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Water Harmony
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Project examples for resource orientated sanitation systemsr

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10.07.2017

Obstacles of conventional sanitation

- High water consumption for transportation of sewage
- „End-of-Pipe“ Technology
- Discharge and accumulation of P and N in water bodies
- High energy consumption for the degradation of organic matter
- High energy consumption for the production of fertiliser (N)
- High investment and O&M-costs for the operation of the systems
- Small efficiency for the removal of micropollutants
- Transferability in developing and threshold countries not possible

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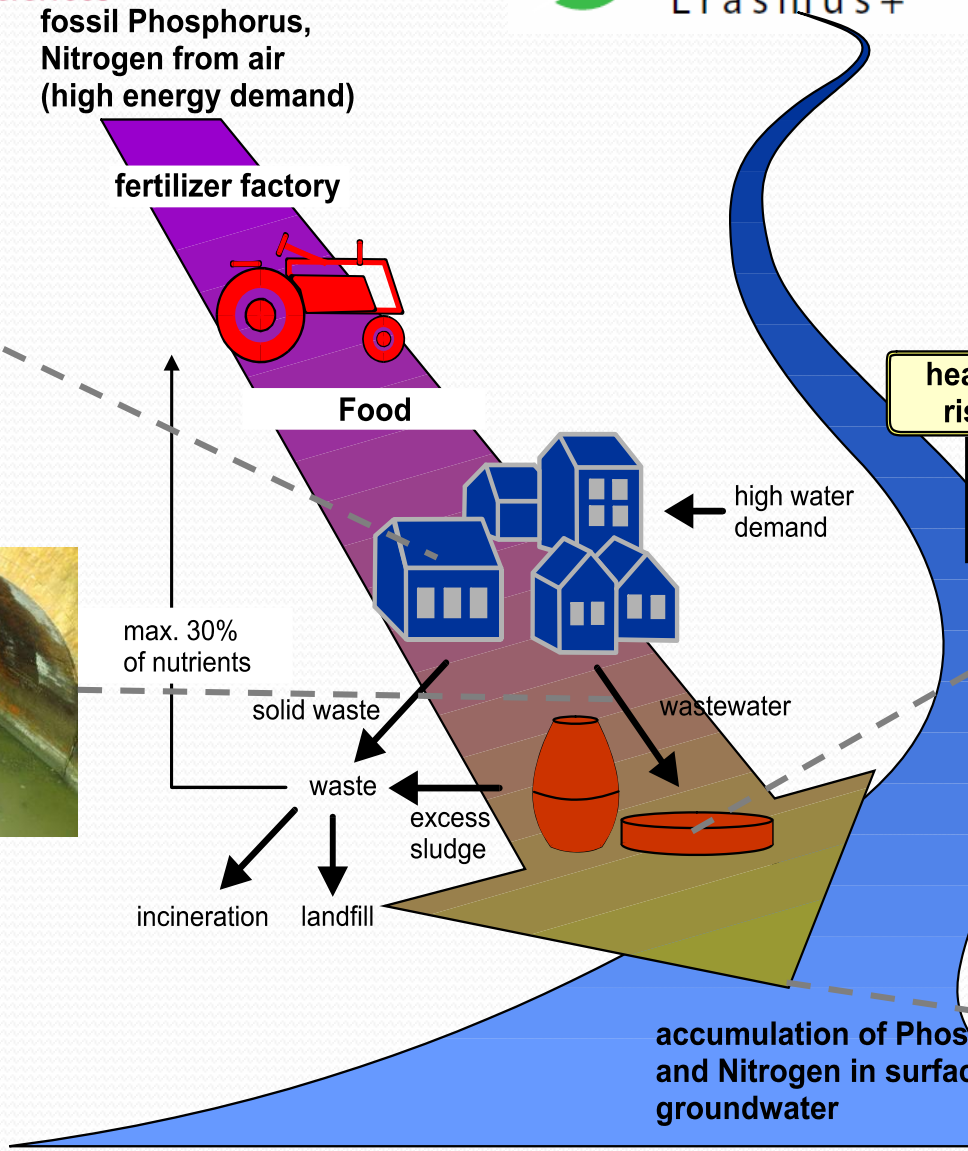
Linear Flows in Sanitation ystems



Wastewater is a resource

- **Organic matter** is energy source and soil conditioner
- **Nitrogen, Phosporus** are nutrients (agriculture)
- **Heat energy** is reservoir for heat exchanging processes
- **Methane** is energy source
- **Water** for irrigation and source for water bodies

These „substances“ have to be identified as ressource and integrated into Loops.

Segmentation of flows

<table>
<tr><td rowspan="3">Toilet waste-water</td><td rowspan="2">Without water</td><td>Urine</td><td>Faeces</td></tr>
<tr><td colspan="2">Excreta</td></tr>
<tr><td rowspan="2">With flush-water</td><td>Yellowwater</td><td>Brownwater</td></tr>
<tr><td colspan="2">Blackwater</td></tr>
<tr><td colspan="2">Domestic wastewater without toilet wastewater</td><td colspan="2">Greywater
(more sub-divisions for greywater are possible)</td></tr>
</table>

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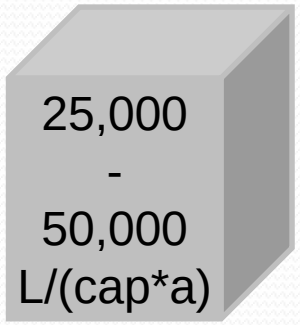
Distribution of loads



		Greywater	Urine	Faeces
			~ 500 L/(cap*a)	~ 50 L/(cap*a)
N	~ 4.7 kg/(cap*a)	~ 8 %	~ 85 %	~ 7 %
P	~ 0.7 kg/(cap*a)	~ 25 %	~ 50 %	~ 25 %
K	~ 1.8 kg/(cap*a)	~ 34 %	~ 54 %	~ 12 %
COD	~ 35 kg/(cap*a)	~ 48 %	~ 10 %	~ 32 %

