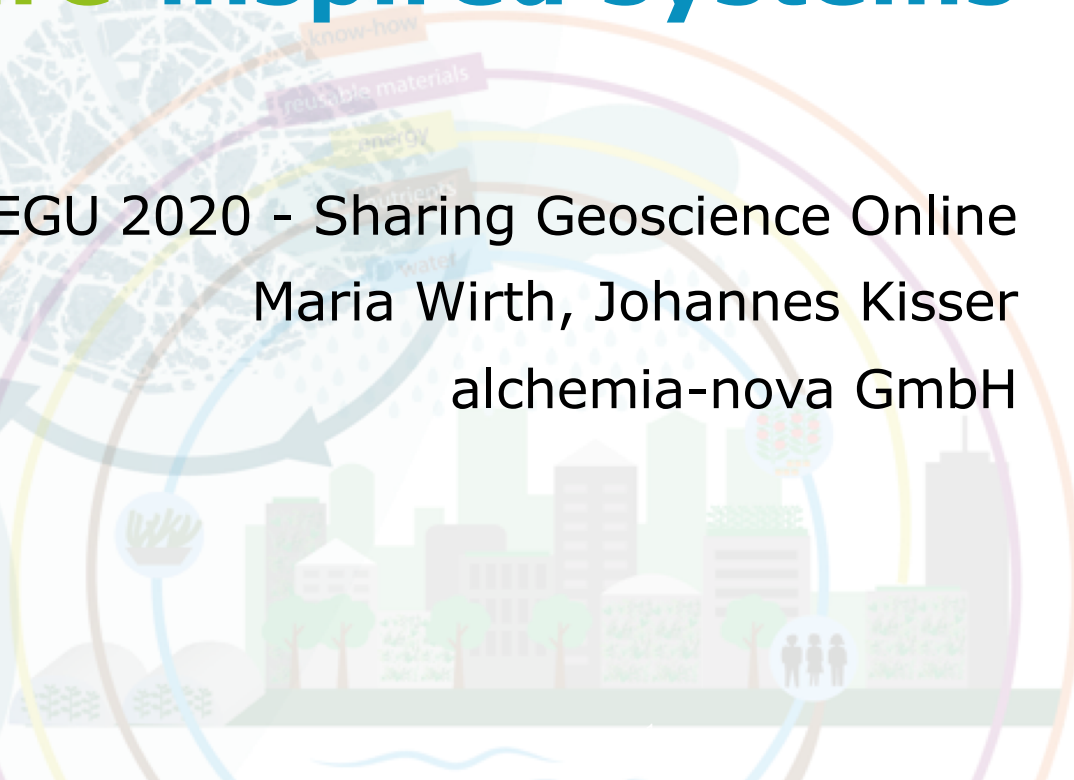


Closing urban resource cycles through **nature**-inspired systems

EGU 2020 - Sharing Geoscience Online
Maria Wirth, Johannes Kisser
alchemy-nova GmbH



circular economy & nature-based solutions

out of the box thinkers

innovative research

About us

- Innovation-driven SME & NPO
- 28 people, HQ in Austria, branch office in Greece
- Cradle to Cradle® partner since 2006



**alchemia
nova**

*institute for innovative
phytochemistry @
closed loop processes*



www.alchemia-nova.net

Expertise

- Nature-based urban sanitation
- Circular economy – strategy development
- Resource recovery with nature-based solutions
- Phytotechnology
- Bio-based materials and cascading utilisation strategies
- Sustainable building with integrated ecosystem services and materials

Current challenges

- Water shortages, climate change
- Carbon footprint of synthetic fertilisers & import dependency
- Topsoil loss
- Pollution, eutrophication
- Resources lost via wastewater
- Urbanisation, urban sprawl



