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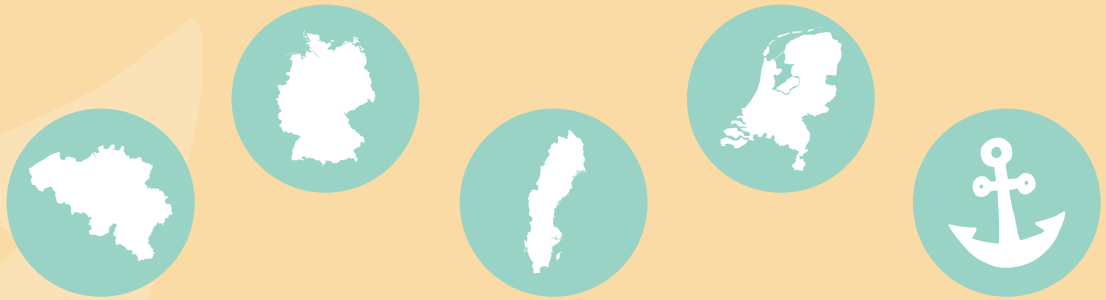

2nd cross-border lunch meeting

April 16th 2024

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HAMBURG WASSER

Bauhaus-Universität Weimar

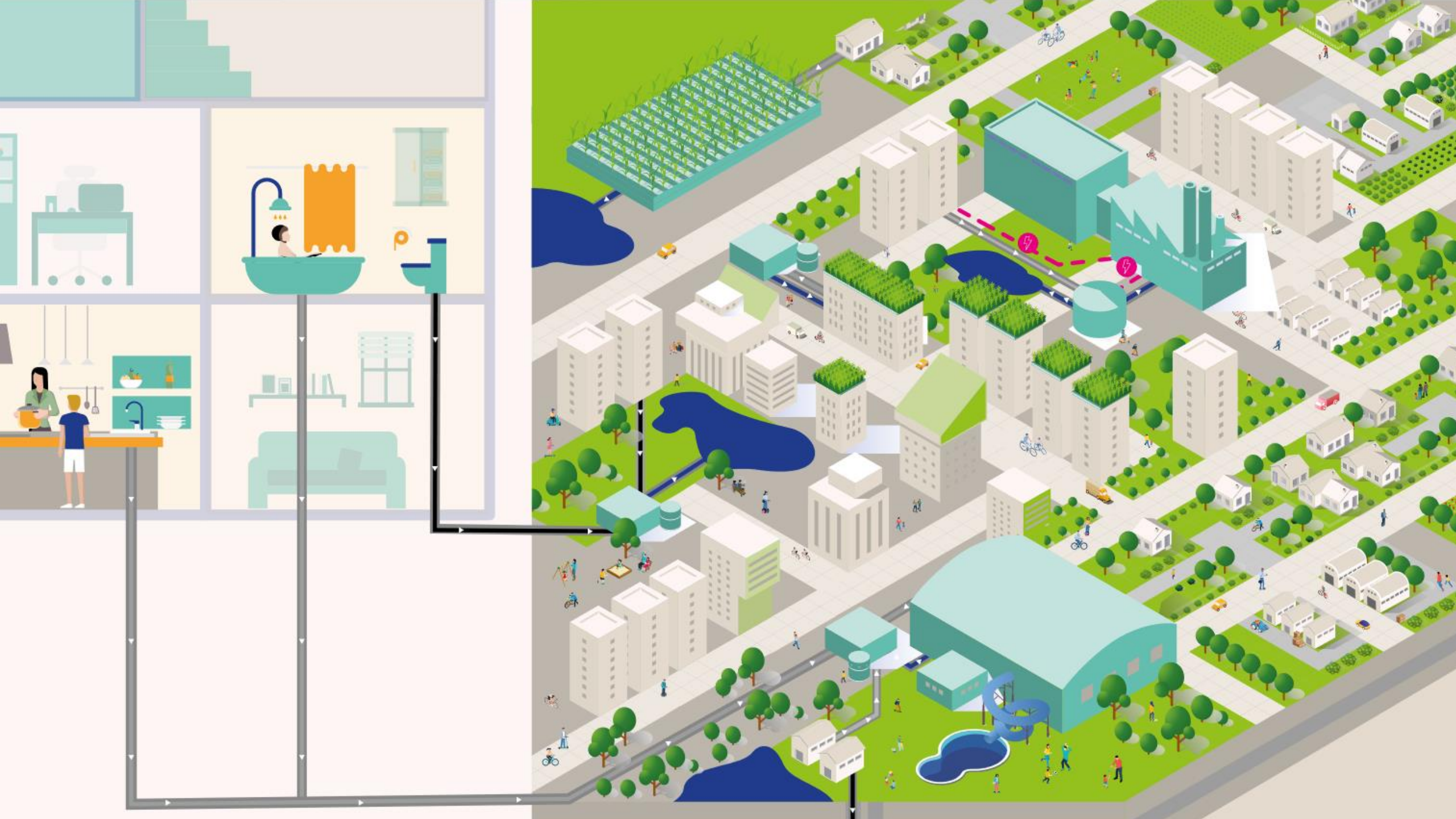
waternet
waterschap amstel gooi en vecht
gemeente amsterdam

KWR

Stockholms stad

NSVA
NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP

Let’s fuel ”
the transition towards
water wise
neighbourhoods



HOW?

- By gathering experiences from a **unique EU demo network** in Belgium, the Netherlands, Germany and Sweden with **source separation technology**, and expanding it with **new pilots**
- By mapping the impacts of **decentralized water systems** in urban areas
- By closely **engaging with stakeholders**
- By delivering **practical tools and transition knowledge**

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WHO?

vito

DuCoop

HAMBURG WASSER

Bauhaus-Universität Weimar

waternet
waterschap amstel gooi en vecht
gemeente amsterdam

KWR

Stockholms stad

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Anchor Lunch Meeting

AGENDA

- Different ways to value wastewater resources and services
- A city's ambitions for higher levels of sustainability in city development
- A cost-benefit analysis for a new, urban area in Stockholm
- Questions from the audience

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16-04-2024

ANCHOR Digital lunch meeting

Novel value perspectives on evaluating Urban Waste Water Systems

KWR

Bridging Science to Practice

Changing perspectives on Urban Water Systems

Novel perspective on multiple value creation in cooperative societal networks

Value Creation from a **single business perspective**
Concept that is generally is focused on developing 'value' for one business.

Characteristics

- Objectives from a single business or stakeholder
- Focused on 'financial benefits'

Multiple Value Creation from a **cooperative societal network ('cluster') perspective**
Developing 'societal value', which can be 'measured' or 'captured' in various ways.

Characteristics

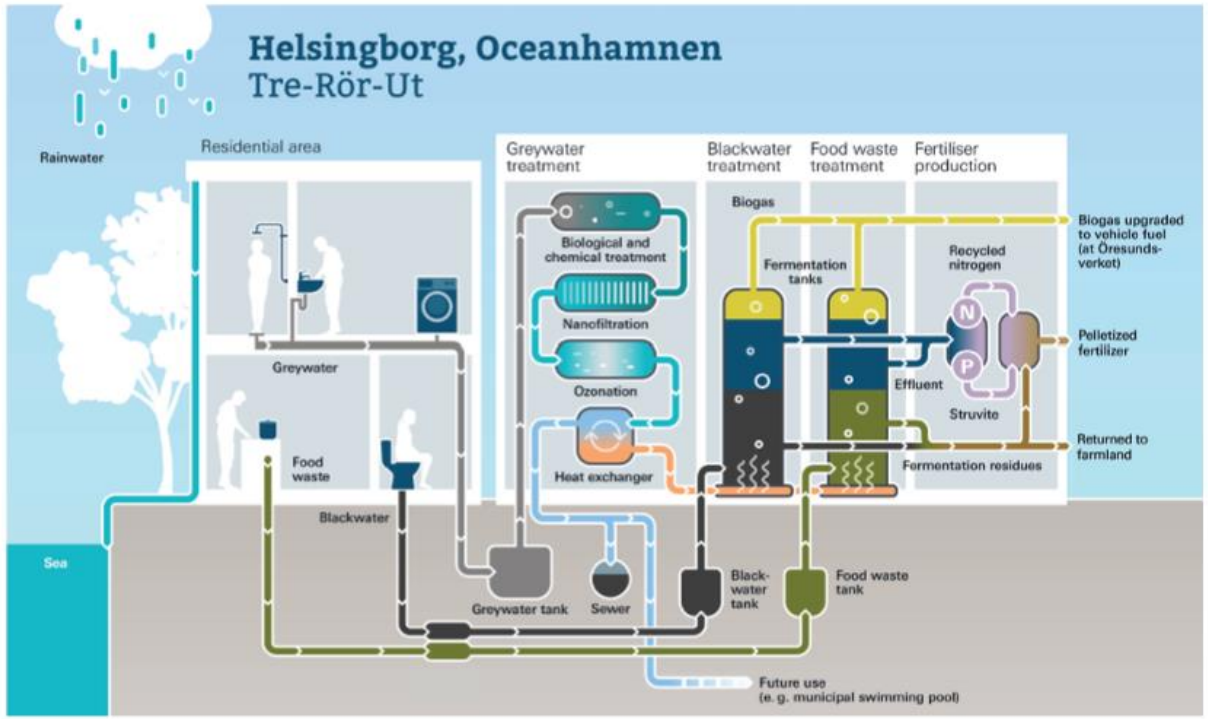
- Integration of multiple and societal objectives
- Focused on 'Societal benefits'; social, economic and ecological/environmental impact