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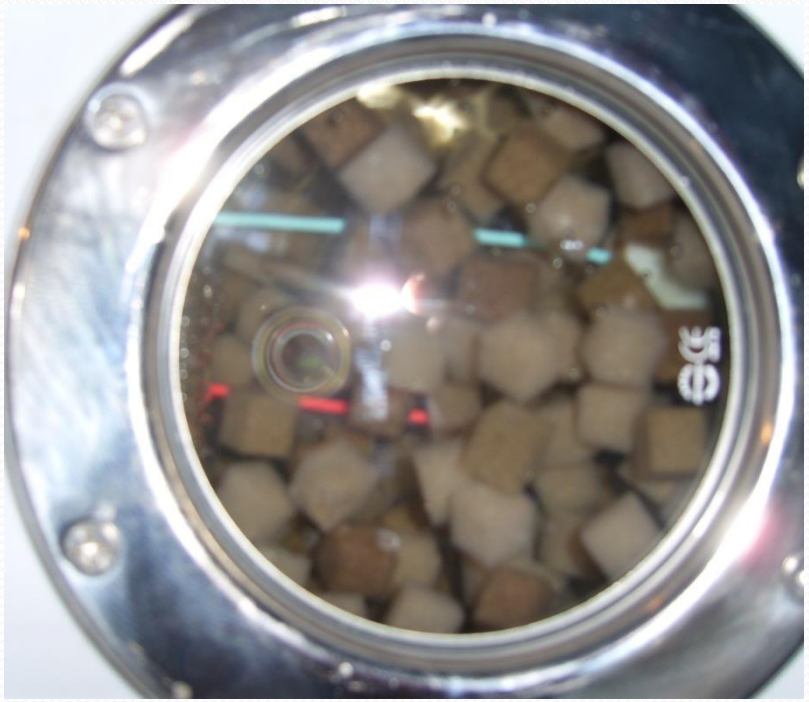
Greywater reuse in Berlin



- 70 households with approx. 240 inhabitants
- Reuse volume 10 m³/d
- Reuse water is sold to the users.

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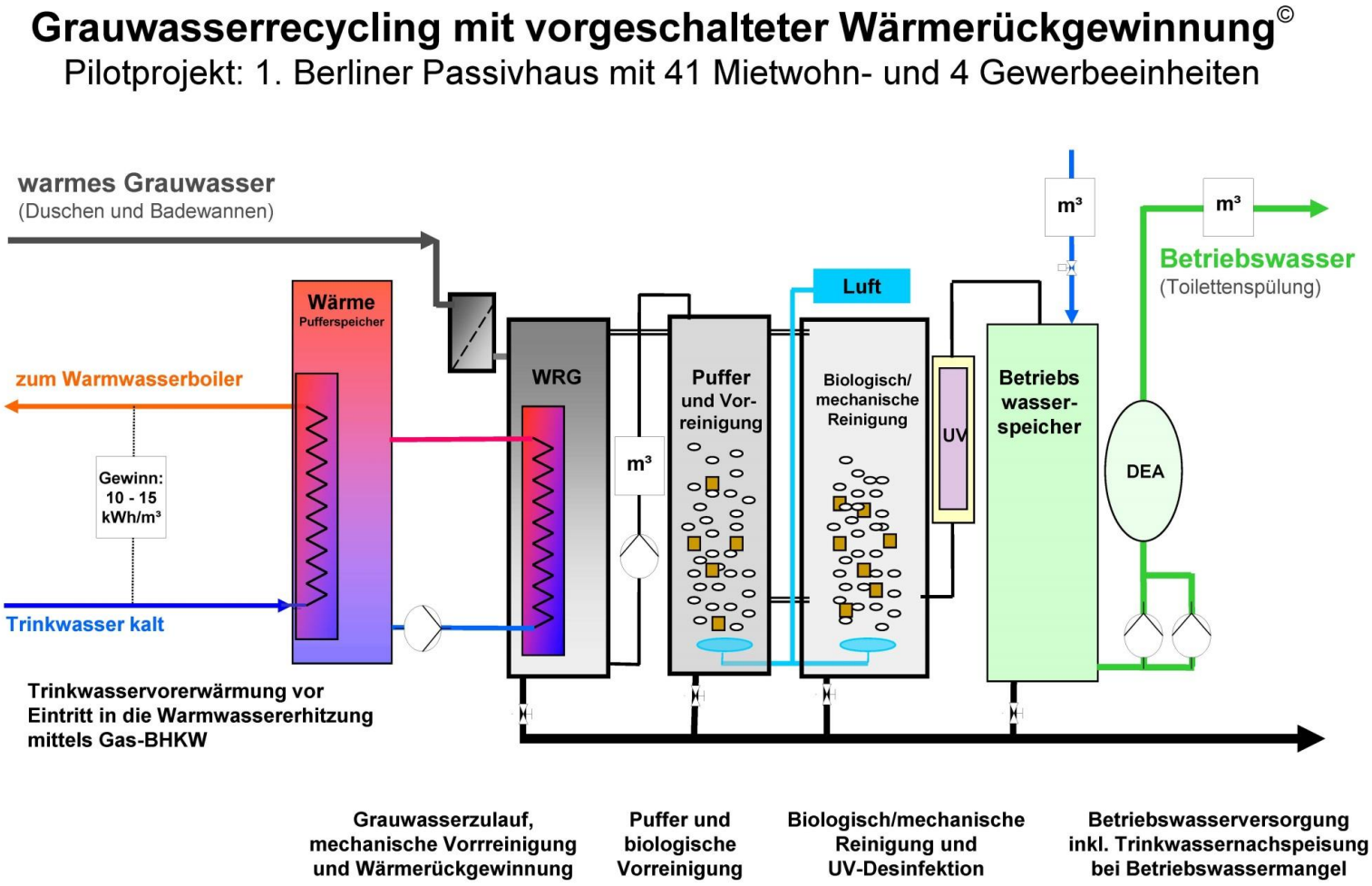
Heat recovery from greywater



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Heat recovery from greywater

Investment (Prototype)
additional costs 11,30 €/m^2
1 % of building costs

Space demand:
9 m^2 = 0,1 m^2/cap

Water saving
approx. 1.100 m^3/a

Heat recovery
ca. 13.000 kWh/a

O&M
Electricity ca. 1.800 kWh/a
no maintencance in the first six months of operation