Source: cdn.britannica.com; algae-bloom Dnieper-River, Kiev, Ukraine



Source: the guardian; peri-urban London, UK

Cities are circular economy hotspots

Cities are centres of human & economic activity



material



energy



water



solid waste



waste heat

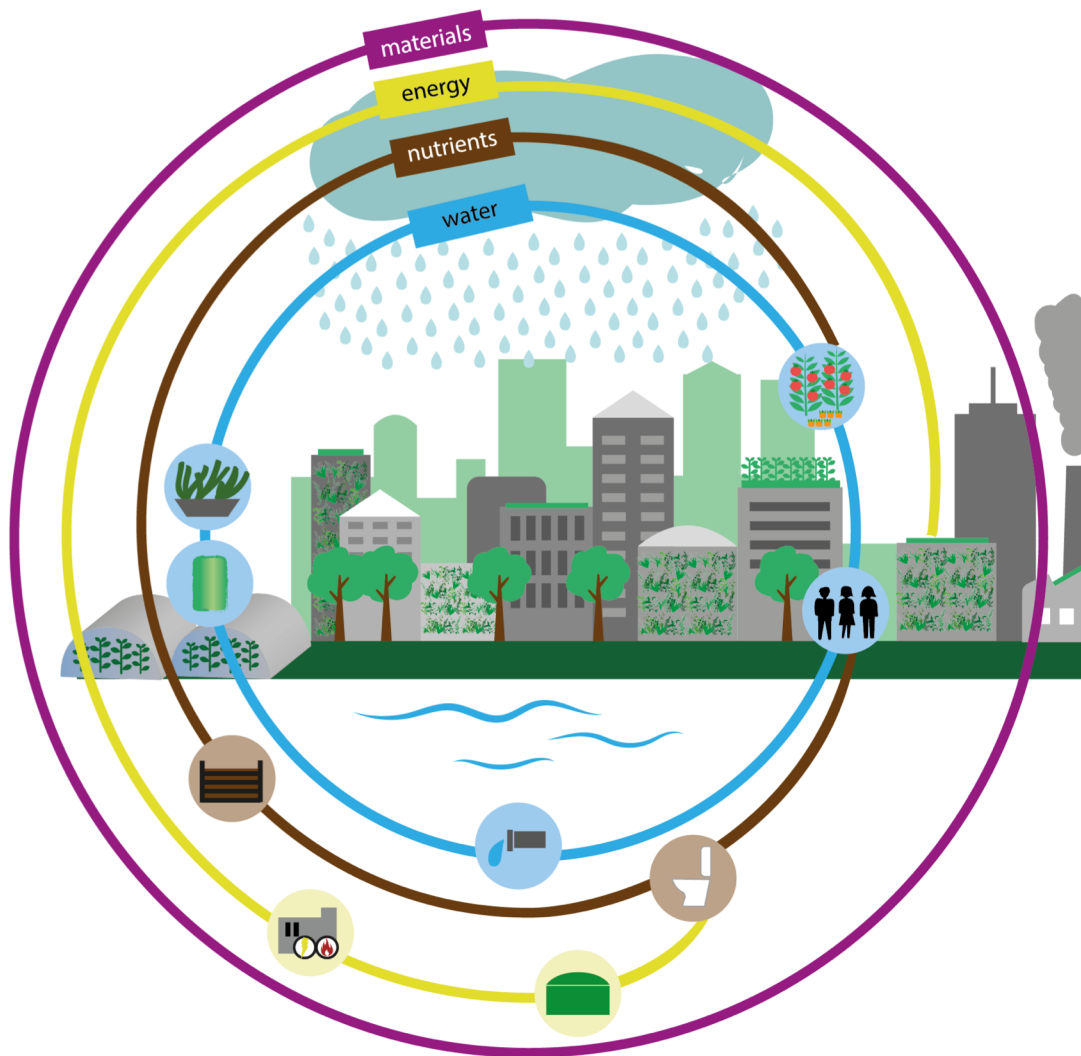


wastewater



Source: iStock by petovarga

Cities as resource turntables



built environment

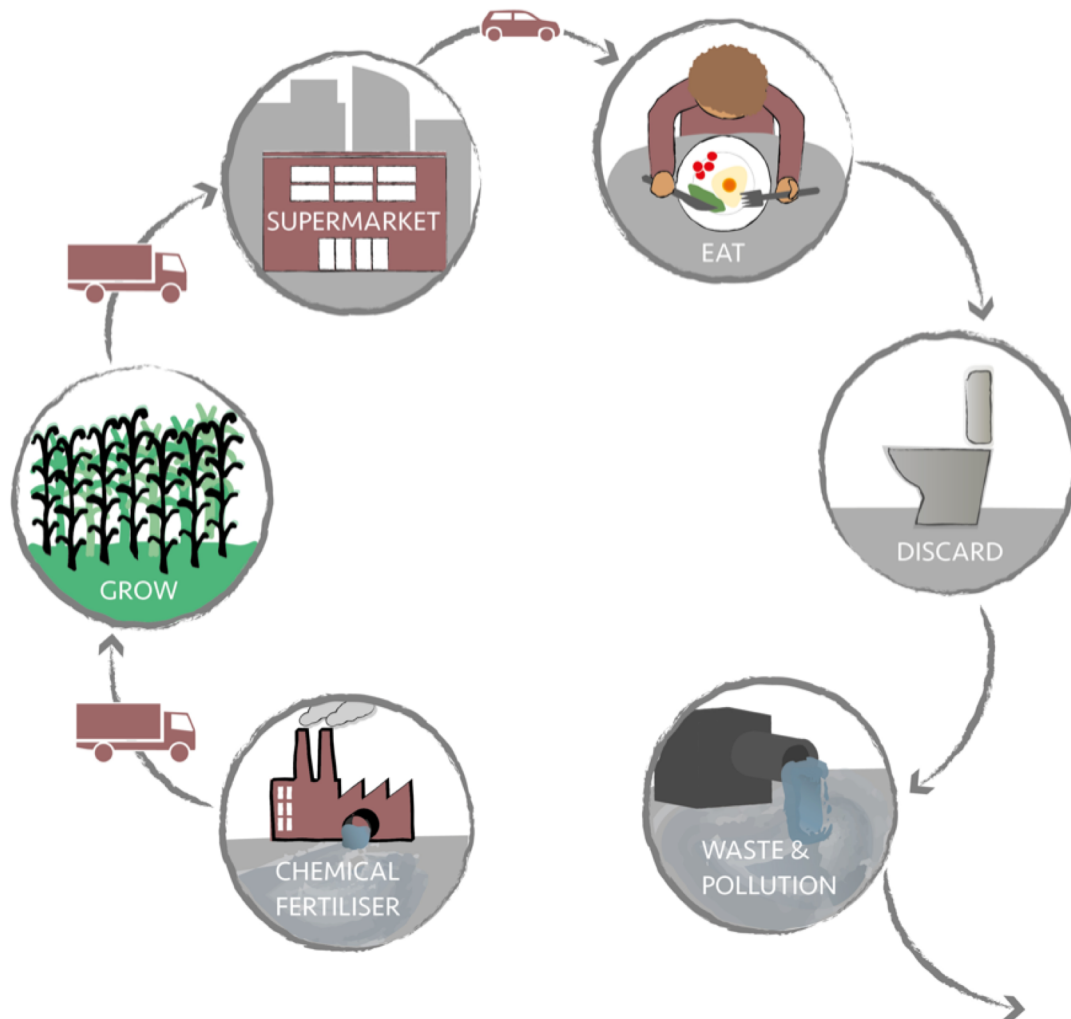


commodities



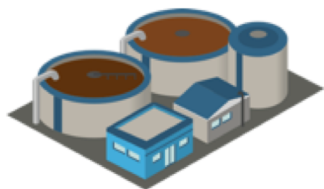
biological cycles

Biological cycles & the food system



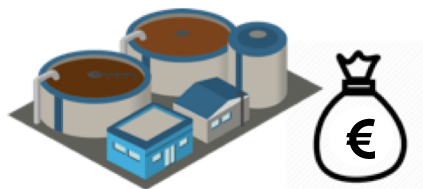
- How can we rethink urban infrastructures to transform cities from resource sinks into circular resource transformation hubs?