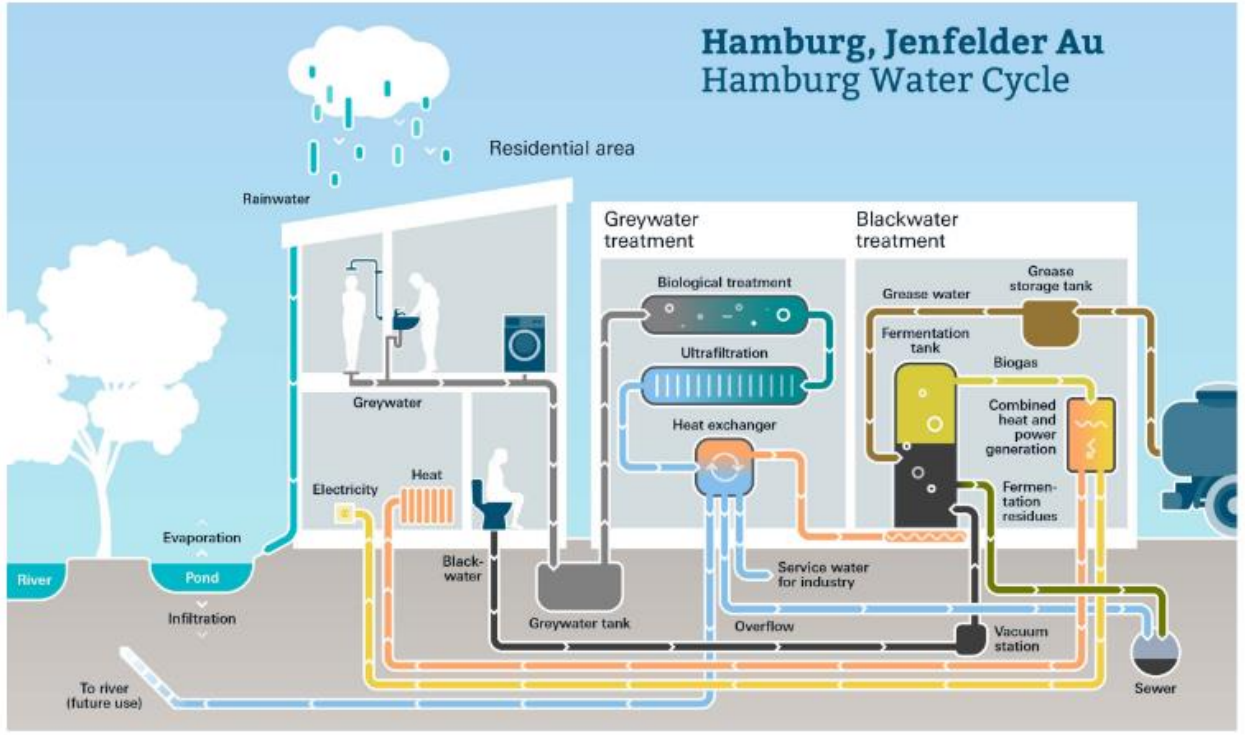
Core question: *In what way does a UWS-project contribute to multiple societal objectives in the long term?*

Urban Water Systems

Similar, but different integrated designs

Under which conditions do these different systems deliver value?

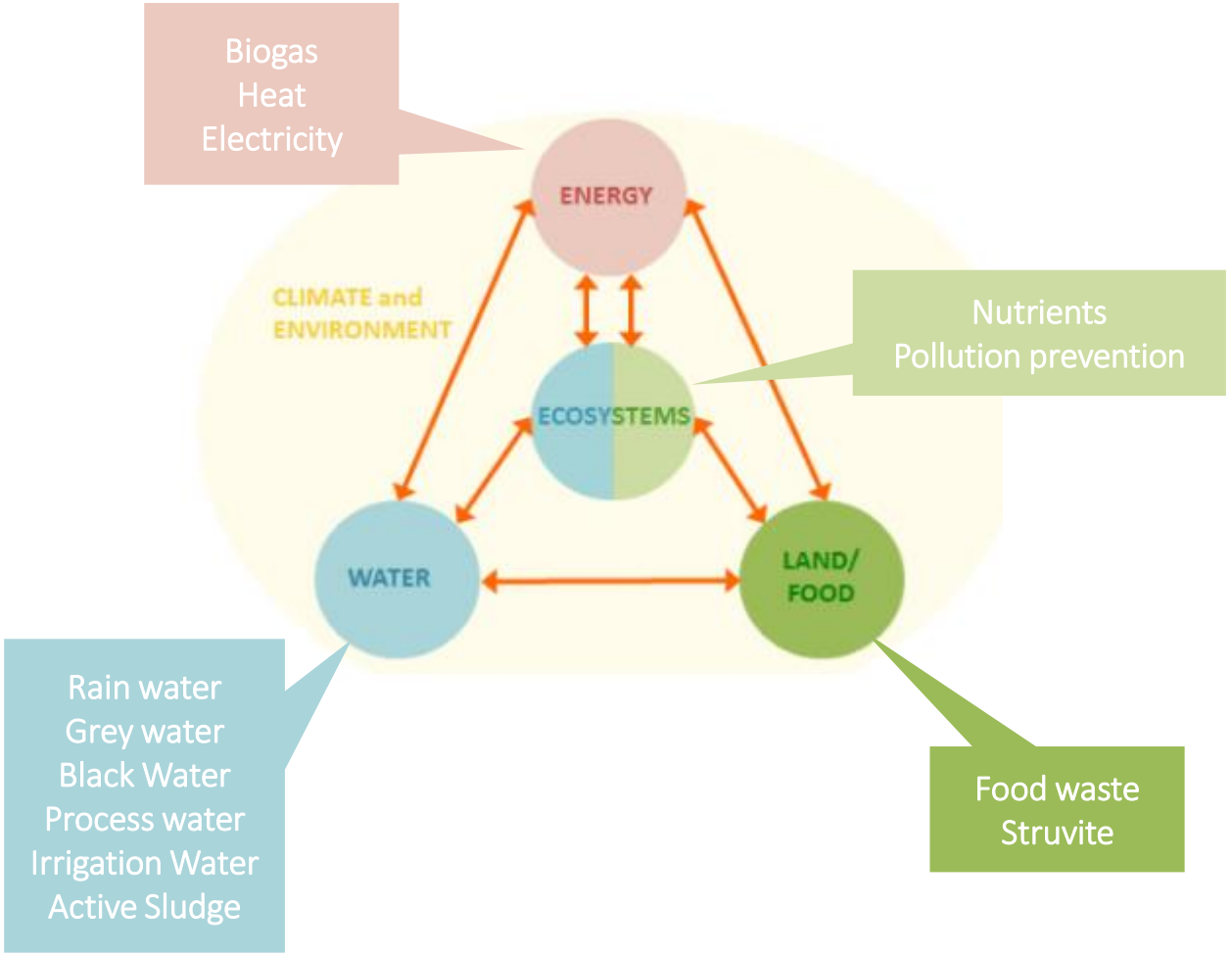




Source Image: Lighthouse Project

Contextualising UWS

Value Mapping of NEXUS solutions in the local environment



Source Image: Municipality of Amsterdam

Source Image: de Strasser, L., Lipponen, A., Howells, M., Stec, S., & Bréthaut, C. (2016). A methodology to assess thewater energy food ecosystems nexus in transboundary river basins. *Water (Switzerland)*, *8*(2).

Integrating Industrial Ecology and Circular Economy

Industrial Symbiosis for a more holistic perspective on multiple value creation

Industrial Symbiosis

Industrial Ecology

…*socio-technical process* based on the coöperative interaction of separate business entities exchanging materials, energy, water, by-products, services and infrastructures to achieve competitive advantage

(Boons et al., 2014, 2011; Chertow, 2007; Massard et al., 2014.)

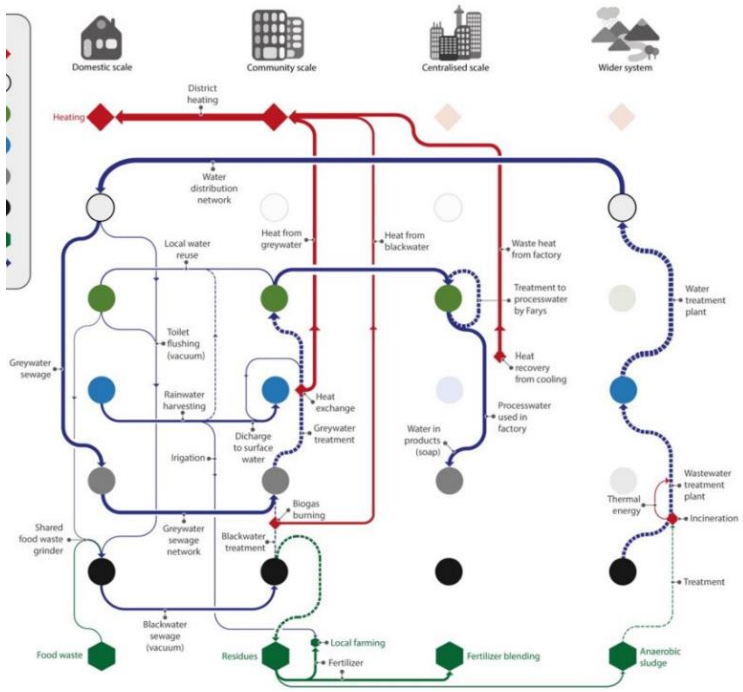
Circular Economy

… a *business model archetype* based on sharing infrastructures and by-products to improve resource efficiency and to create value from waste

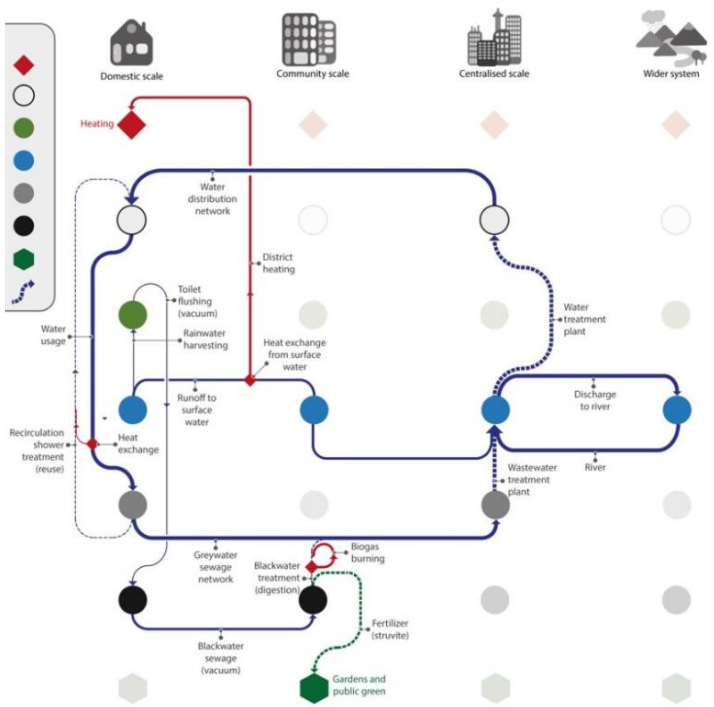
(Bocken et al., 2014; Forum for the Future, 2016; Kraaijenhagen et al., 2016; Lombardi and Laybourn, 2012; Short et al., 2014).

