

# Aanbevelingen ontwikkelingen sanitatie in Europa

Huub Rijnaarts

ENVIRONMENTAL TECHNOLOGY GROUP



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Environmental Technology

## Two Chairs



Annemiek Ter Heijne  
Per 1-7-2023

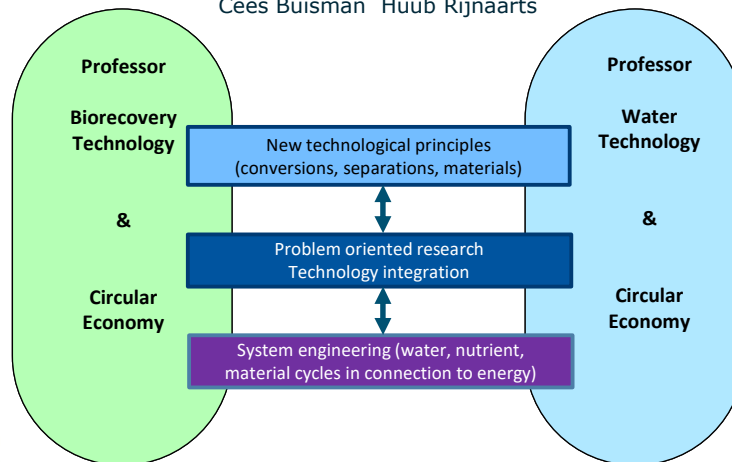
Cees Buisman Huub Rijnaarts



Vacancy  
Per May 2024

EWUU Alliance  
Professor  
Circular Society  
0.4 FTE

Until 2028



PhD  
Graduates:  
10-15/yr

MSc & BSc  
graduates:  
100/yr

Lectured  
students:  
500/yr



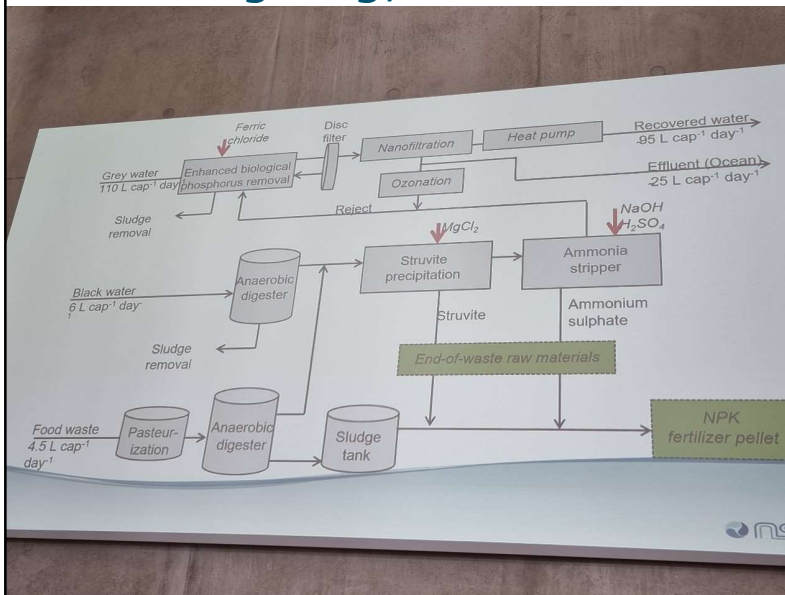
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## Vooruitblik Sanitatie en Afvalwaterzuivering

- West-Europa:
  - Tabula Raza – Nieuw te Ontwikkelen Stadsdelen
    - Meerstromen Riolering plus Decentrale Zuivering
    - Voorbeelden Grietje Zeeman > Helsingborg, Groeiplan WT
  - Voortbouwen op bestaande AWZI/RWZI's en riolering
    - Water Nexus, AquaConnect, Groeiplan Water Technologie, NEREUS,.....
- Oost-Europa, China, MENA, India, Global South