- And how can we apply nature-inspired systems to achieve this?

Urban wastewater strategies



Option 1:
Conventional
centralised system,
no resource
recovery

✓ Pollution control



Option 2:
Centralised system
with end-of-pipe
resource recovery

✓ Pollution control
✓ Resource recovery



Option 3:
Decentralised
resource recovery
near the source and
point of reuse

✓ Pollution control
✓ Resource recovery
✓ Energy & material efficiency
✓ Adaptability

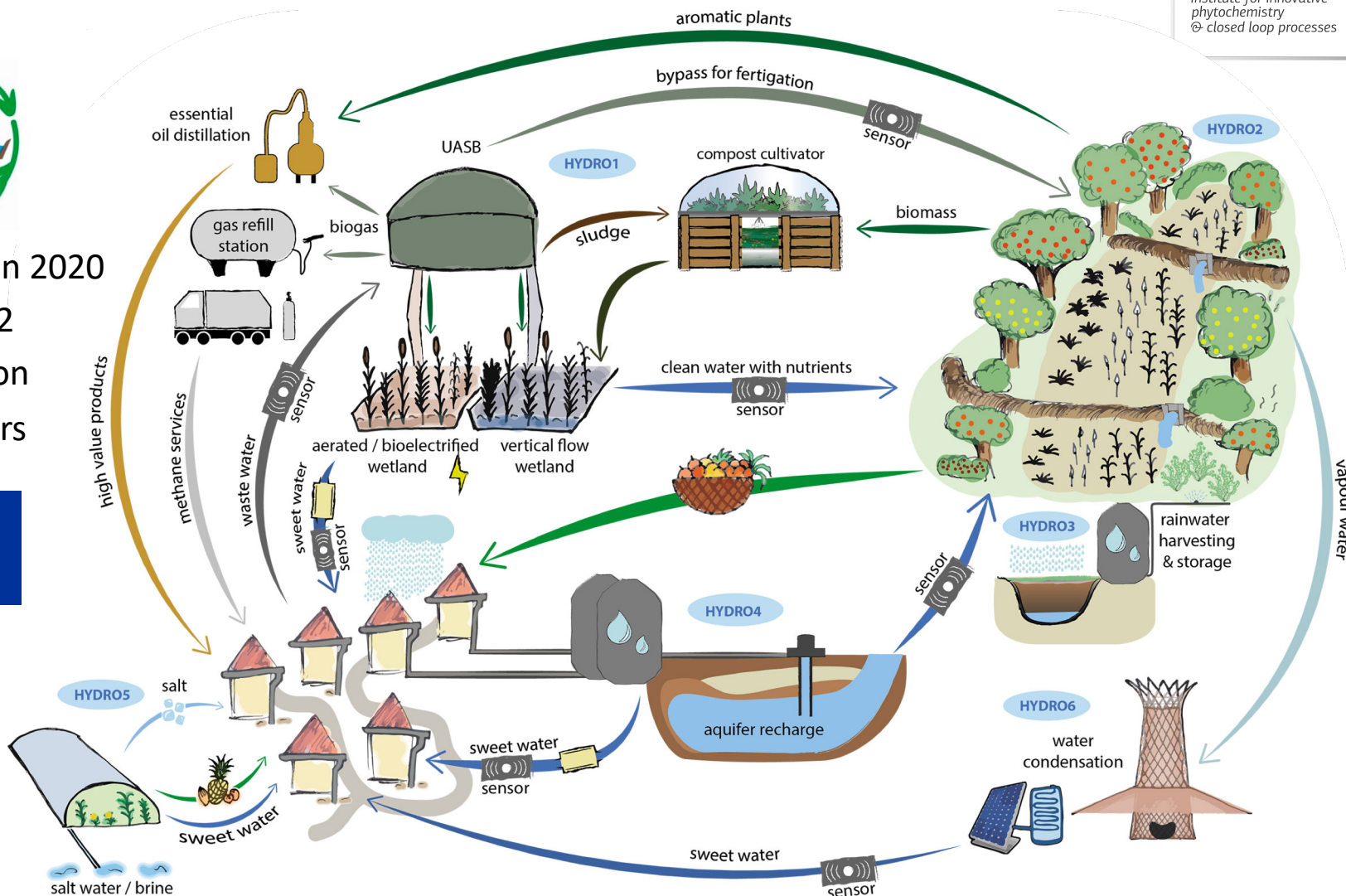
HYDROUSA



EU Horizon 2020
2018-2022
€ 12 million
27 partners



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Using the power of nature-based solutions