Evaluating of the UWS as Integrated Designs

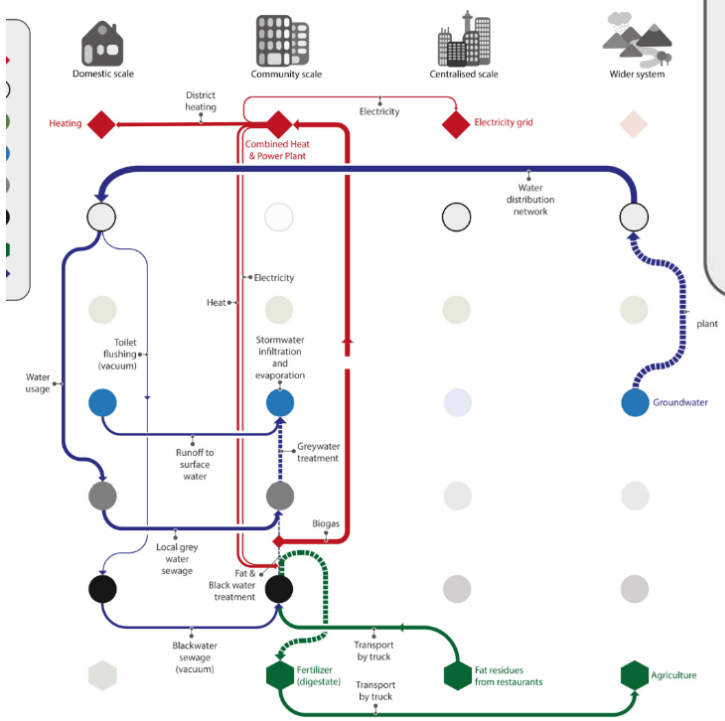
Nieuwe Dokken

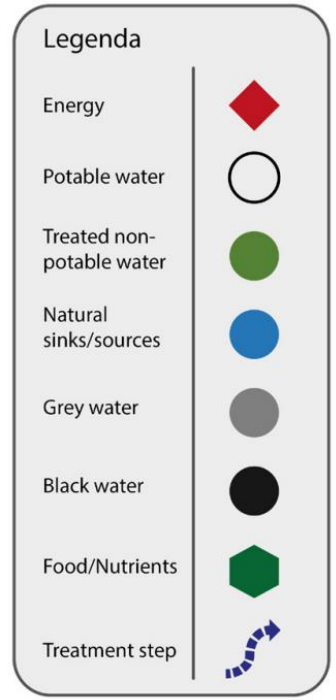


Schoon Schip



Jenfelder Au





Source: *Van Duuren (2020) Sense project*

Evaluating of the UWS as Integrated Designs

Helsingborg

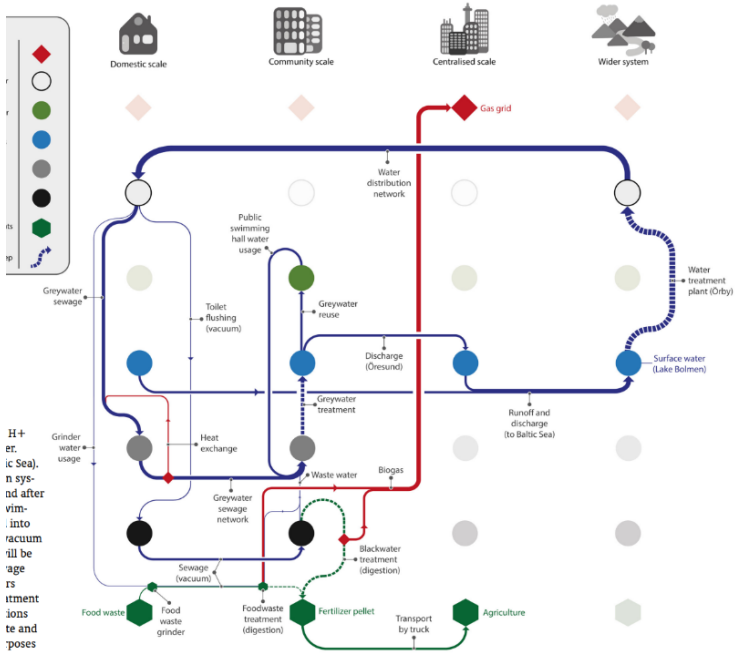


Figure 5: H+ urban water system

Superlocal

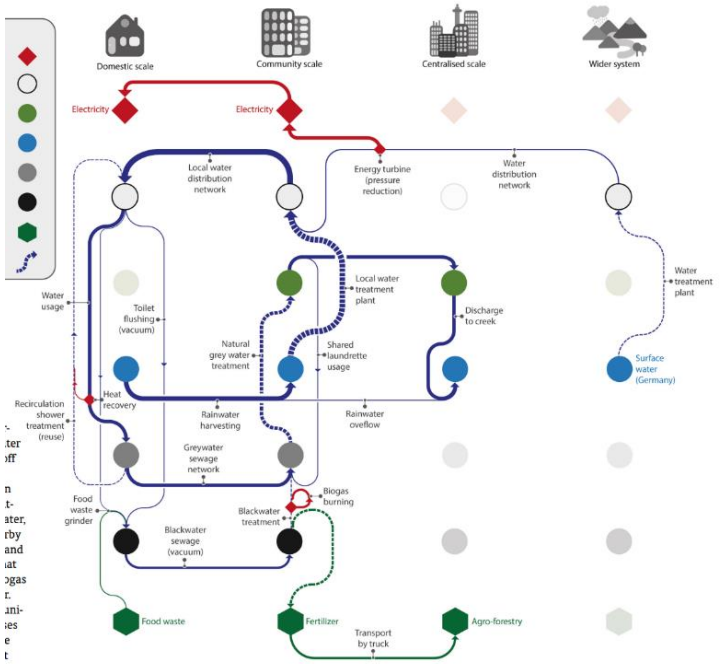
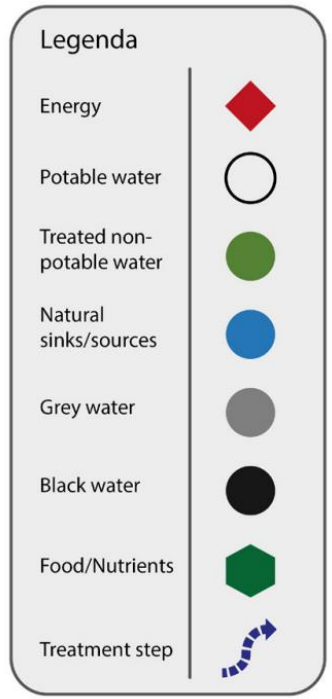


Figure 6: SUPERLOCAL urban water system



Source: *Van Duuren (2020) Sense project*

Research: Mapping Multiple Value Dynamics

Evaluating UWS in their national and local context

What are the motivations of the integrated designs in the local context?

1. Mapping the development trajectory

STARTING CONDITIONS	EVENTS	OUTCOMES
Antecedents leading to the establishment of an IS cluster.	Chain of technical, social and policy actions that are performed to implement the IS cluster.	Economic, environmental and social impacts of the IS cluster.

2. Mapping the multiple value dynamics

TECHNICAL INNOVATION	COLLABORATION	SUSTAINABLE BUSINESS MODEL INNOVATION
Exchange of waste / energy / resources across industrial processes.	List of stakeholders involved in the development / operations of the IS cluster.	Value proposition + value creation / delivery + value capture: elimination of the concept of waste to reduce economic and environmental costs.