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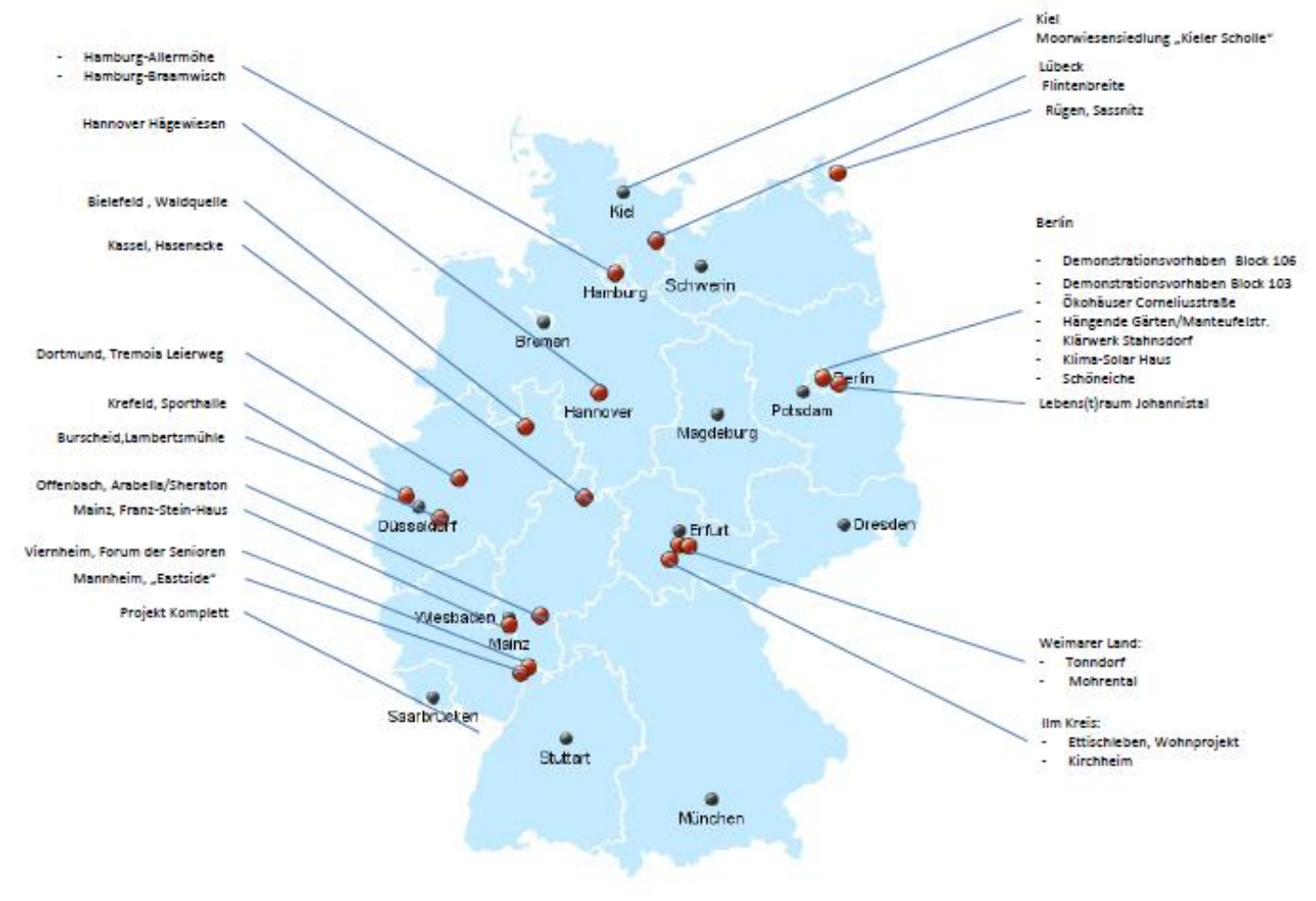
Greywater treatment projects



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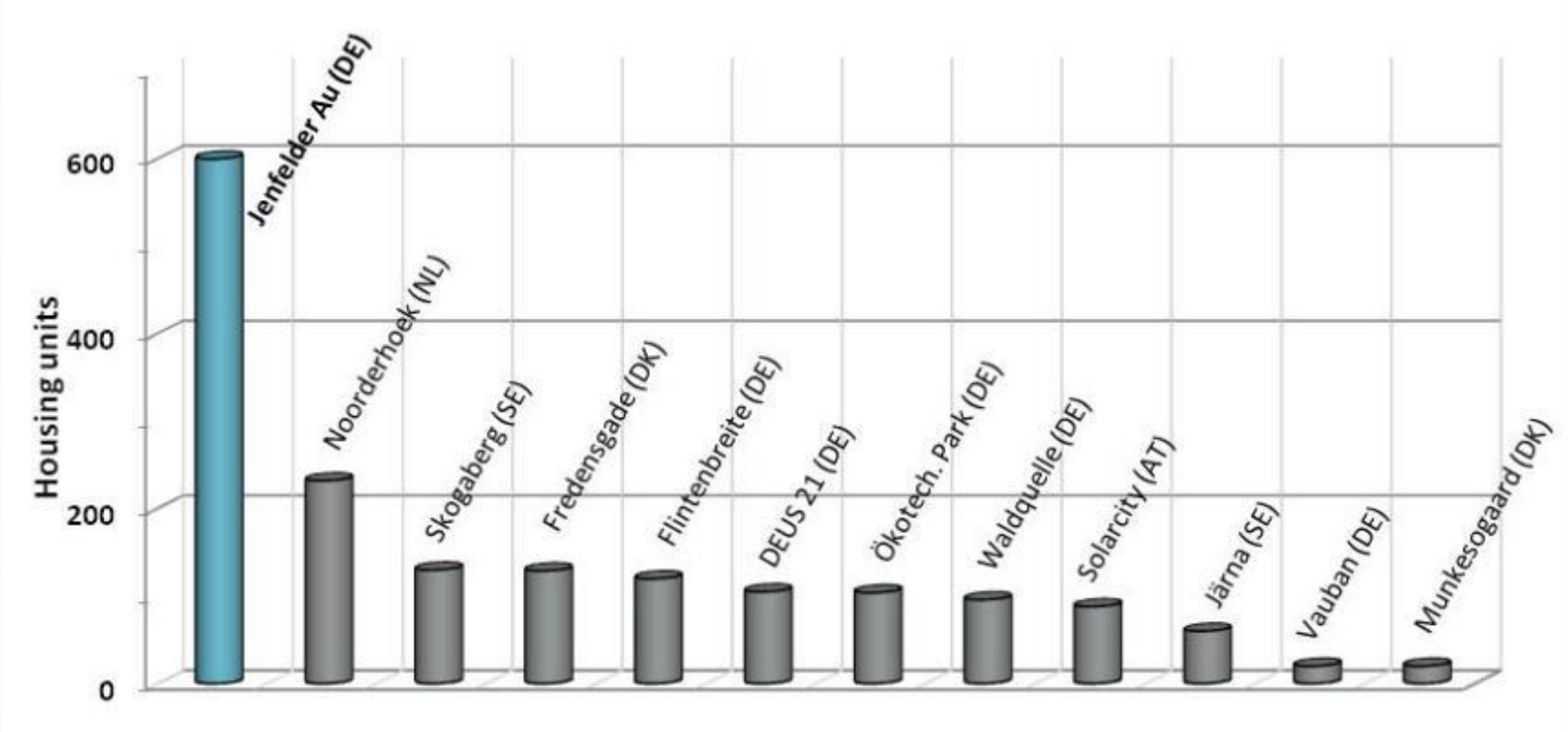
Ressource orientated sanitation systems