HOUSEFUL



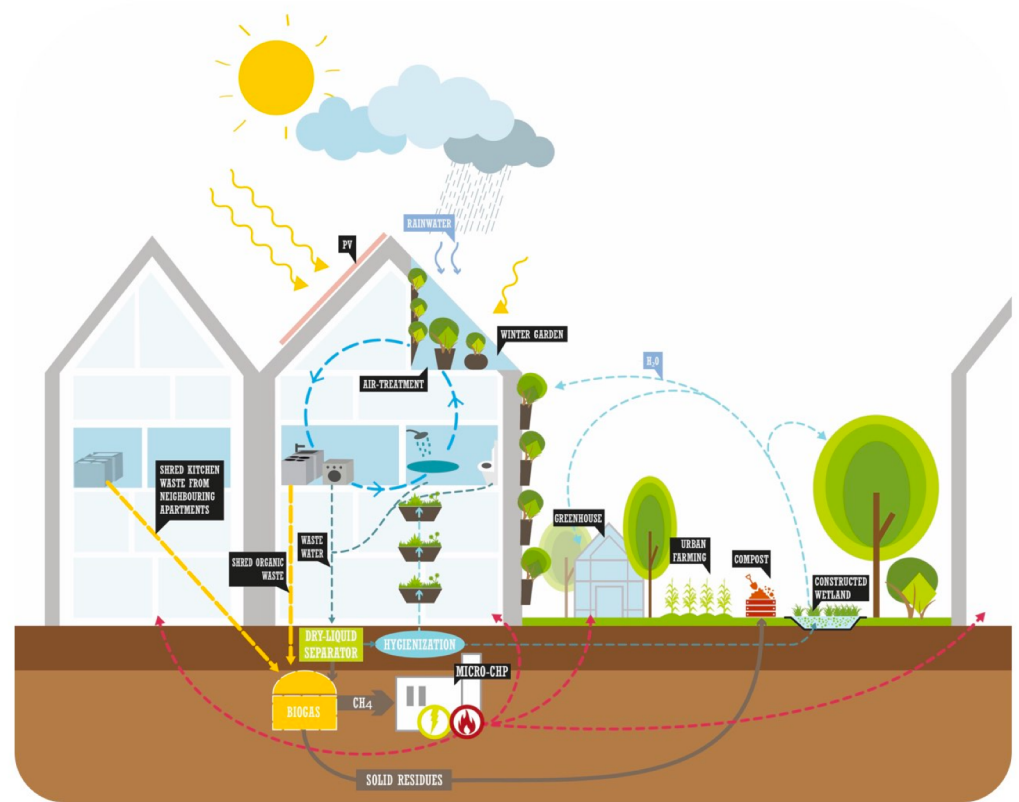
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A building like a tree



William McDonough's Treescraper Tower of Tomorrow



alchemy-nova HOUSEFUL





HOUSEFUL

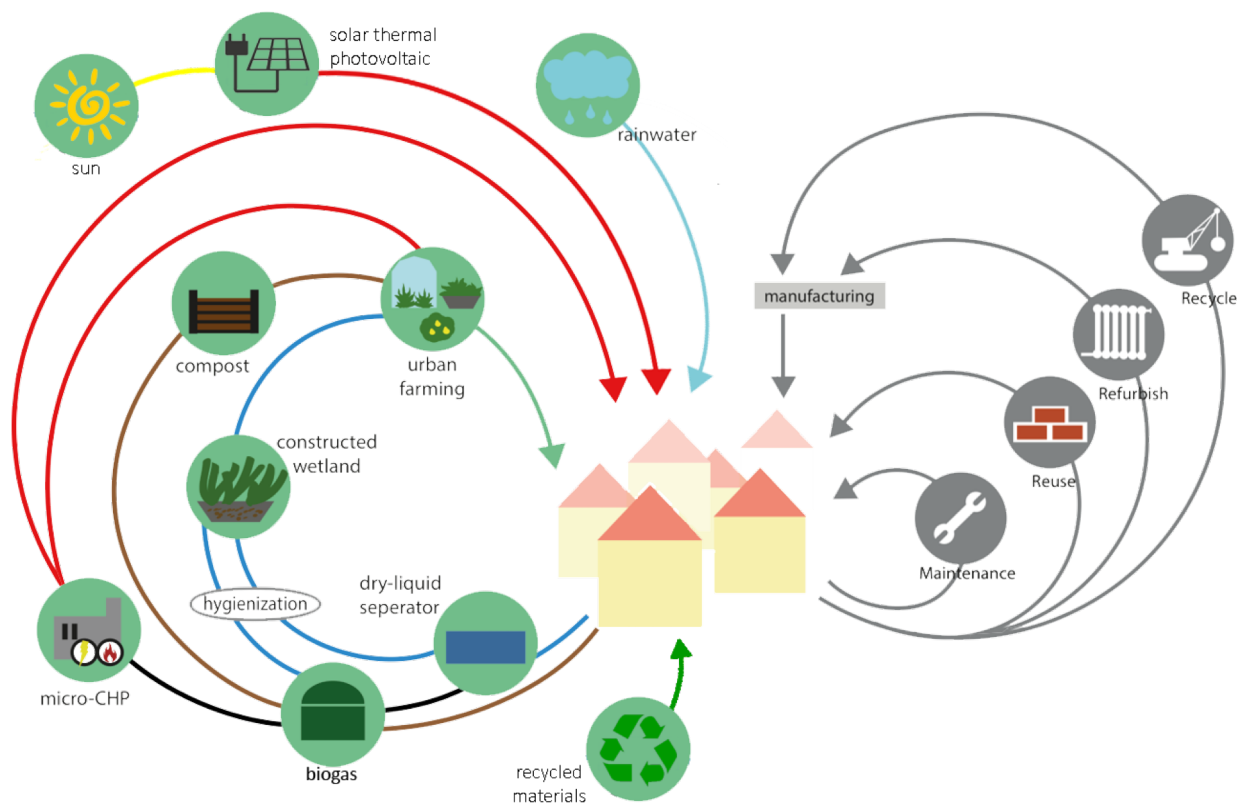
Innovative circular solutions for the housing sector