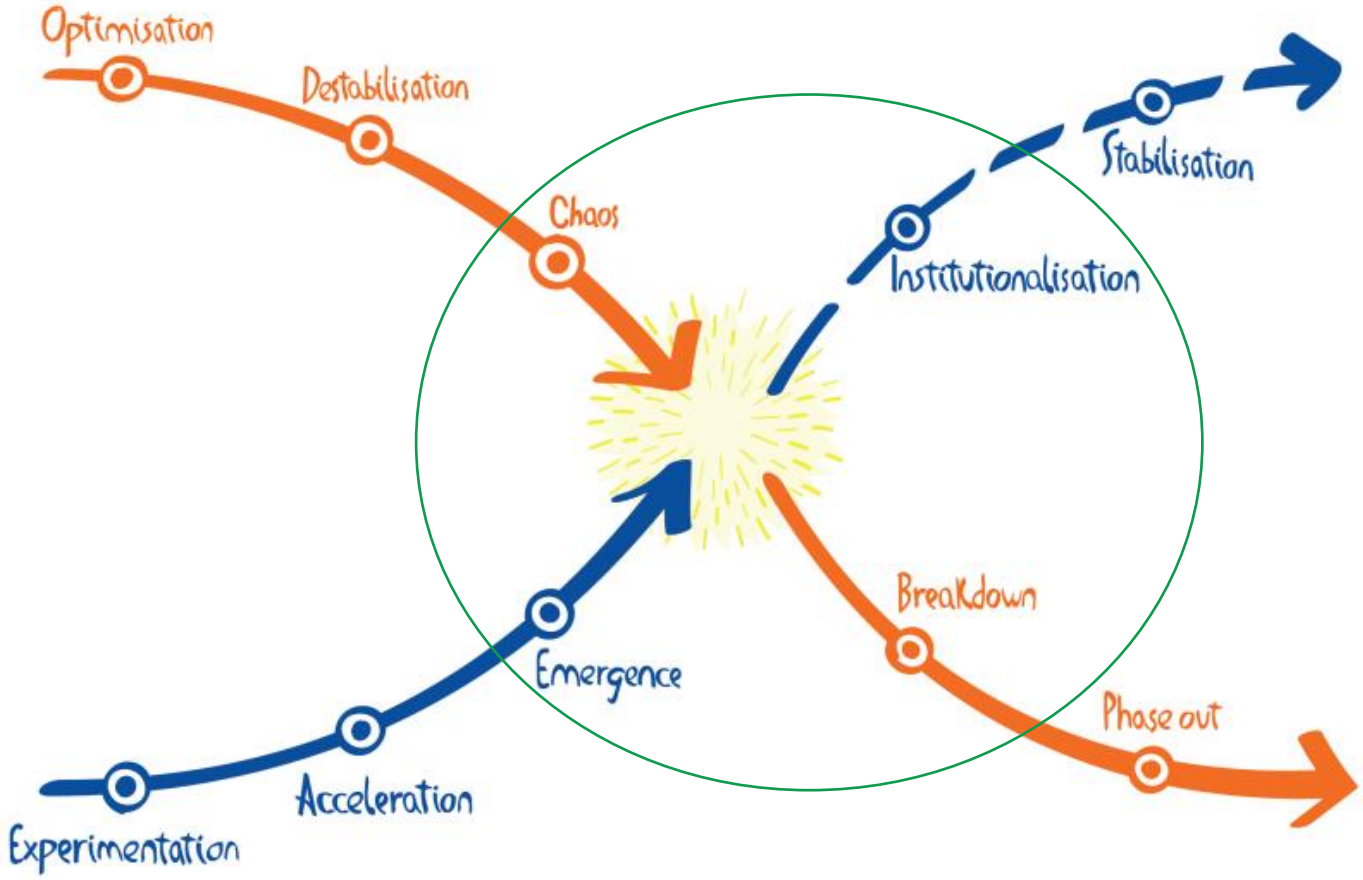
Source: Baldassarre, B., Schepers, M., Bocken, N., Cuppen, E., Korevaar, G., & Calabretta, G. (2019). Industrial Symbiosis: towards a design process for eco-industrial clusters by integrating Circular Economy and Industrial Ecology perspectives. *Journal of Cleaner Production*, *216*, 446–460.

What can we learn from this?

- Motivations (drivers and values) of stakeholders to engage in UWS?
- Reflect on motivations for decision-making on implementing (technical) innovations in the integrated designs?
  - Why is a specific technological system a logical (technical) solution in a specific context?
  - Is it logical from an ‘cluster’ perspective (NEXUS) or the ‘local urban environment’?
- Reflect on which values are created and gained by means of UWS implementation in a specific context, but also which are lost or missed?
- Reflect on the contexts (5 cases) in which implementation of an Urban Water Systems ‘valuable’ or ‘logical’?

Core question: *In what way does a project contribute to multiple societal objectives in the long term?*

Under what conditions can UWS be scaled up?



Source: *Drift (2022)*

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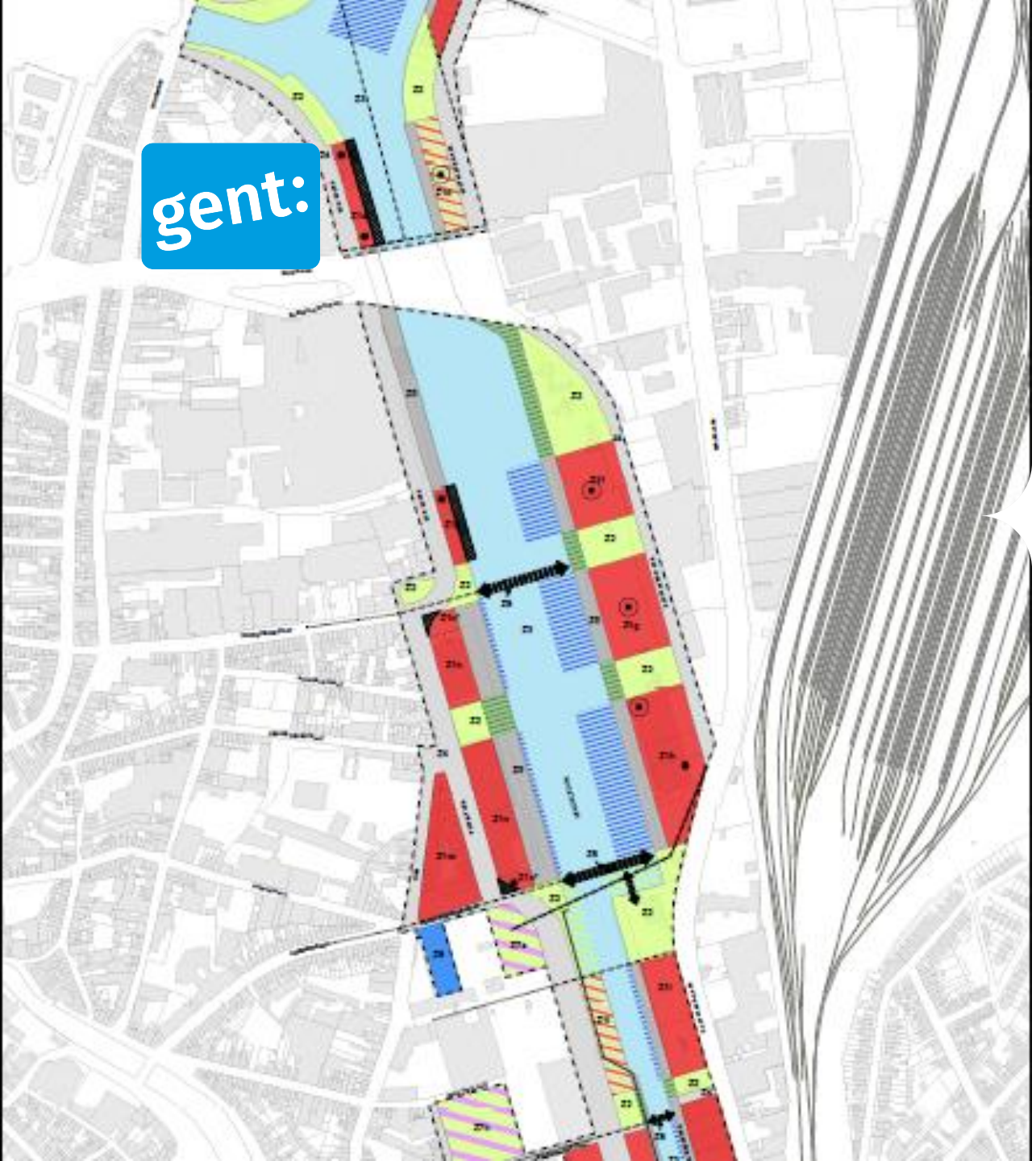


Sustainability in city development

City of Ghent (Belgium)

Preparation for a sustainable city development project

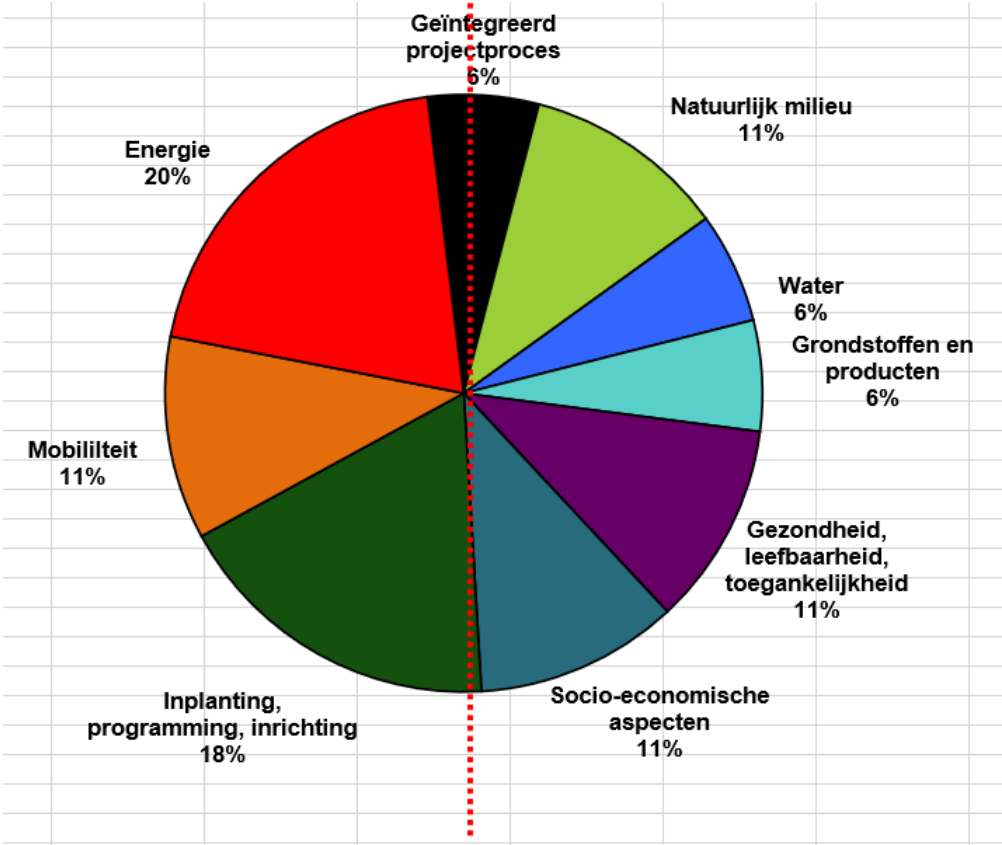
- Spatial development plan 2011: conversion of an old harbour area to a residential neighbourhood with public green spaces
- Brownfield agreement as a framework for cooperation between public stakeholders
- Need for soil remediation
- Public ownership of terrain
- Temporary use for local initiatives

