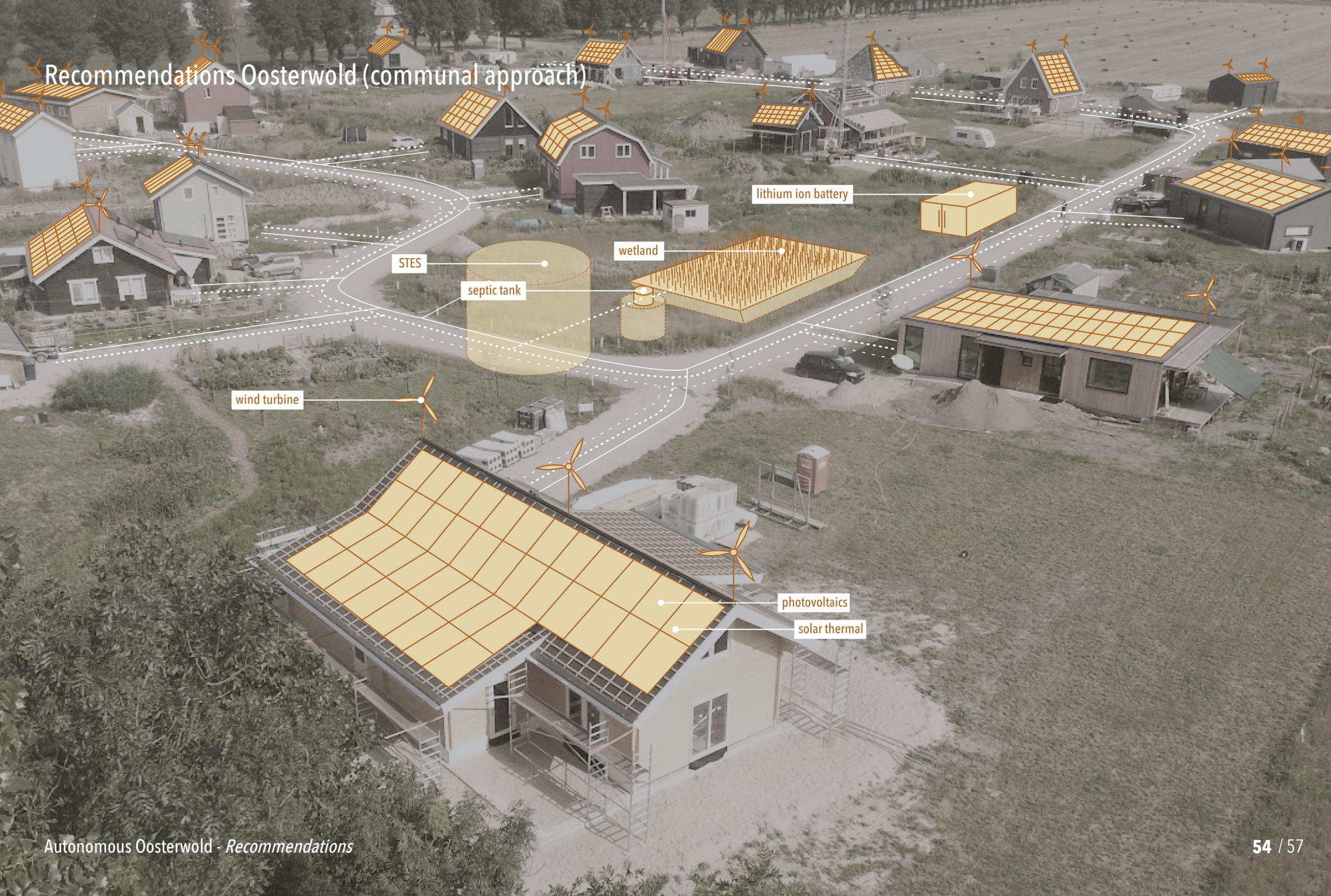
Minimizing environmental risks

- Communal wastewater treatment or composting

- Chemical batteries for electricity storage and wind turbines should be placed accordingly

Recommendations Oosterwold (individual approach)

Recommendations Oosterwold (communal approach)



Recommendations Oosterwold (top-down approach)

(source: Oosterwold uit de lucht)

P5 Presentation, 09.07.20
Charlotte von Meijenfeldt, 4209990
Mentors: Ulf Hackauf & Ellen van Bueren

Autonomous Oosterwold

Exploring the land-use intensity, environmental impact and environmental risks of local essential service provision on different levels of autonomy