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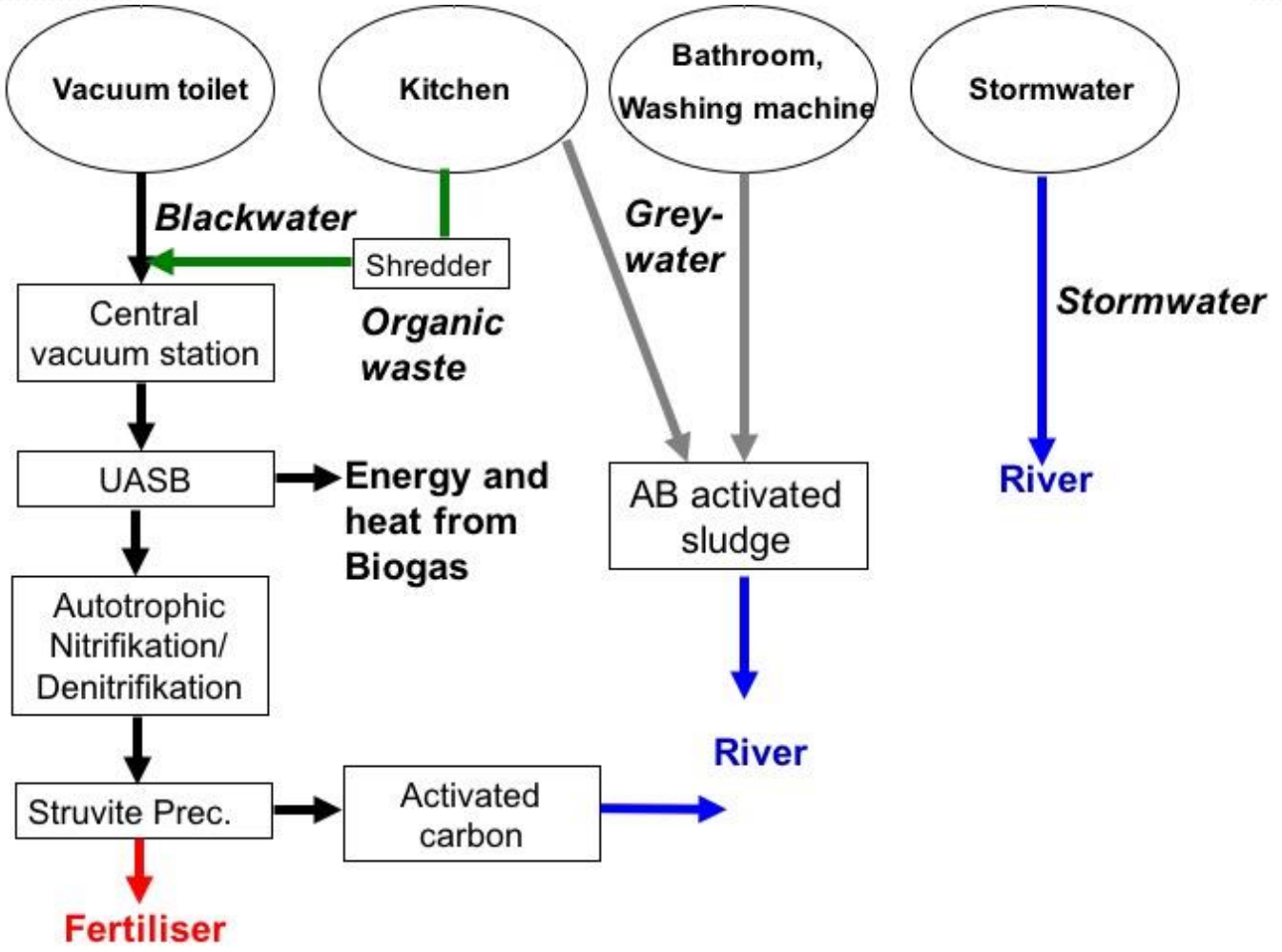
Project Sneek/NL - Lemmerweg

- Pilotproject 32 housing units

Sanitation system Sneek/NL



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Project Sneek/NL - Noorderhook