Finding a private partner for development

- Two-step procedure by the City development company sogent, 2011-2014
- Tender with financial criterion + quality criteria:
  - Urbanism and architecture
  - Sustainability (20%)
  - Soil remediation
  - Process
- Public-private partnership agreement 2014
- De Nieuwe Dokken is now partly in use, partly still being built

Sustainability meter

- Instrument developed by the City of Ghent
- Inspired by BREEAM and LEED
- Criteria on different aspects of sustainability at site level
- Objective and integrated approach
- A step further than regulations
- Focus on results, not on specific solutions
- Overall score but no certificate
- Follow-up throughout the entire process



Sustainability (meter) in De Nieuwe Dokken

- Analysis of sustainability meter by the City of Ghent based on site qualities and previous decisions
  - Some criteria are already fulfilled, some cannot be fulfilled or are not applicable
- Overall score must be >= 70%, preferably >= 80%
- Extra requirements on energy performance; no extra requirements on wastewater treatment
- Quickscan analyses on heat pumps and energy from wastewater provided by the City of Ghent
- 3 ambitious candidates
- Preferred candidate: highest score for sustainability, energy from wastewater (ZAWENT)
- Proposed overall score 93,9% + ZAWENT concept fixed in public-private partnership agreement
- Efforts to fit ZAWENT into regulations and permits
- Yearly follow-up meeting on sustainability meter

Lessons learned

- Public ownership of terrain is an important lever for sustainability
- Sustainability meter works best for large public-private residential projects
- Sustainability meter as a base for discussion; no need for certification
- Long duration of projects vs fixed sustainability ambitions / criteria:
  - Decreasing enthusiasm of private partner
  - Changing regulations and insights
  - Try to avoid too specific criteria
  - Find a balance between flexibility and enforcement of key ambitions
- Encouraging innovation vs ensuring long-term quality by using trusted solutions

Questions?

Elisabeth Kuijken

City of Ghent – Environment and Climate Service

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Project Status

provincie Oost-Vlaanderen

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DE NIEUWE DOKKEN

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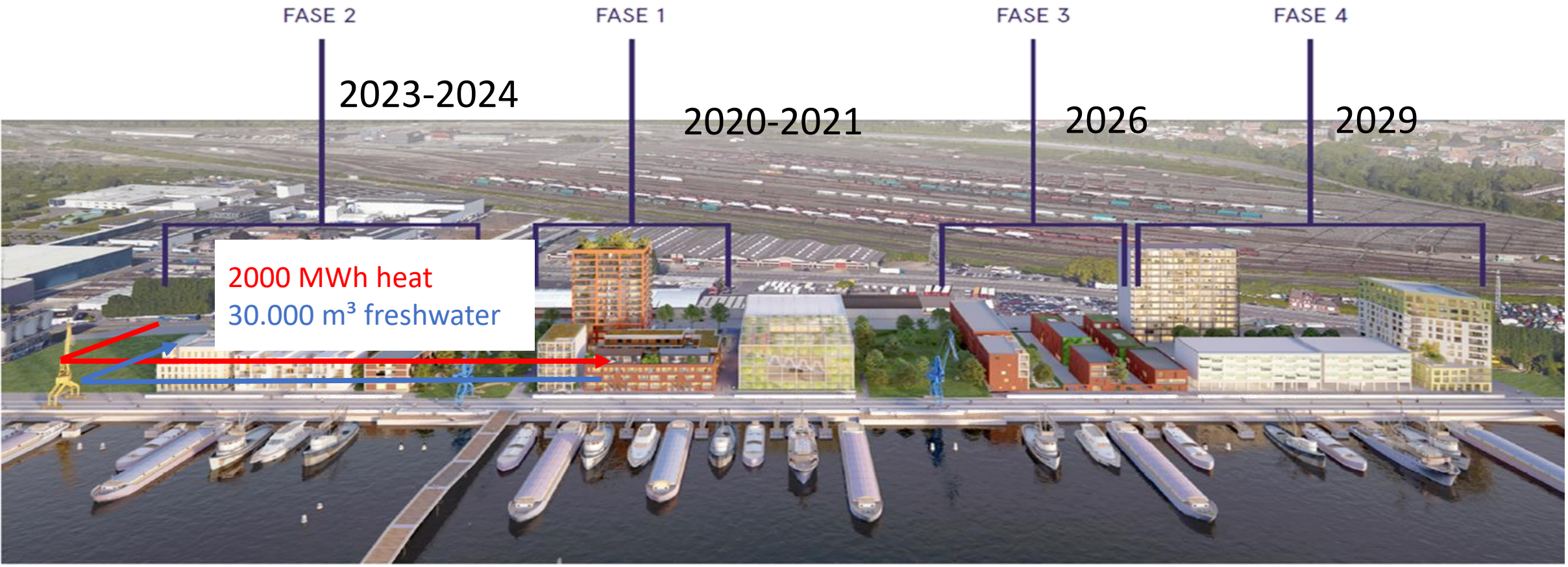
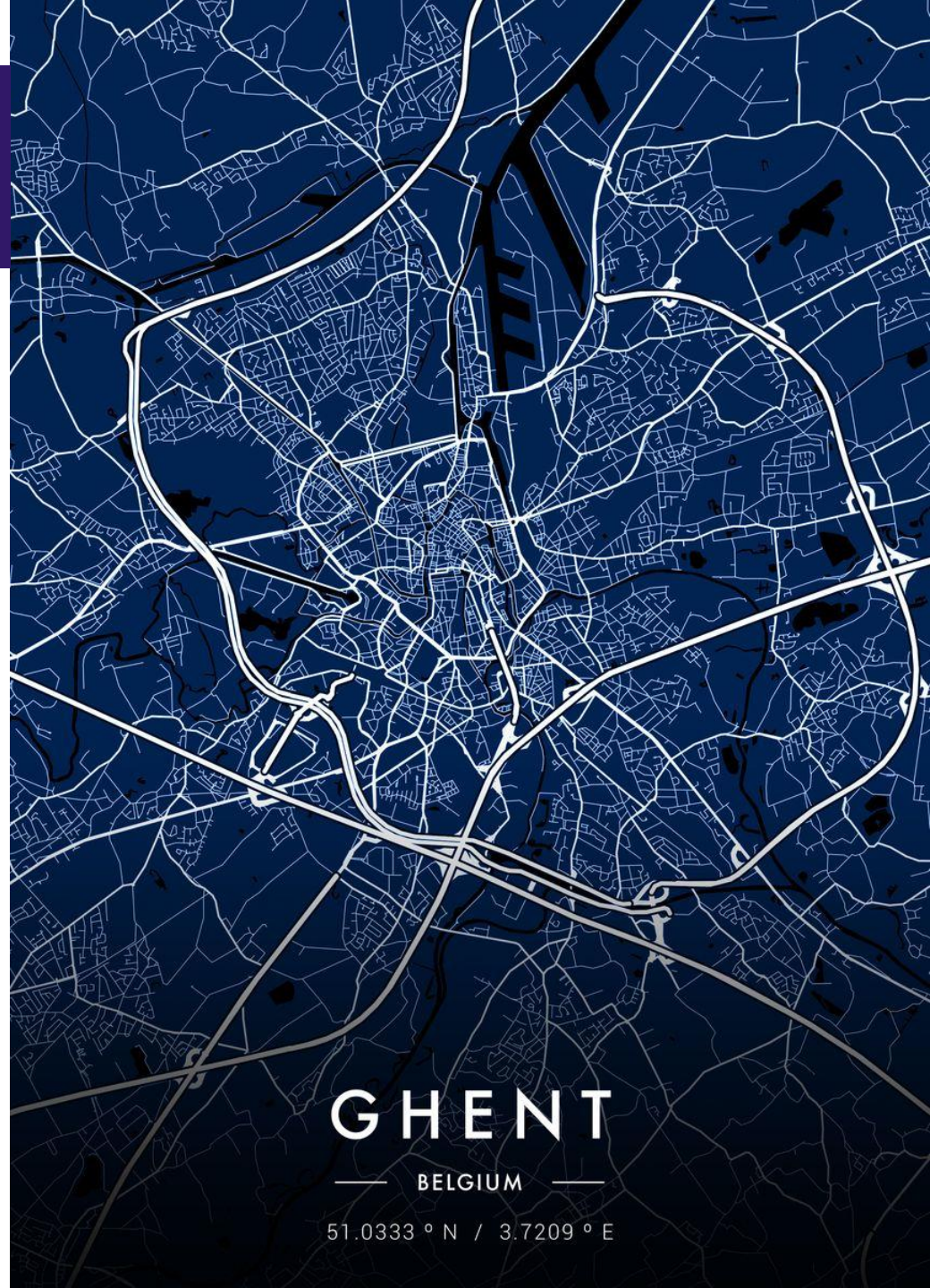


>400 Housing units + City complex (schools, sports infrastructure etc.)

Implementing future proof districts with Local Water Community requires:

- Early urban planning and support by local authorities – part of city blue print
- Modular planning of infrastructure and investments
- Different financing structures: Added value is not always created on the project level



Want to know more or collaborate? Contact us !