EU Horizon 2020

2018-2022

€ 8.5 million

16 partners



Holistic



Materials



Water



Waste



Energy



HOUSEFUL organic cycle: Sites in Austria

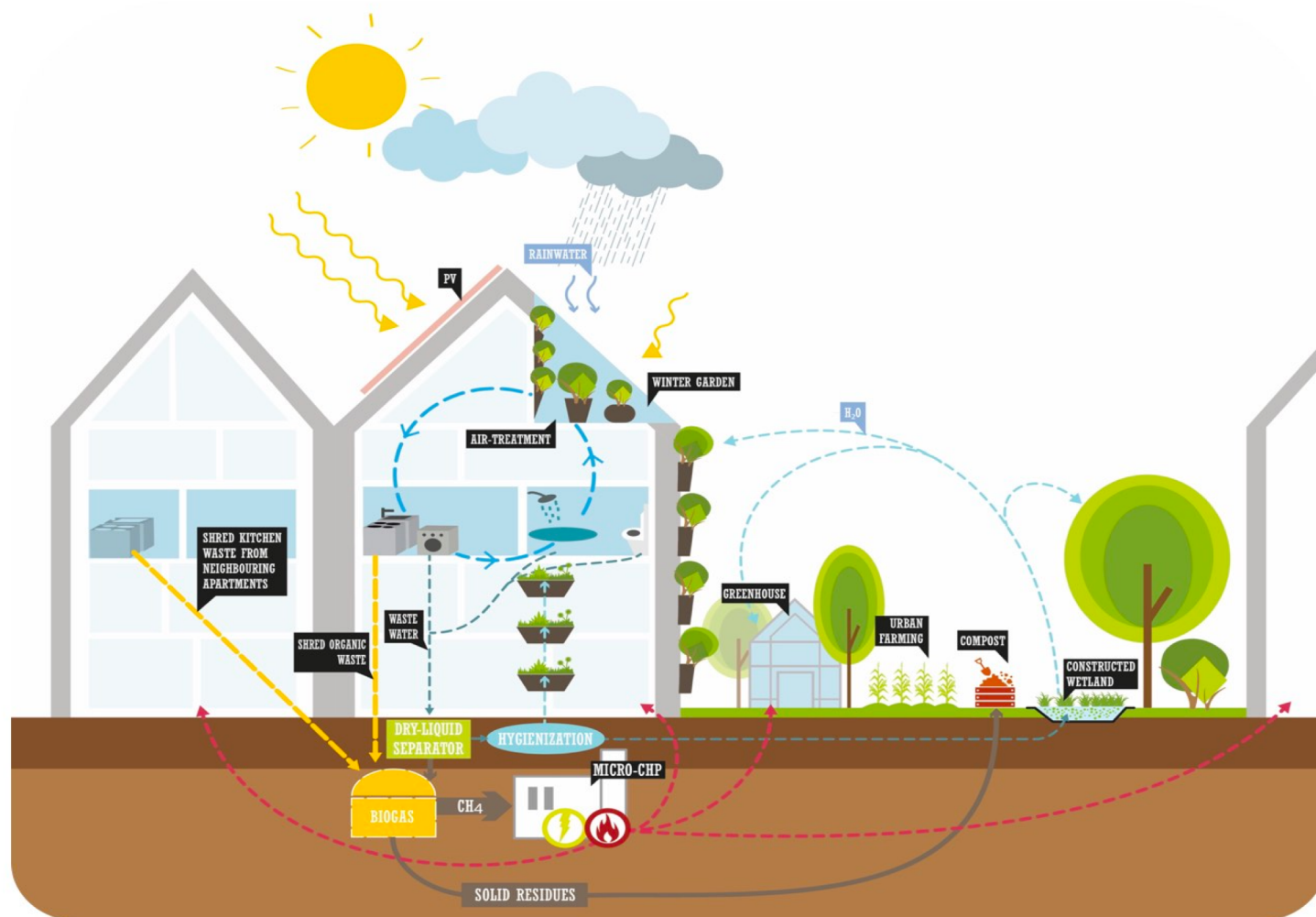
**Central European Centenary
building (1900):**
office, laboratory, apartment
urban, 10 PE

Community building (1960s):
apartments & shared community centre
peri-urban, 28 PE, 50 PE during public events