- 200 housing units currently
- Extension to 600 housing units

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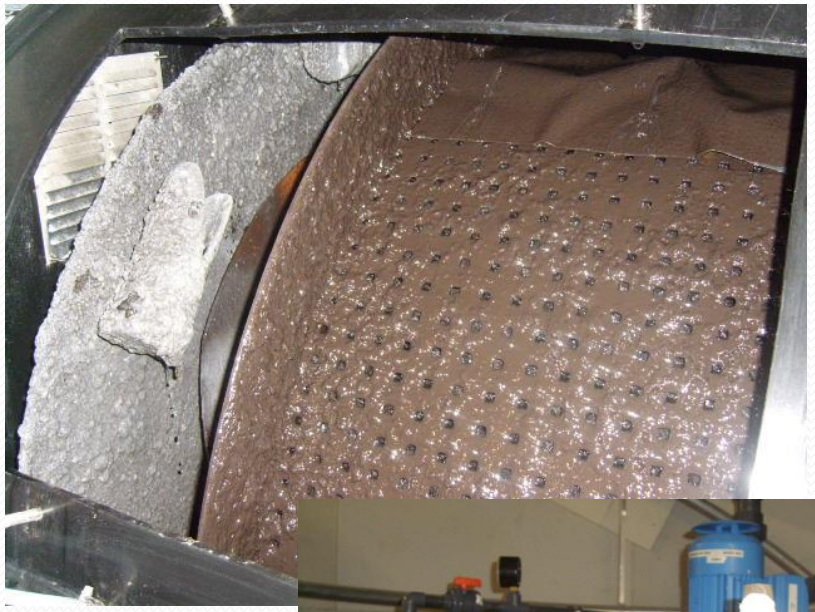
Project Sneek/NL - Noorderhook



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KREIS
Versorgung durch Entsorgung

KOPPLUNG VON
REGENERATIVER
ENERGIEGEWINNUNG MIT
INNOVATIVER
STADTENTWÄSSERUNG

Resource orientated sanitation at district level in Hamburg

Combining the production of renewable energy with innovative urban drainage systems – The *Jenfelder Au* Project

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung
FONA
BMBF

NaWaM
INIS

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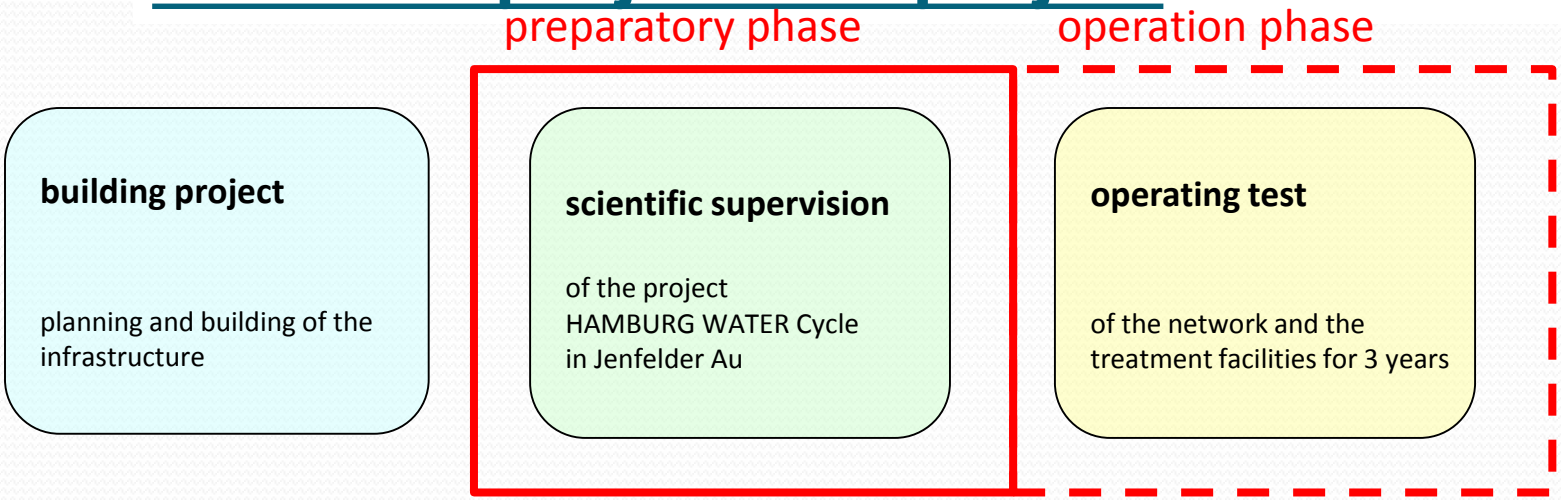
KREIS – a project in a project



Objectives of KREIS:

- scientific supervision of different implementation options of HAMBURG WATER Cycle® combined with heat supply concepts in Jenfelder Au
- support of the planning and building process; support of the treatment facilities' start-up processes including preliminary investigations
- scientific supervision of the operation after the completion of the treatment plants
- project duration: November 2011 until February 2015

Life

Bundesministerium für Wirtschaft und Technologie

Bundesministerium für Bildung und Forschung

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Urban quarter Jenfelder Au

- revitalisation of former army barracks
- 45 ha total area, 35 ha reconstructed
- realisation: 2012 - 2019
- 835 accommodation units about 2.000 inhabitants
- high energy standards
- commercial as well as recreation areas

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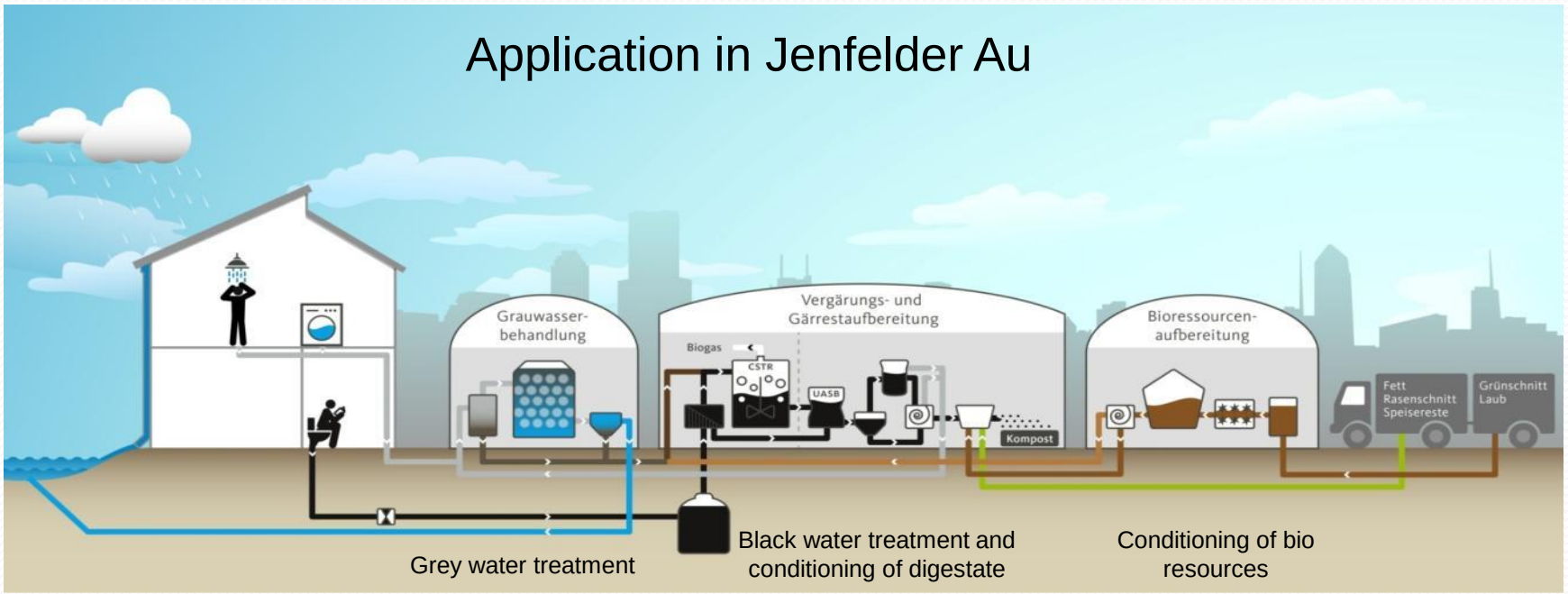
Application in Jenfelder Au