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## Helsingborg, Zweden



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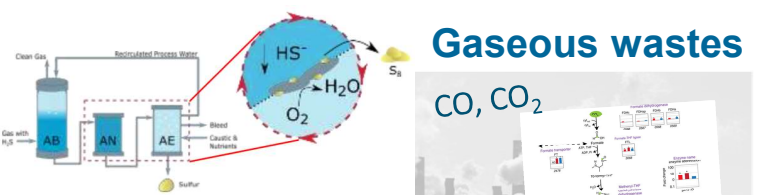
# NEREUS Project

- <https://youtu.be/dypEWIvxc0A>
- Centralised, decentralised >> hybride??
- Schaalbaarheid, kosten efficiency
- Infrastructuur/logistiek/vraag en aanbod (water, nutriënten, energie, producten)

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Veel nieuwe (NL) Technologieën Beschikbaar (TU's, Wetsus, GPWT, TKI,..)  
Maar schaalgrootte doet er toe > market pull

## World-wide 1<sup>st</sup> Chain Elongation Factory



Sludges/Organic Wastes  
>> Reusable Organic Chemicals




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## WATER NEXUS 2015-2021

### Industrial water provision and reuse


Salt when possible




Saline

- Fresh & Brackish Water Resources
- Supply-Demand Networks

Fresh when needed



- Treatment Technologies
- Technology Trains
- International connections



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## AquaConnect 2021- 2026



### Securing water for drinking, agriculture, nature and industry

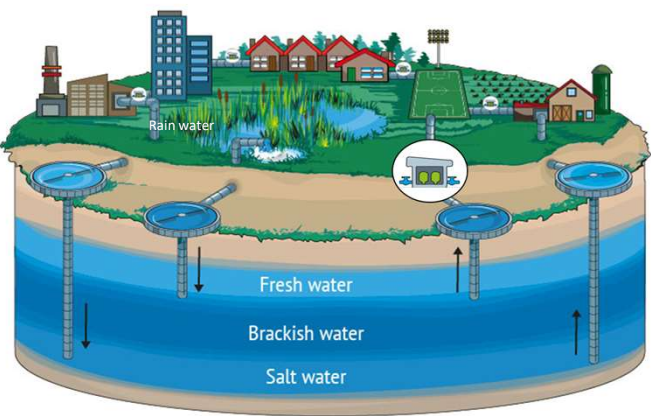
Smart water-grids

Key technologies

Water-governance

AquaConnect: A collaboration of



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# Integraal door-ontwikkelen van "de WaterFabriek" voor de effluenten van 350 RWZI's van Nederland

Salt Water Pressured regions



AquaConnect  
Cases for smart water grids



Ground Water Depletion Regions

## Modelled design of urban water-energy systems



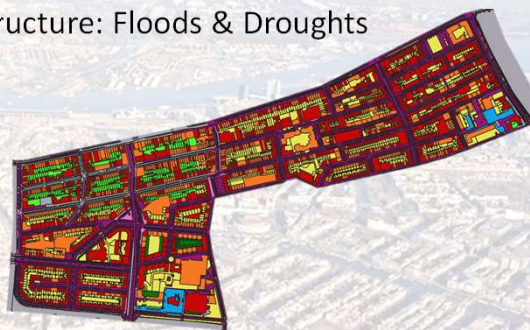
### Blue-Green Infrastructure: Floods & Droughts

EU projects

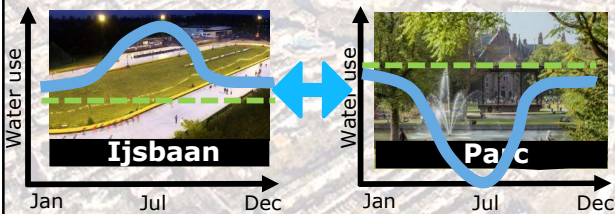
MULTIGREEN

RAIN SOLUTIONS

- BGI Measures
- Bioretention Area
  - Constructed Wetland Area
  - Grass
  - Green Roof
  - Infiltration Trench
  - Permeable Pavement
  - Rain Barrels
  - Rain Garden
  - Swale
  - Trees
  - Unsuitable Area for BGI