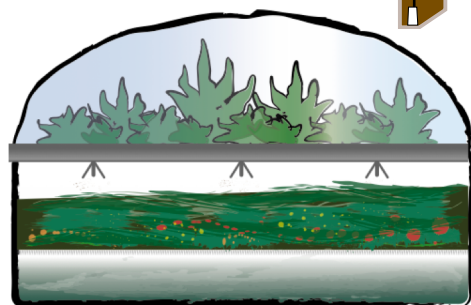
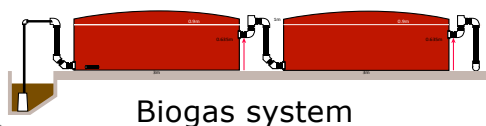
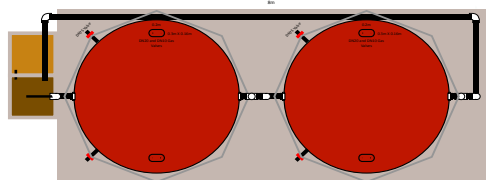
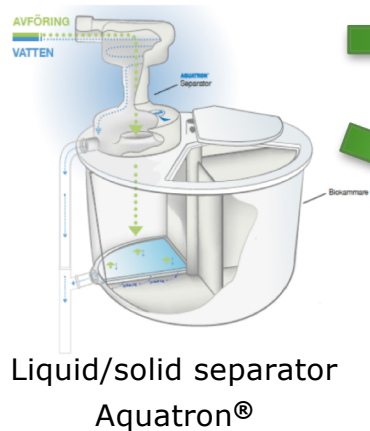
minimal reconstruction
maximum replicability



Closing water, energy and nutrient cycles at building scale



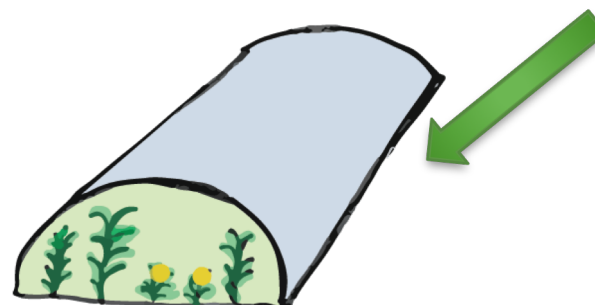
HOUSEFUL technologies for resource recovery



Compost cultivator



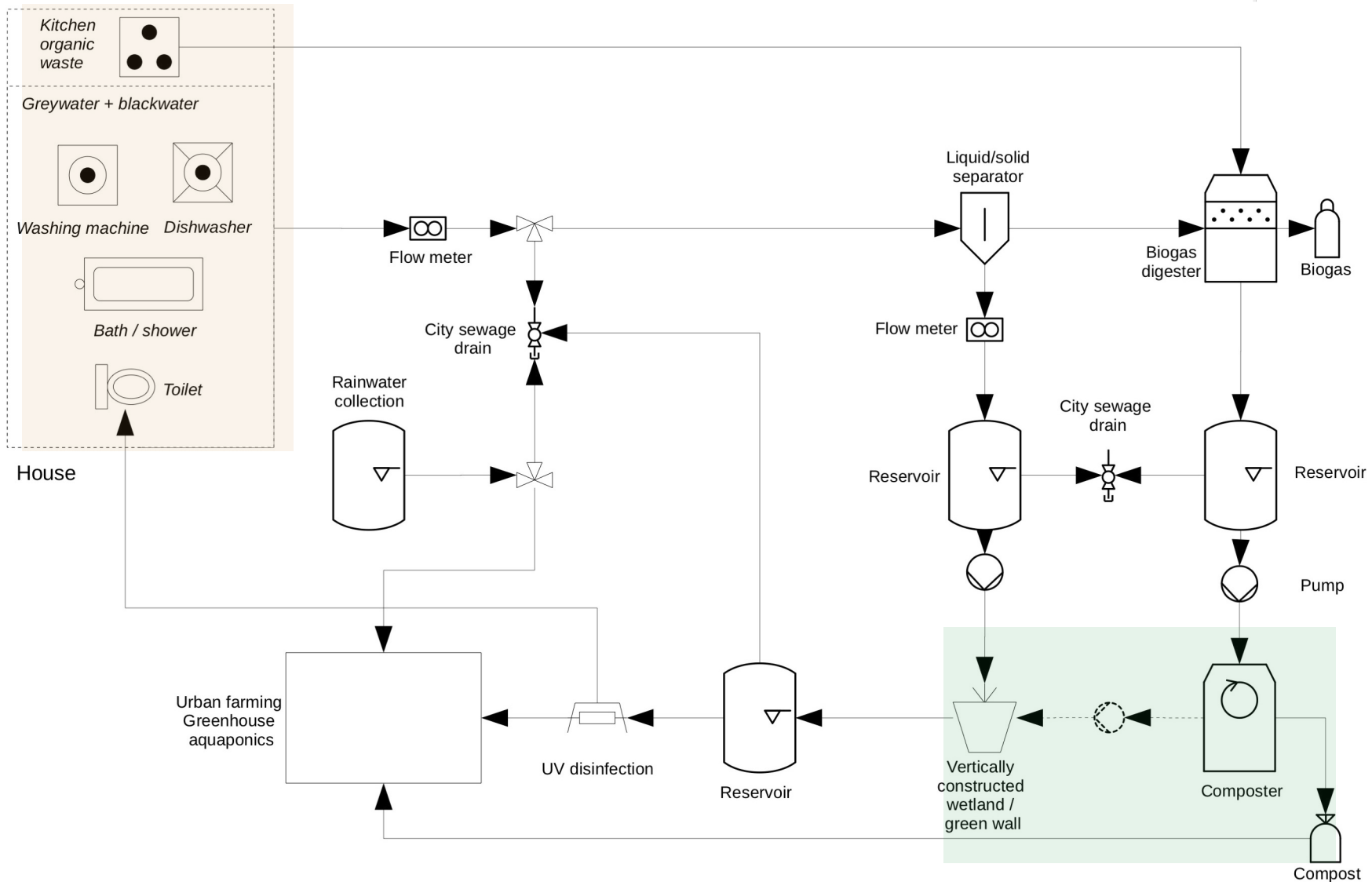
Horizontal sub-surface flow CW in cascading vertical setup with aeration