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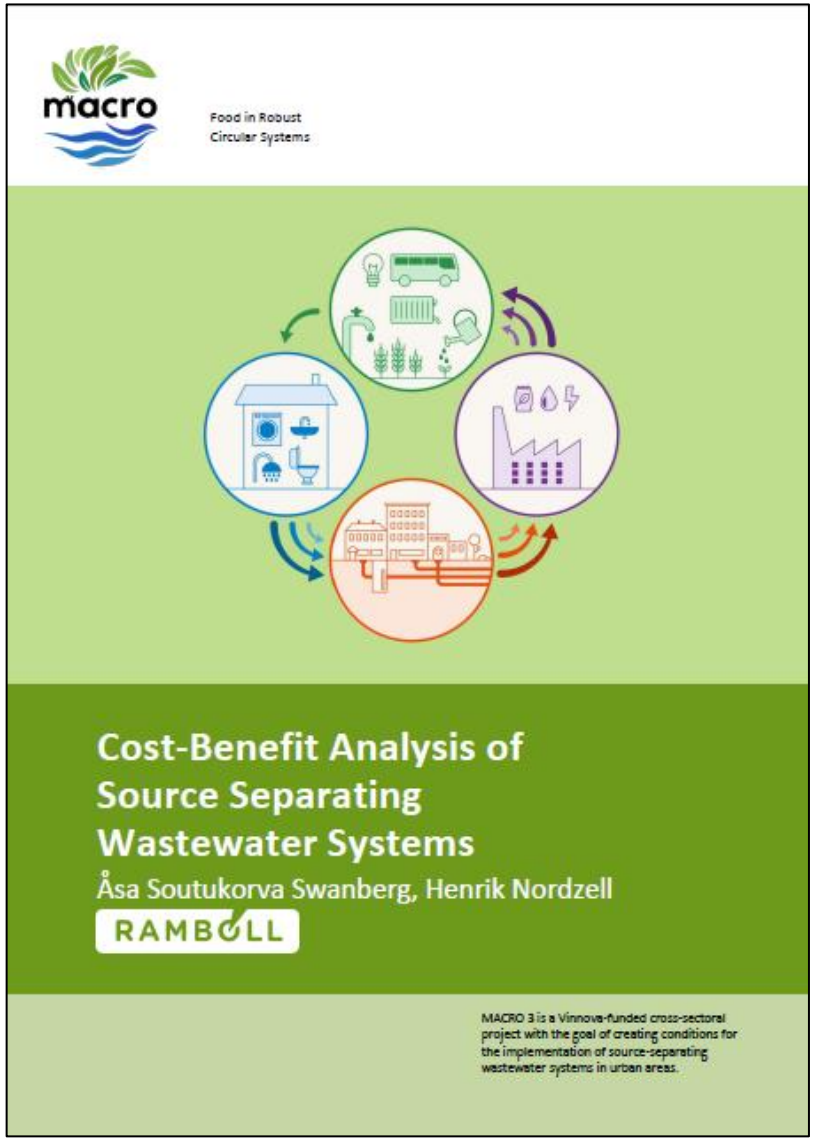
A Cost-Benefit Analysis for wastewater systems in a New Urban Area in Stockholm

*Based on work by **Åsa Soutukorva Swanberg** and **Henrik Nordzell**, presented by Elisabeth Kvarnström*

A Cost-Benefit Analysis for Wastewater Systems in a New, Urban Area in Stockholm, Sweden

What is cost-benefit analysis?

- Desicion-support tool to evaluate an investment's benefits to society in relation to their costs
- Use of methods to monetize services that normally do not have a market value
- Comparison
  - are benefits higher than costs?
  - How much of the costs are covered by benefits?



The study area – Loudden, a brownfield area in Stockholm Royal Seaport

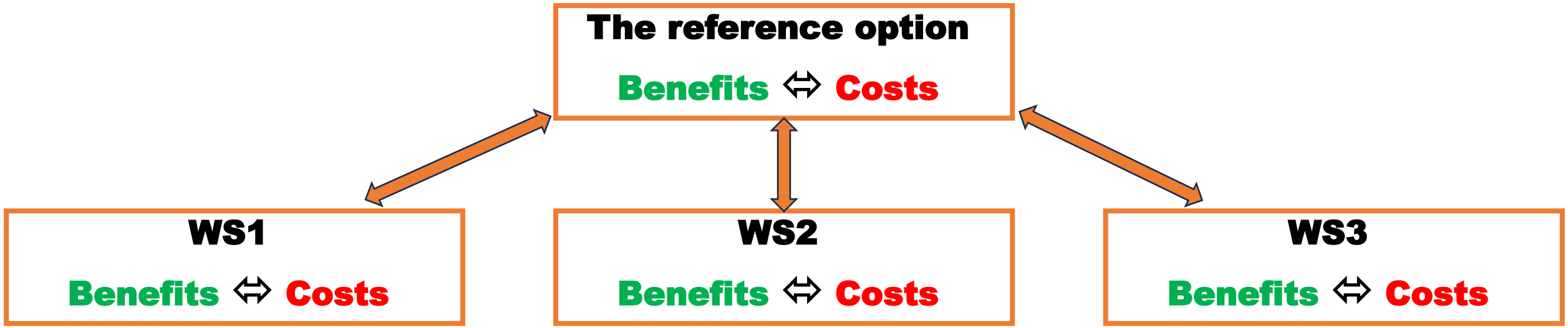
Port and industrial area today

Undergoing redevelopment between 2020-2040

About 9,800 people will live and work here when fully developed

Offices, schools and pre-schools

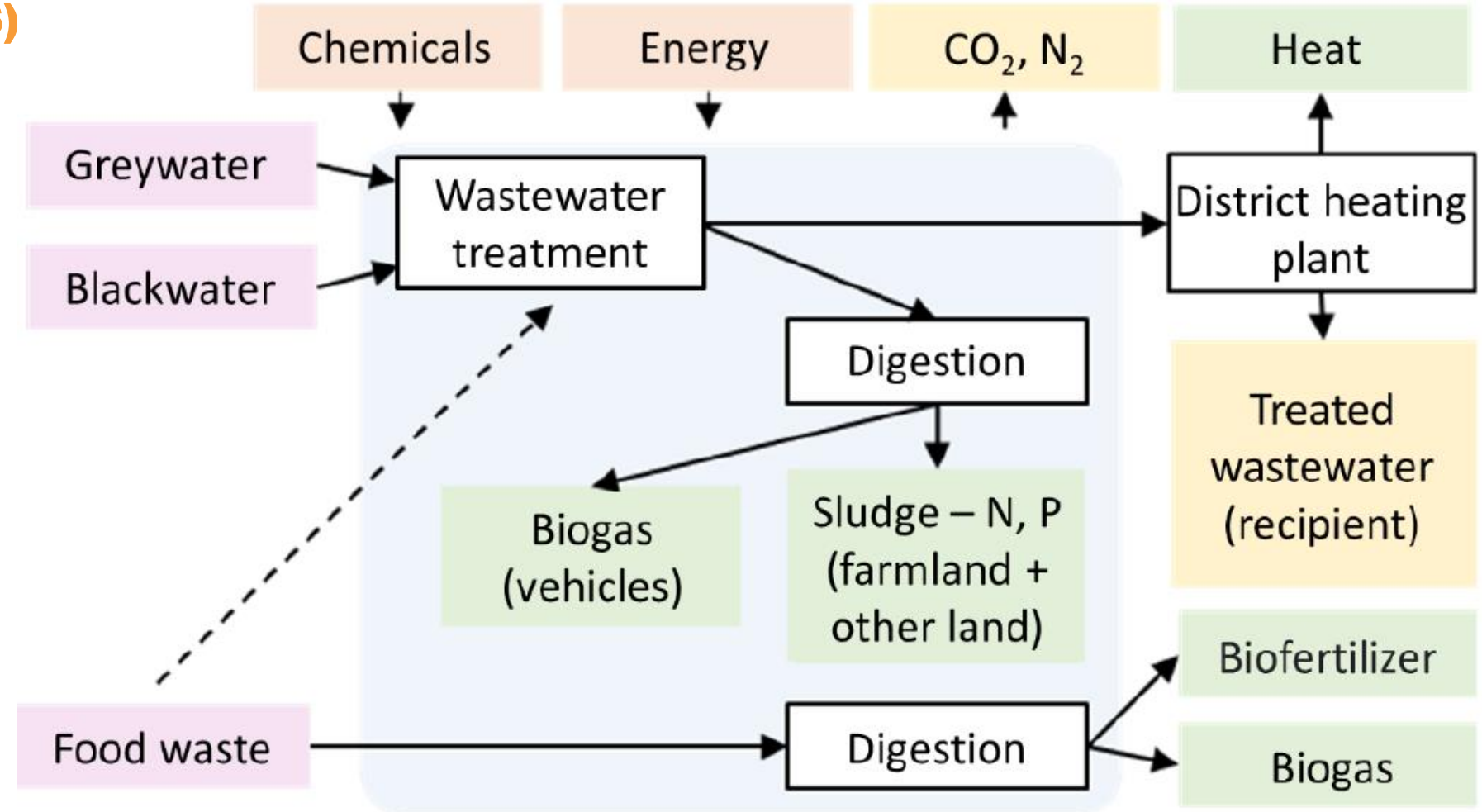
The cost-benefit analysis of wastewater management in future Loudden