Grey water treatment

Black water treatment and conditioning of digestate

Conditioning of bio resources

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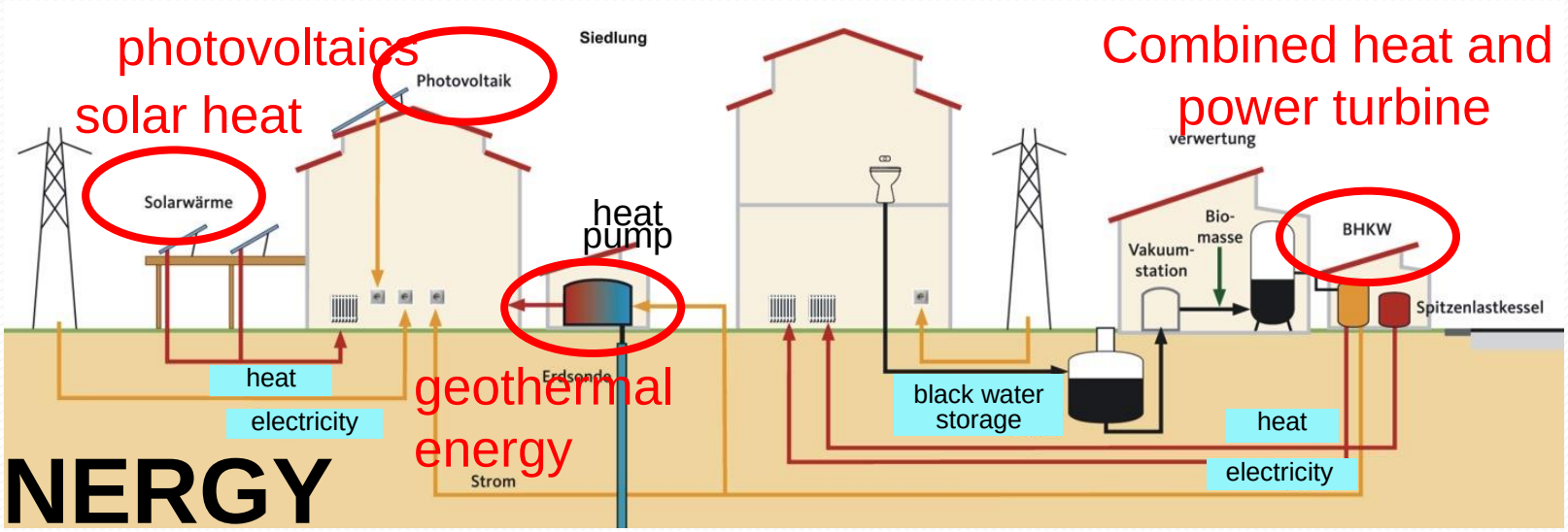
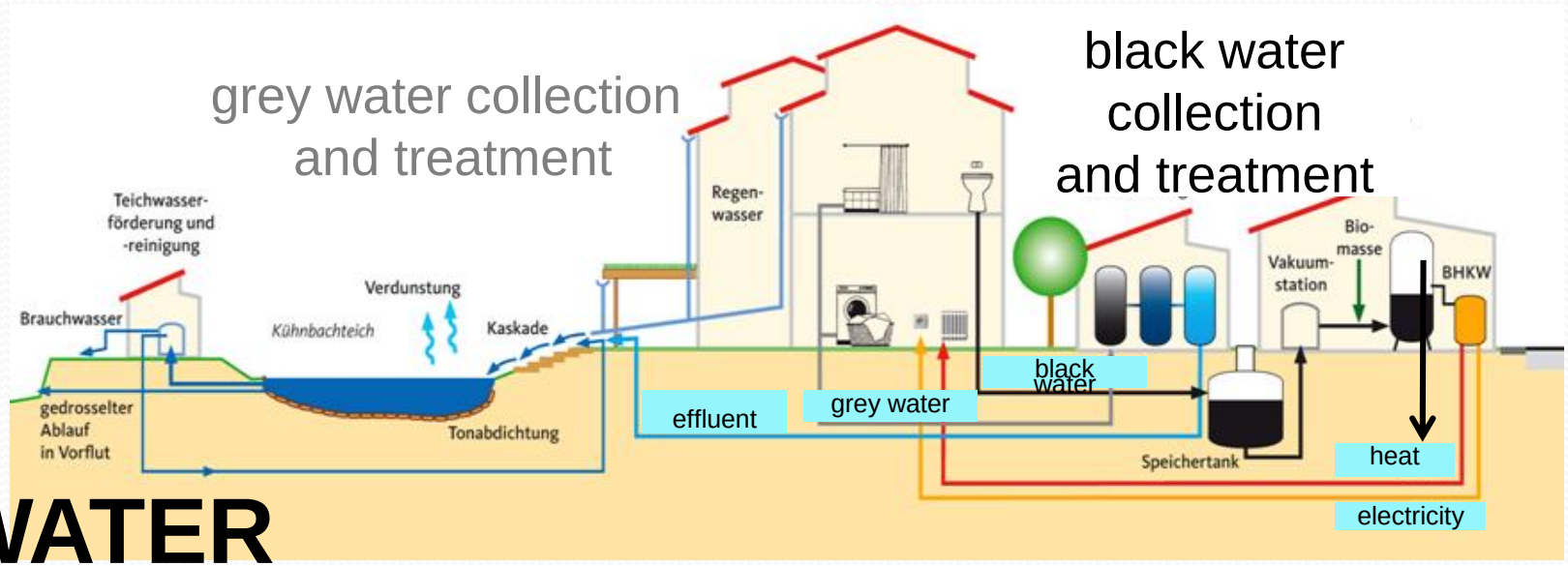