### Matching Demand and Supply



### Water and Energy

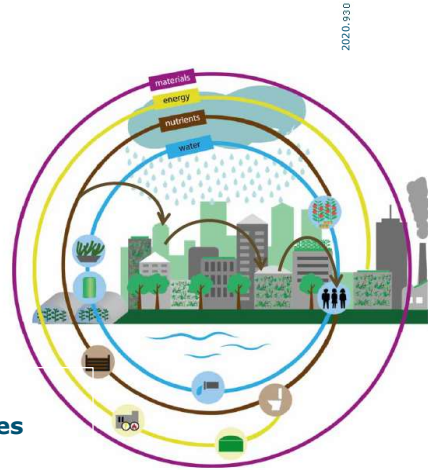




System engineering (water, nutrient, material cycles in connection to bioenergy)

# Closing nutrient and carbon cycles

Recovery of carbon (energy) and (micro) nutrients for reuse in agriculture and industry from e.g.



### Multiple Innovations Needed

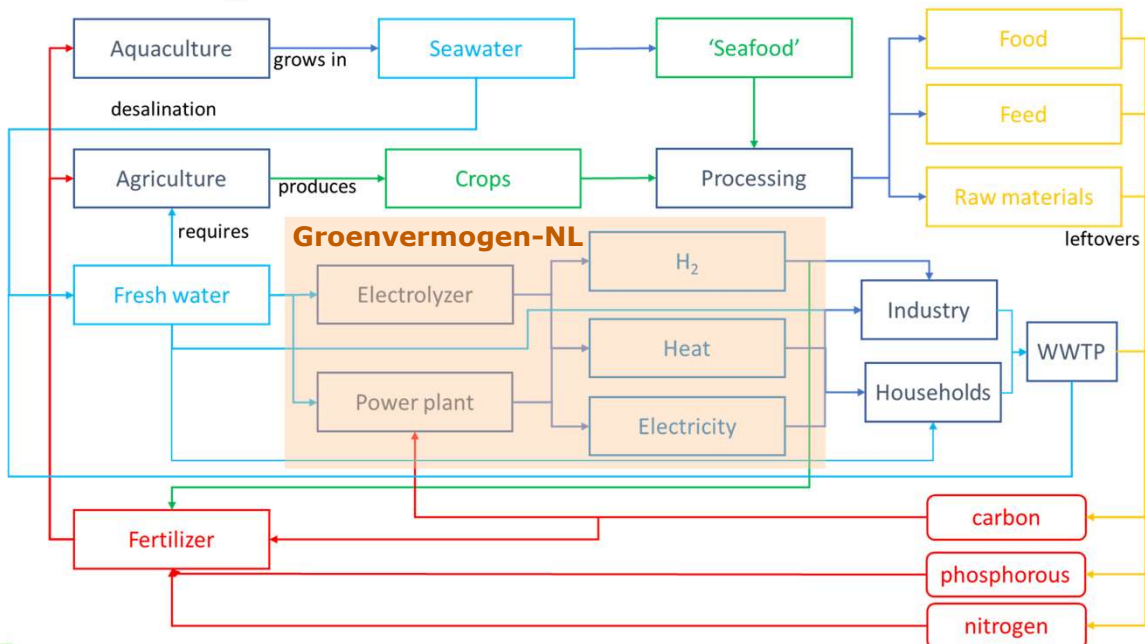
- System engineering at varying temporal and spatial scales
- Technological innovation
- Demand-supply balancing in regional Urban and Urban-Rural

### Context



Wielemaker et al., 2019 <https://doi.org/10.1111/jieec.12962>  
 Wielemaker et al., 2020 <https://doi.org/10.1016/j.jclepro.2020.120789>