A reference alternative + three alternatives

Reference alternative (WS) Henriksdal wwtp in 2020

Costs based on 869,000 pe, downscaled to 9,800 pe for Loudden

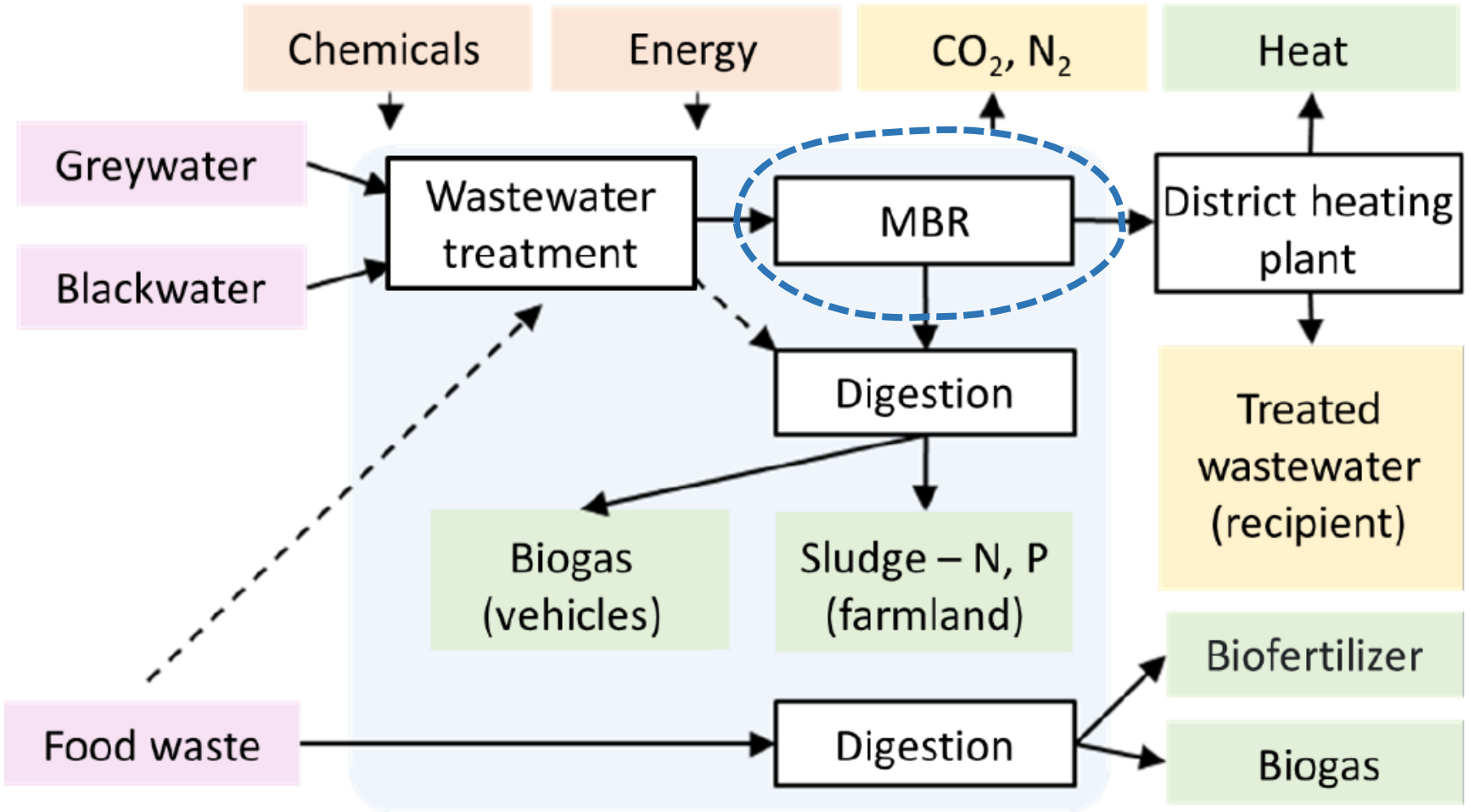


A reference alternative + three alternatives

Reference alternative (WS): Henriksdal wwtp in 2020

WS1: Like WS + membrane bioreactors

Costs based on 1,150,000 pe, **down-scaled** to 9,800 pe for Loudden



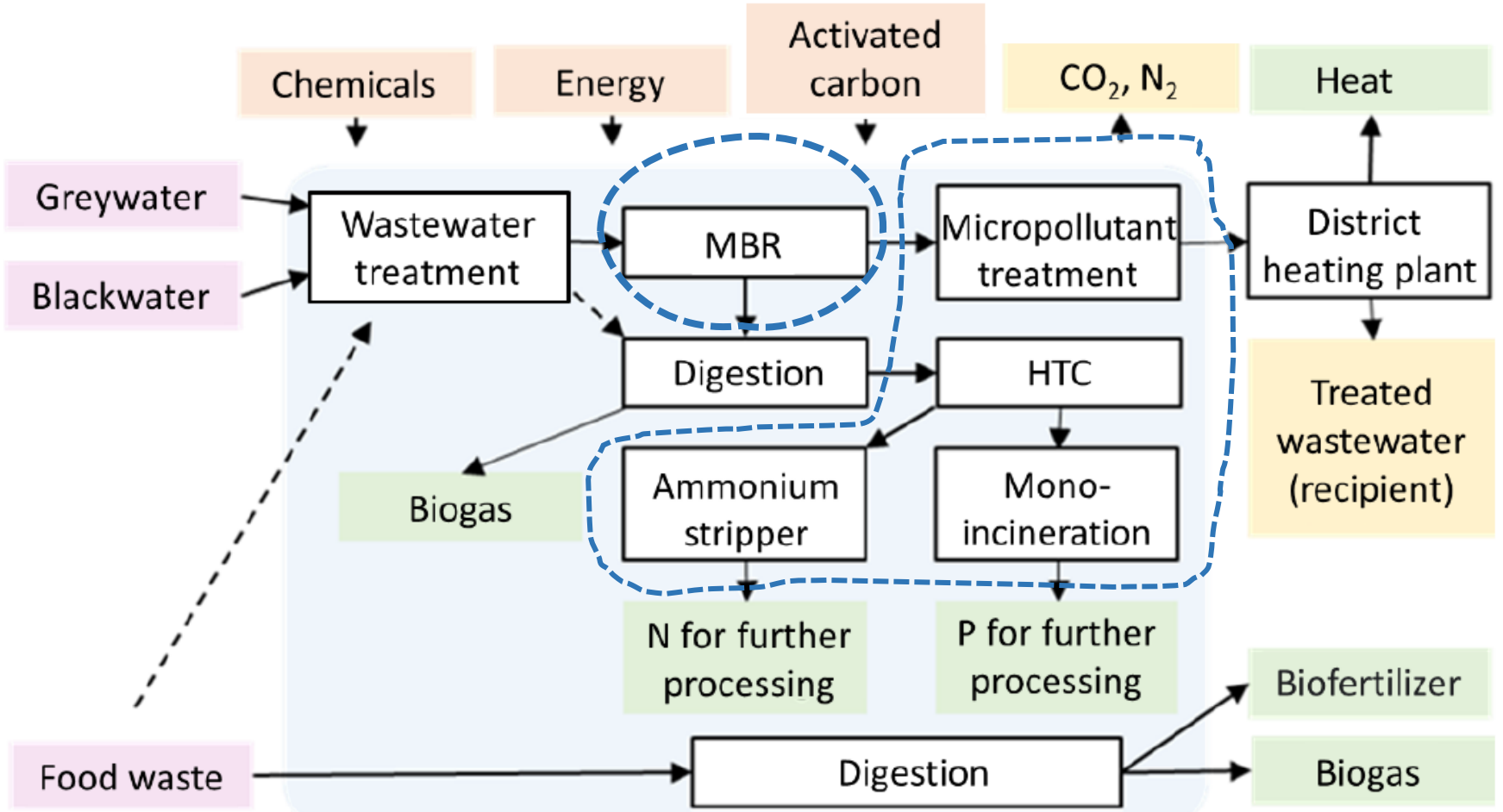
A reference alternative + three alternatives

Reference alternative (WS): Henriksdal wwtp in 2020

WS1: Like WS + membrane bioreactors

WS2: Like WS 1 + micropollutant removal and nitrogen and phosphorus recovery

Costs based on 1,150,000 pe, **down-scaled** to 9,800 pe for Loudden



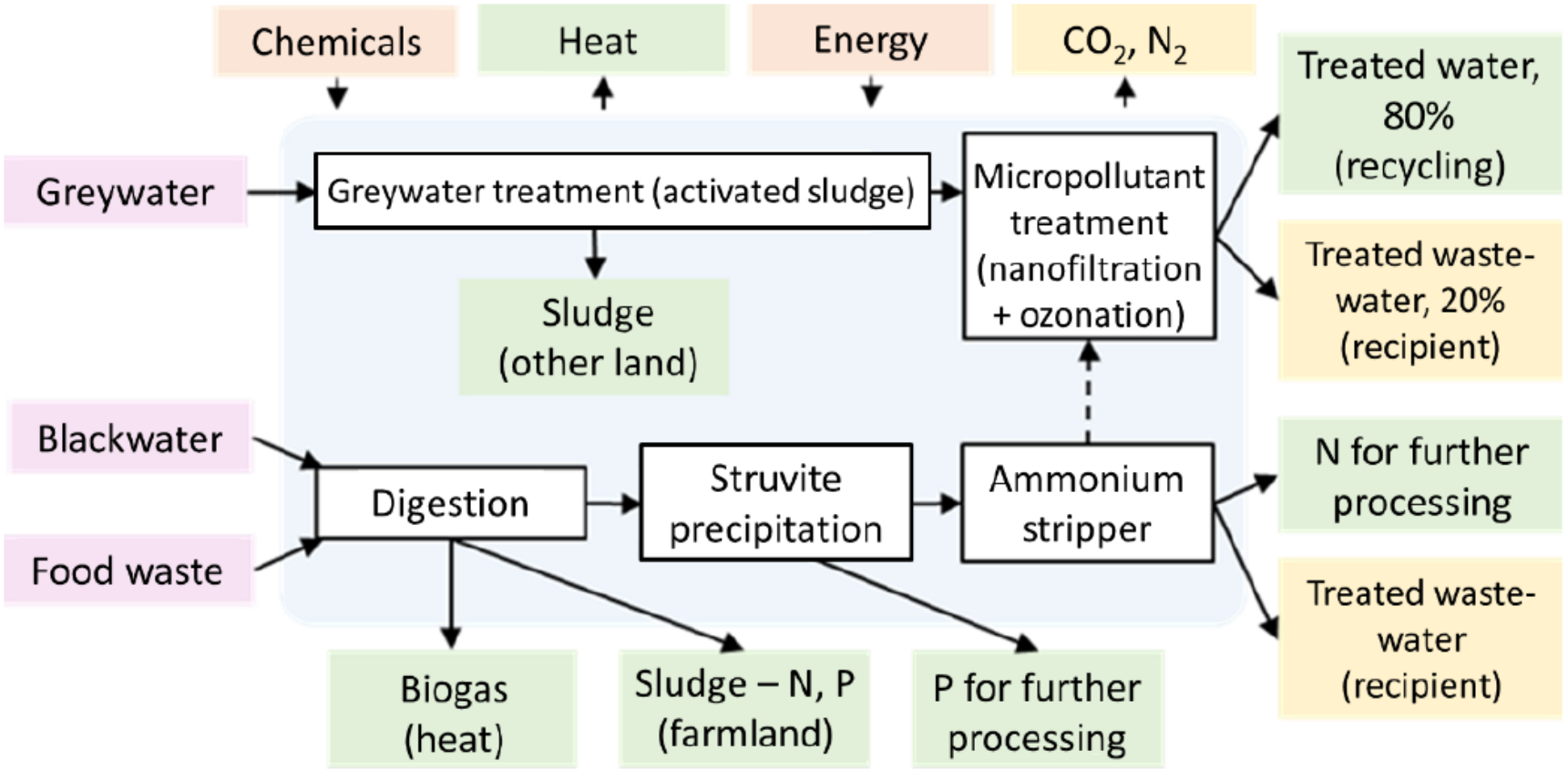
A reference alternative + three alternatives