ENERGY



WATER

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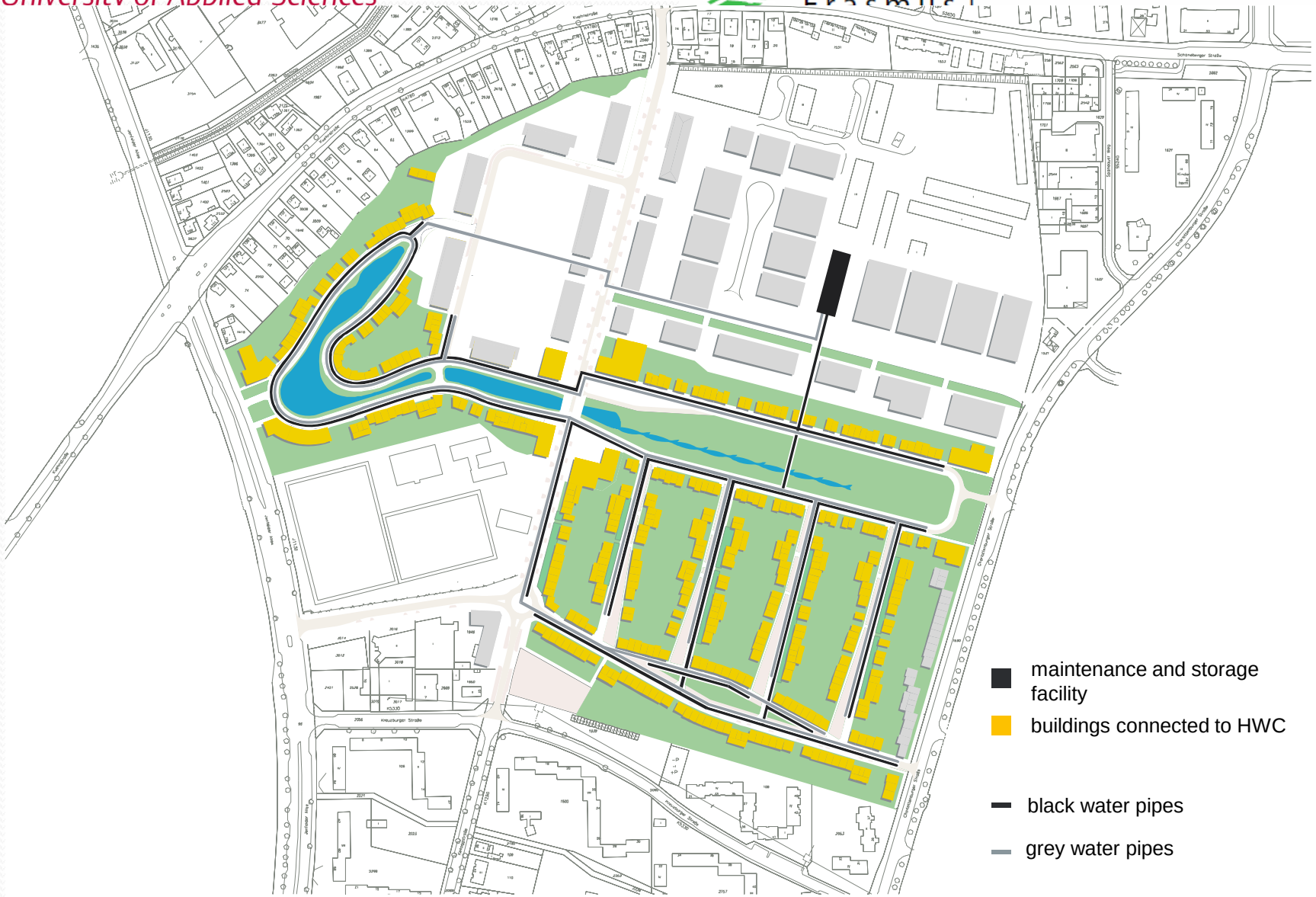

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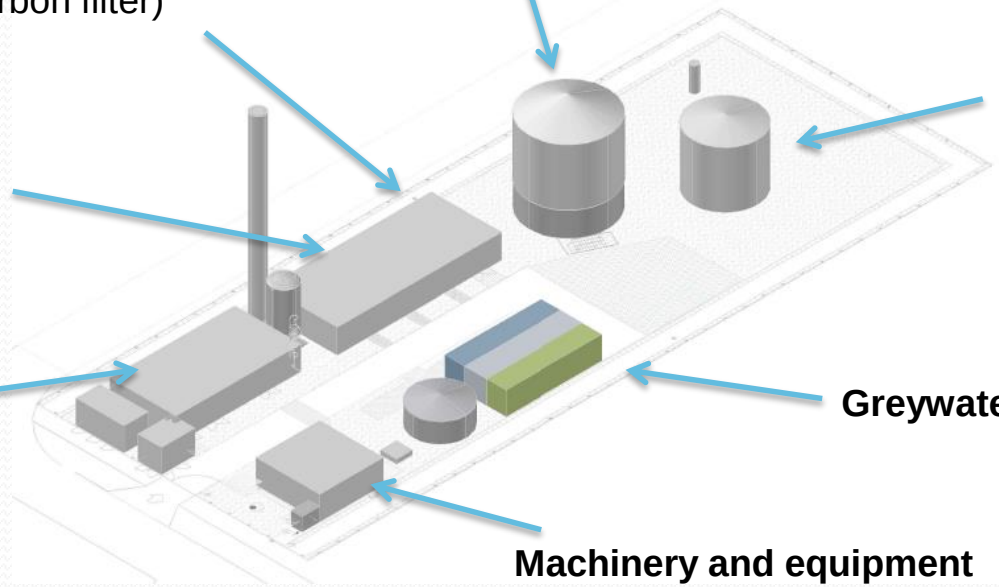
Processing water and solids - Jenfelder Au