Greenhouse

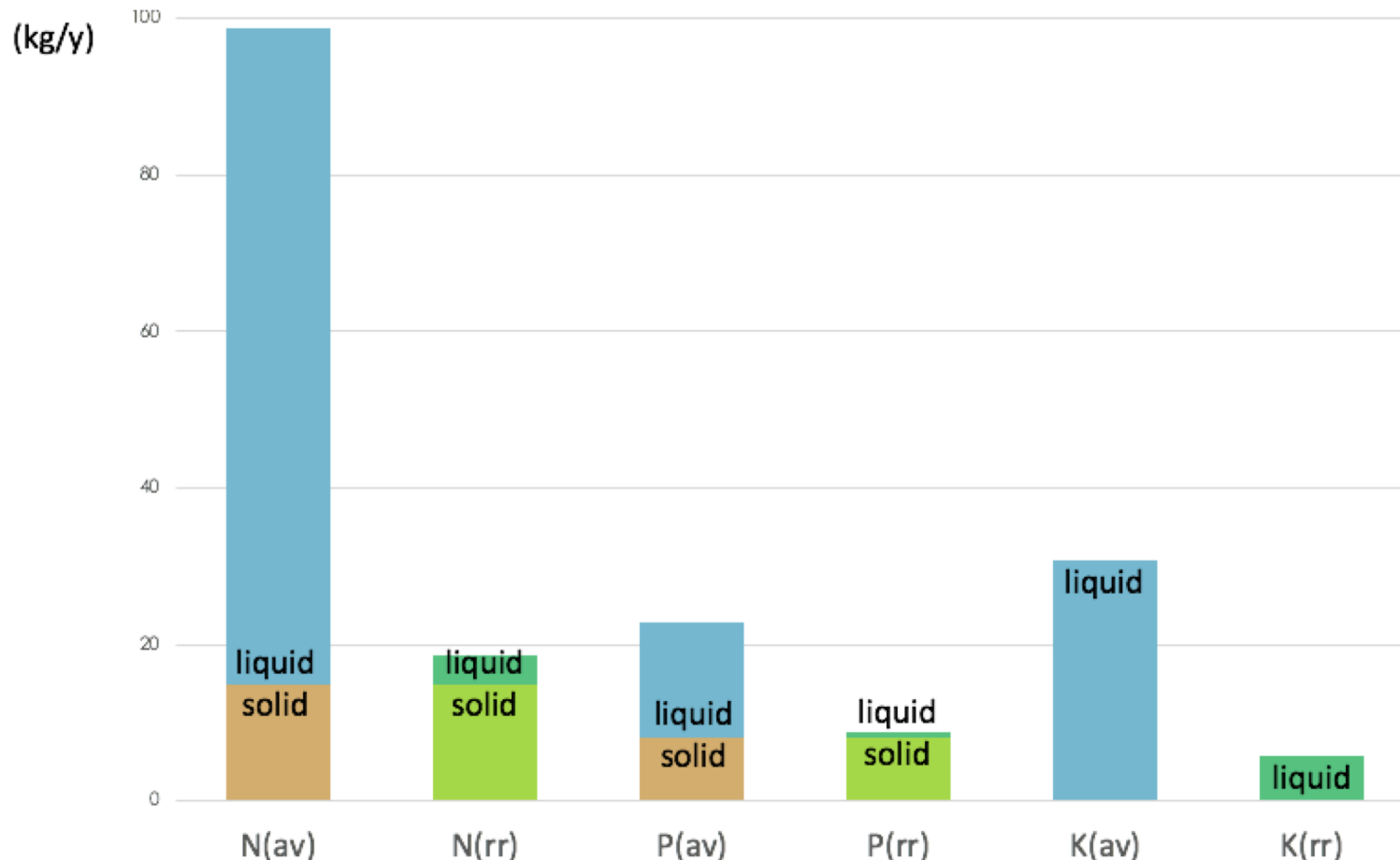


Process configuration



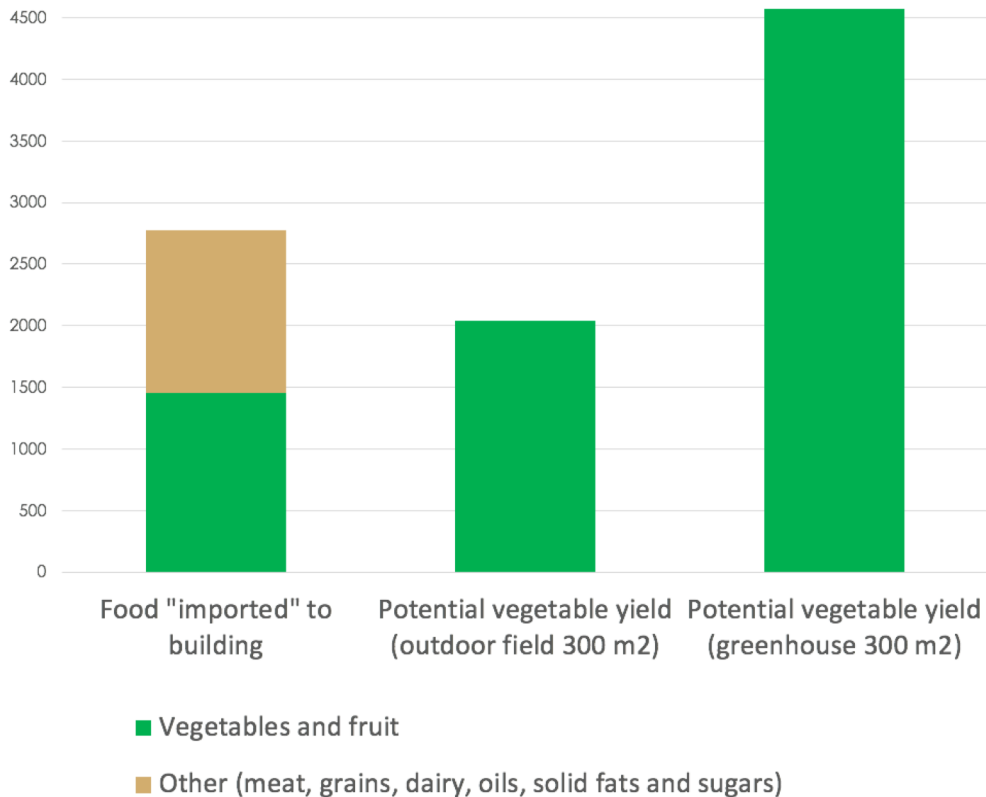
Secondary resource use

Nutrients (N, P, K) that are available in wastewater vs. nutrients that can be recovered and reused from liquid and solid phases of the building's wastewater:



Yield from secondary resources: food

With the vegetables and fruit produced on site,