### Water – Energy - Food nexus

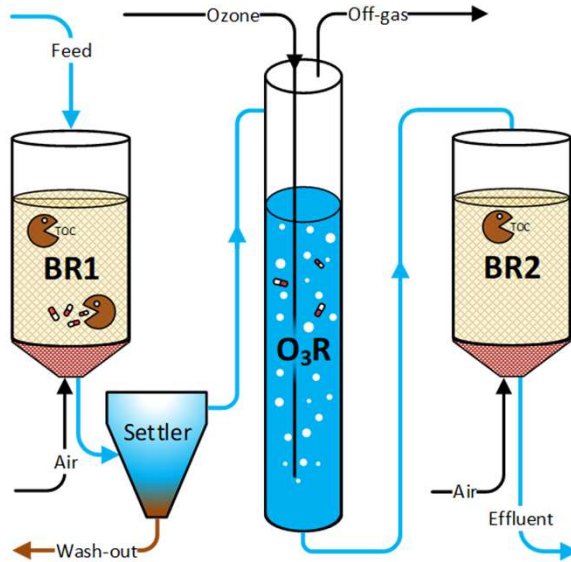


From H. Cappon, HZ Vlissingen

# Quality of the Recovered Resources



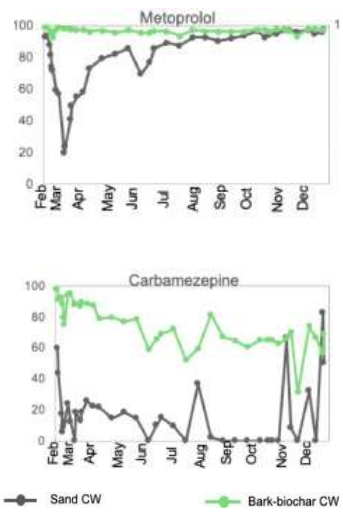
Effluents  
+  
Micropollutants



BO3  
RH DHV – WUR ETE



# Technologies &..... Nature Based Solutions (CWL)

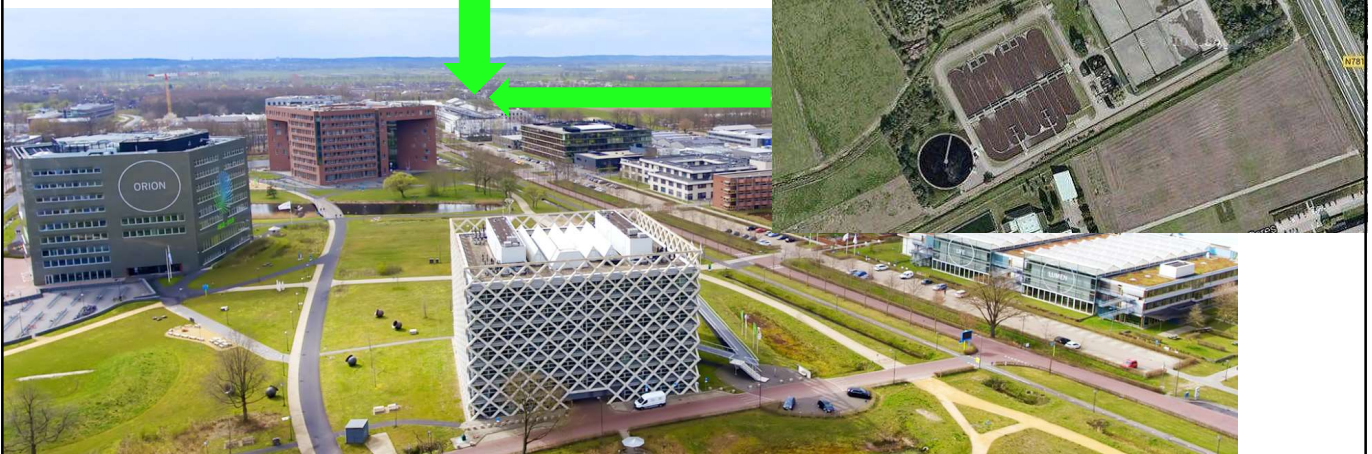




## Groeiplan Water Technologie Wetsus – KWR – Groep Oost

Environmental Technology - WUR

## Actief Slib Bennekom



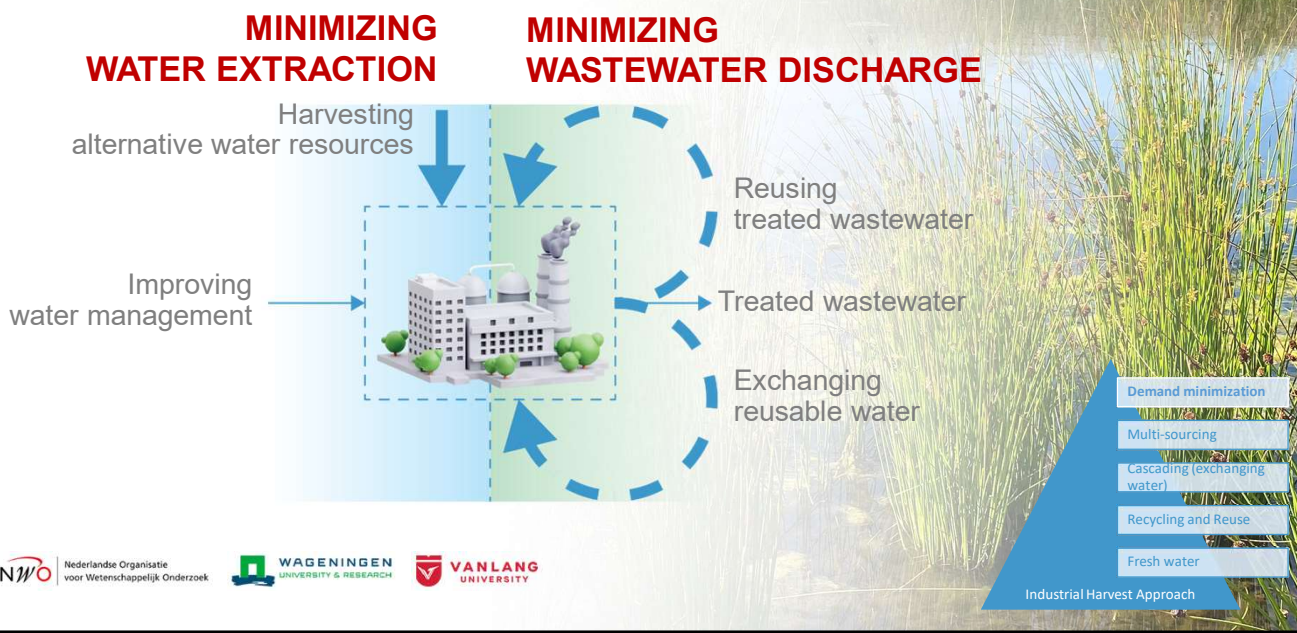
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# Let's go to India



## How to make industrial water use in Vietnam sustainable?





**Water - Food - Sanitation - Health in GS**

**Research and Education**

Countries with active research and education activities:

- Asia (Vietnam, India, Indonesia, Bangladesh)
- Africa and Middle East (Jordan, Egypt, Ghana, Ethiopia)
- South America and Caribbean (Chile, Brasil, ABC islands)

Financing: NWO Nuffic LDPD INREF

Contact: [Katarzyna.Kujawa@wur.nl](mailto:Katarzyna.Kujawa@wur.nl)



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## Oost-Europa, China, MENA, India, South East Azia, Global South

- Veel zuiveringen en rioleringen nog te verbeteren/aan te leggen:
  - kans >> duurzame sanitatie oplossingen
- Maar:
  - Landen willen "Bewezen oplossingen"; geen "West-Europese experimenten"
  - Milieu- en waterkwaliteit en gezondheid (nog) boven duurzaamheid/circulariteit
- Dus bv Nederland:
  - circulaire oplossingen ontwikkelen tot proven technologies en opschalen in thuishmarkt en daarmee naar buitenland
  - Diverse oplossingen: Centraal, Decentraal en Hybride
- Verandering Beleid, Regelgeving en Perceptie, aandachtspunt

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DANK U VOOR DE  
AANDACHT!



To explore  
the potential  
of nature to  
improve the  
quality of life