Blackwater fermenter
Volume: 750 m³, d= 10 m,
Gas production approx.: 1.380 m³/d

Combined heat and power plant
(2 MGT with altogether 240 kW_{th}, 130 kW_{el};
gas conditioning via carbon filter)



Biogas tank
(400 m³, ca. 50 mbar)

Service building

GETEC AG

Greywater treatment

Machinery and equipment
(incl. blackwater pumping station)

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Jenfelder Au

2009

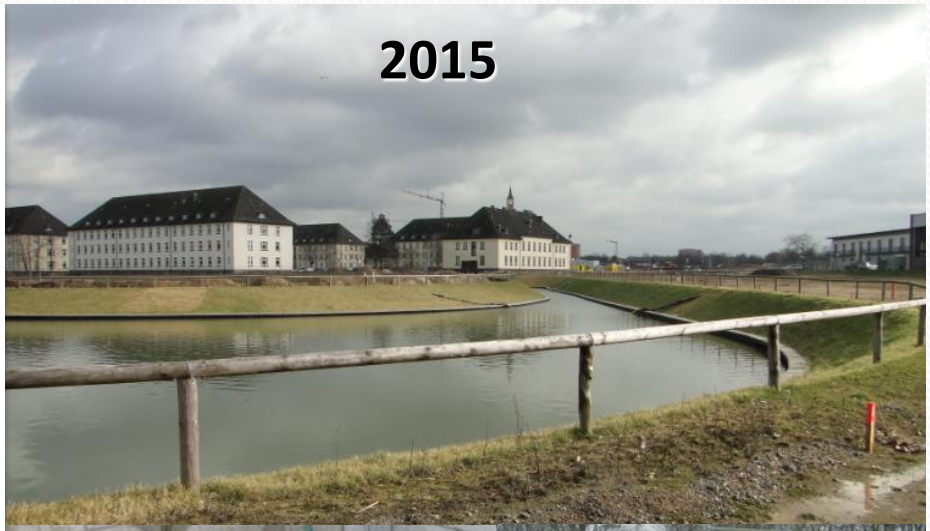
2012

2013

Jenfelder Au

2014

2015



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Jenfelder Au

2015

Conclusions

- KREIS is a new approach related to wastewater disposal and energy supply in urban areas.
- The HWC in combination with local energy concepts will offer different chances for new building projects and housing stocks as well – if the technologies work suitable.
  ➔well-done production, competent operating and public relations are mandatory
- The implementation of new infrastructure systems takes time and patience.
- Small efficiency for the removal of micropollutants
- Transferability in developing and threshold countries not possible

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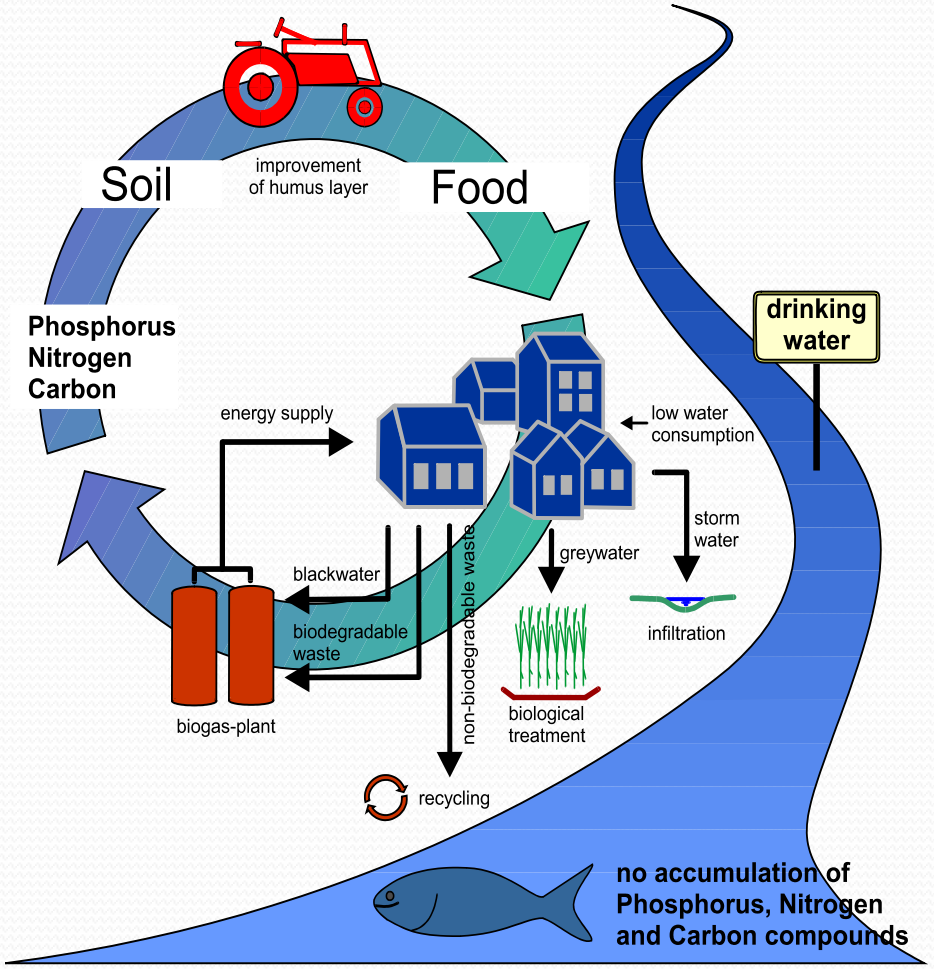
Vision for Sanitation systems



Closing
The Loop!

Thank you for your attention