we can overshoot the current “imports”:

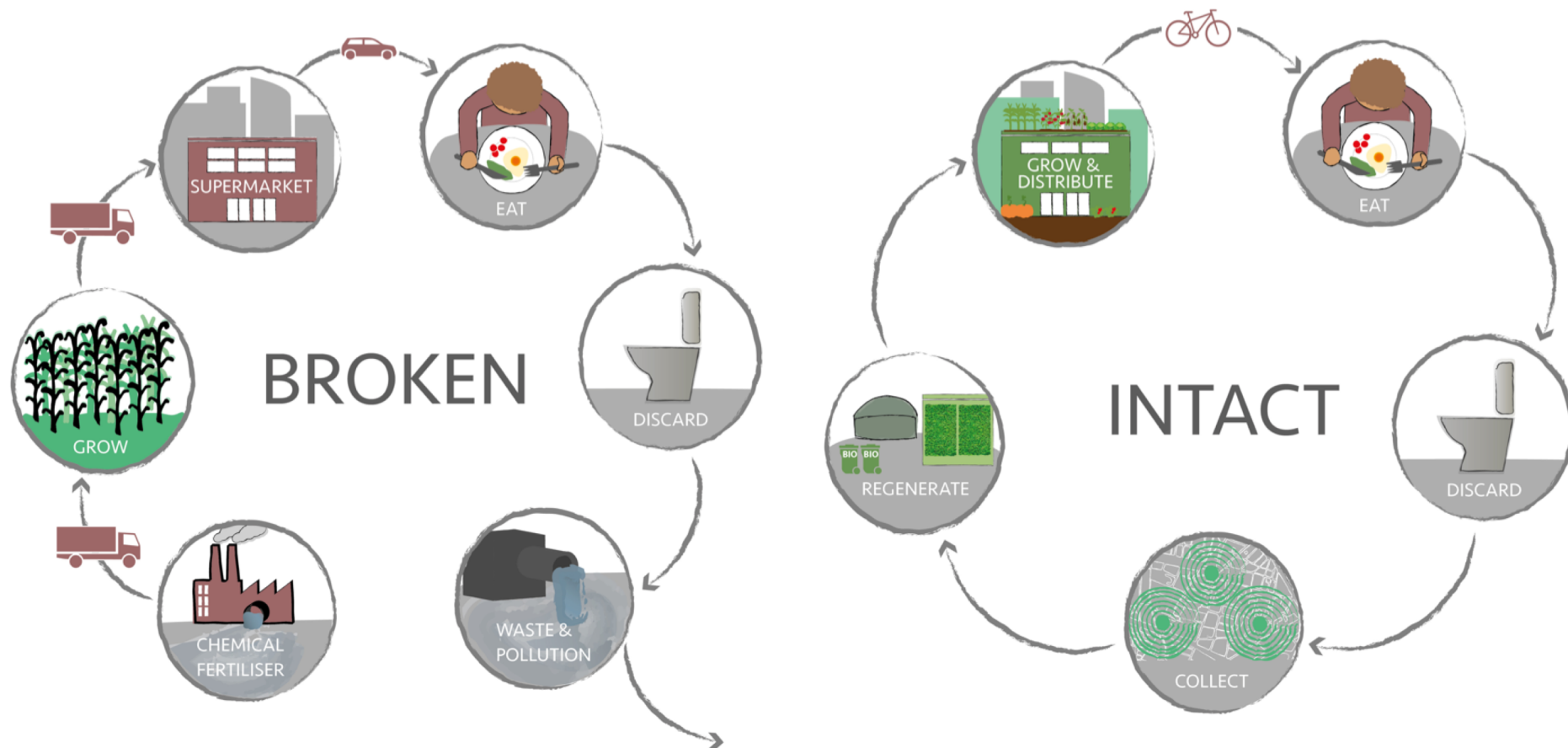


For 70% tomatoes or similar marrow vegetables, 20% salad, 10% herbs

Nearby available area fertigated with excess water and nutrients

Solid fertiliser (compost) distributed to peri-urban farmers

Outlook: an intact food cycle





A city like an ecosystem

source: Agricultura Urbana



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