Reference alternative (WS): Henriksdal wwtp in 2020

WS1: Like WS + membrane bioreactors

Costs based on 2,000 pe, **up-scaled** to 9,800 pe for Loudden

WS3: Source-separating ww system with micropollutant removal and nitrogen and phosphorus recovery



Results - The benefits

Darker green – monetized benefits

Lighter green – non-monetized benefits

Red – negative external effect

Minimum benefits:

Source-separating alternative, WS3, has the highest minimum benefits

	WS1	WS2	WS3
Benefit	**WS1 (MSEK/yr)**	**WS2 (MSEK/yr)**	**WS3 (MSEK/yr)**
Reduced emissions to recipient	0.6-0.7	1.2-1.4	1.9-2.2
Reduced emissions of nitrogen and phosphorus to water	✓	✓	✓
Reduced emissions of bacteria, parasites and viruses	✓	✓	✓
Reduced emissions of pharmaceutical residues and hormones to the water			✓
Better sanitization			4.8
Mining and production of mineral fertilizers			
Reducing externalities in terms of greenhouse gas emissions	-0.56	0.033	1-3
Reduced need for mineral fertilizer production with increased recycling of plant nutrients	✓	✓	✓
Heat return as a result of separate greywater pipe			✓
Increased biogas production			✓
Reduced nitrous oxide emissions			✓
Reduced water use			0.32
Water recycling			1.4
Potentially reduced vulnerability			
Reduced spreading of heavy metals on arable land		0.1	0.1
Higher acceptance of recovered nutrient products in agriculture			
Contribution to knowledge development			
Potential contribution to the sustainability profiling of Stockholm Royal Seaport			
Potential contribution to Swedish environmental technology exports			
Minimum estimate of benefits (MSEK/yr)	**MSEK/yr: 0.5-0.6**	**MSEK/yr: 1.6-1.8**	**MSEK/yr: 10.4-10.7**

A closer look at the monetized benefits

Benefit	WS1 (MSEK/yr)	WS2 (MSEK/yr)	WS3 (MSEK/yr)
Reduced emissions to recipient	0.6-0.7	1.2-1.4	1.9-2.2
Better sanitization			4.8
Mining and production of mineral fertilizers		0.25	0.57
Reducing externalities in terms of greenhouse gas emissions	-0.56	0.033	1-3
Reduced water use			0.32
Water recycling			1.4
Reduced spreading of heavy metals on arable land		0.1	0.1
Minimum estimate of benefits (MSEK/yr)	**0.5-0.6**	**1.6-1.8**	**10.4-10.7**

Results – The costs

Darker red – monetized cost

Lighter red – non-monetized cost

Estimated costs above the ref option:

Source-separating alternative, WS3, the most expensive

Important to remember:

- **Costs for WS1 based on costs for 1M pe**
- **Costs for WS3 based on costs for 2,000 pe**
- **Costs for WS2 uncertain (no existing treatment plant)**

	WS1	WS2	WS3
Costs	WS1 (MSEK/yr)	WS2 (MSEK/yr)	WS3 (MSEK/yr)
Capital and operational costs, above the ref option	0.71	2.44	12.2
Higher energy demand			
Higher chemical demand			
Estimated costs above the ref option (MSEK/yr)	MSEK/yr: 0.71	MSEK/yr: 2.44	MSEK/yr: 12.2

Summary of results

Benefits – costs should be a positive value

Benefits/cost ratio should be above 1

Neither of the options meet these requirements

The option that covers most of the costs: WS3

Remember!

- **Uncertainties in cost estimates**
- **Uncertainties in benefits**
- **Many benefits not monetized**

Conclusion from economists:

Summary	WS1	WS2	WS3
Costs above the ref option (MSEK/yr)	0.71	2.44	12.2
Minimum benefits above the ref option (MSEK/yr)	0.5-0.6	1.6-1.8	10.4-10.7
Benefits – Costs (MSEK/yr)	**-0.2**	**-0.84**	**-1.2**
Benefits/Costs	**0.7**	**0.66**	**0.85**

”The results show that investments in new tech can lead to a number of benefits which makes it possible for new alternatives to compete with conventional approaches from an economic perspective, in spite of higher investment costs”

Thank you!

You find the report here:

Cost-Benefit Analysis of Source Separating Wastewater Systems (sanity.io)

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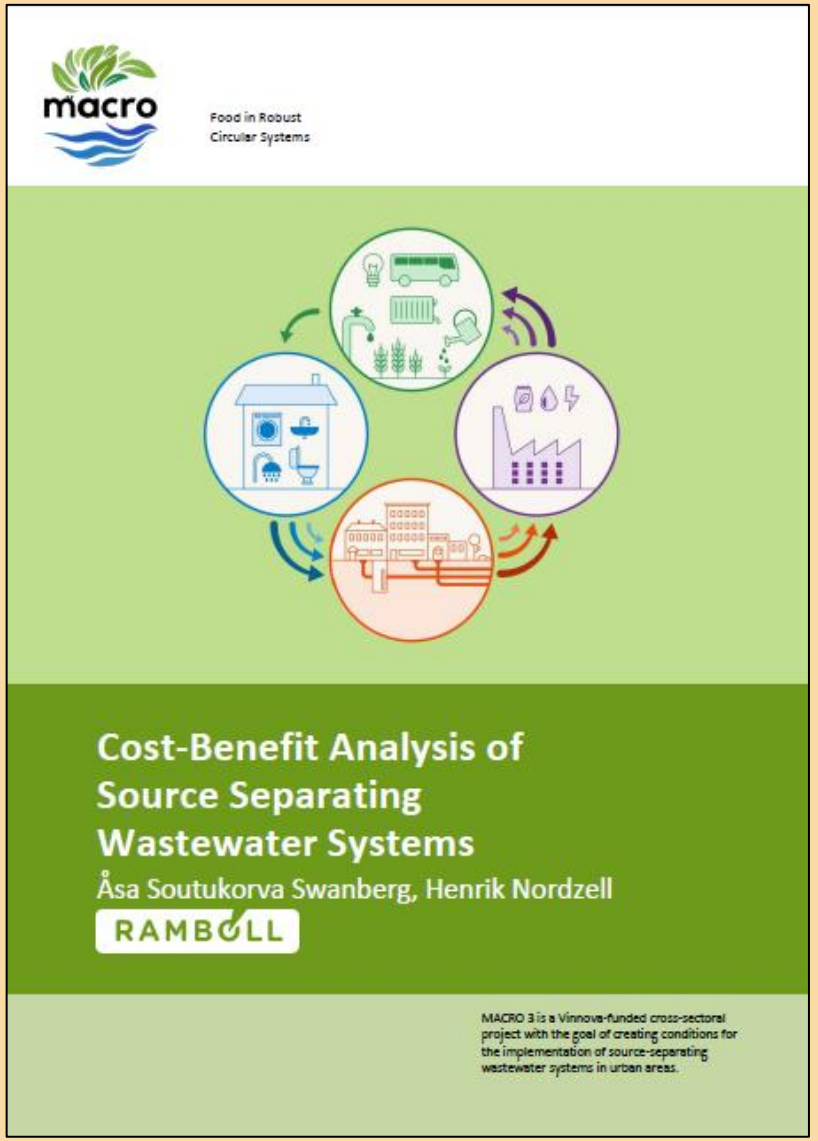

Cross Border Lunch Meeting

Next Lunch Meeting

- When: September 23rd
- Topic: Black water – how can we collect and treat it? What are the resources we want to recycle?

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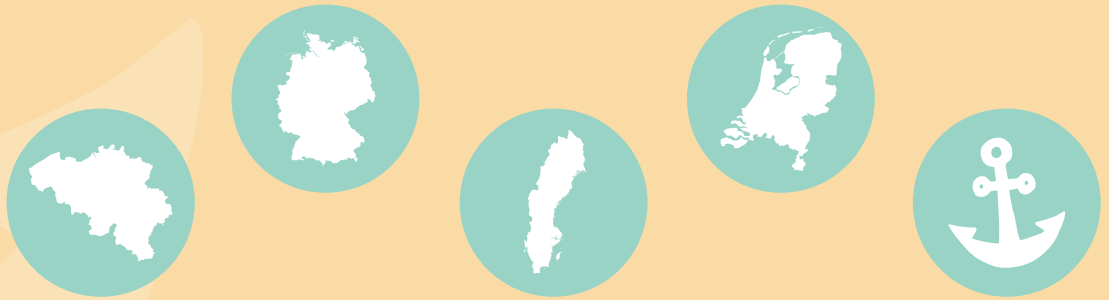
Thank you for attending!



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