

# Recovery and utilisation of nutrients for low impact fertiliser



## Circular economy to safeguard food production and water resources

Run4Life proposes decentralised nutrient recovery from domestic wastewater for application in agriculture. This radical change opens a new paradigm in society. The world food supply is entirely dependent on the use of fertilisers. However, current fertiliser production practices are not sustainable. Domestic wastewater is an important carrier of resources, which are hardly recovered in the current centralised wastewater management systems.

Run4Life demonstrates an alternative strategy for improving nutrient recovery, based on a decentralised treatment of segregated domestic wastewater streams and organic kitchen waste at 4 full-scale sites in Europe. Different innovative technologies are combined to achieve this goal. In collaboration with stakeholders, including key end-users as part of the consortium, the resulting fertiliser products will be characterised and the possibilities for their agricultural application will be determined.

End users and other stakeholders along the value chain are fundamental in achieving institutional, legal and social acceptance, as well as the market uptake of Run4Life technologies and products. This will be achieved through an engagement strategy that incorporates measures such as knowledge brokerage activities.

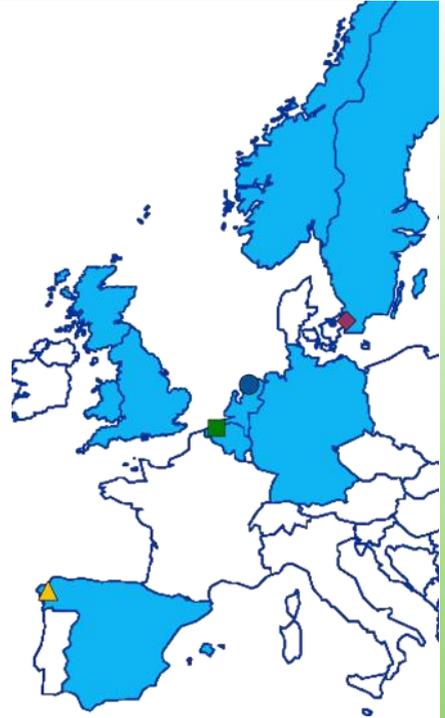


# Demonstration sites

## Full scale demonstrations

Demonstration site Sneek (The Netherlands ●) consists of 32 existing houses for 75-100 people. The focus is on the production of hygienically safe solid and liquid NPK fertilisers in a one-step process: hyper-thermophilic anaerobic digestion (HTAD) of black water. Pathogens are inactivated at the applied temperature of 70°C. The HTAD step is currently undergoing process optimisations. To achieve an increased efficiency of biogas production and nutrient recovery it is important to work with highly concentrated black water. For this purpose novel ultra low flush vacuum toilets have been developed, that are currently being tested in practice before application at the site.

The Vigo demo site (Spain ▲) is an existing business centre (Centro de Negocios Porto do Molle) equipped with separate collection of black and grey waters. All of the grey water produced by the 200 people present in the building is fully treated and reused for toilet flushing. Within Run4Life the treatment plant is extended with a system to also allow resource recovery from the black water, consisting of an Anaerobic Membrane Bioreactor (AnMBR) and post treatment system, obtaining different fertiliser products, biogas and treated water. Part of the liquid effluent will be disinfected for use as a liquid NPK fertiliser, the remainder will be used for struvite precipitation and ammonium nitrate recovery through a bioelectrochemical system.



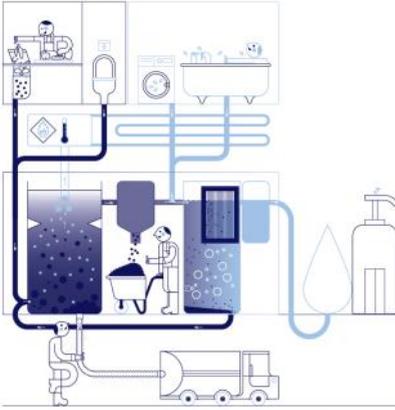
Vigo Porto do Molle business centre (image: ZFV)



Sneek, novel vacuum toilet (image: DeSaH)



# Demonstration sites



Ghent visualisation (image: CEIP)

“De Nieuwe Dokken” (the New Docks) demo-site in Ghent (Belgium ■) will implement the Run4Life concept for 430 houses and a variety of other buildings, serving around 1200 person equivalents. The treatment plant will consist of anaerobic digestion, struvite precipitation and N recovery. The option to recover phosphoric acid from incineration of the anaerobic sludge will be evaluated. The effluent will be further treated together with the grey water, after which the flow will be polished for reuse as process water in a nearby industry (activities outside Run4Life). At the starting phase of the site in

2019, about 20% of the houses will be in use and the city buildings (school, kindergarten, sports facility) open their doors.

In the H+ project in Helsingborg (Sweden ◆) black water, kitchen waste and grey water from 320 apartments and several offices (1800 person equivalents) will be separately collected and treated. The H+ treatment system will be located at the existing Helsingborg sewage plant. Black water and kitchen waste will be treated in separate anaerobic digesters optimised for each specific flow. Struvite and ammonium sulphate will be obtained from the black water digestate, to be mixed in different ratios with hygienised sludge from the kitchen waste digestion. In this way tailor made fertilisers will be produced. Currently the three separate sewage lines have been implemented and the grounds are being prepared for construction.

All four demosites take part in educational and awareness activities, as those are of key importance for the social and market acceptance of the Run4Life concept. This includes e.g. guided tours and the educational showroom that will be implemented together with the treatment plant at H+.

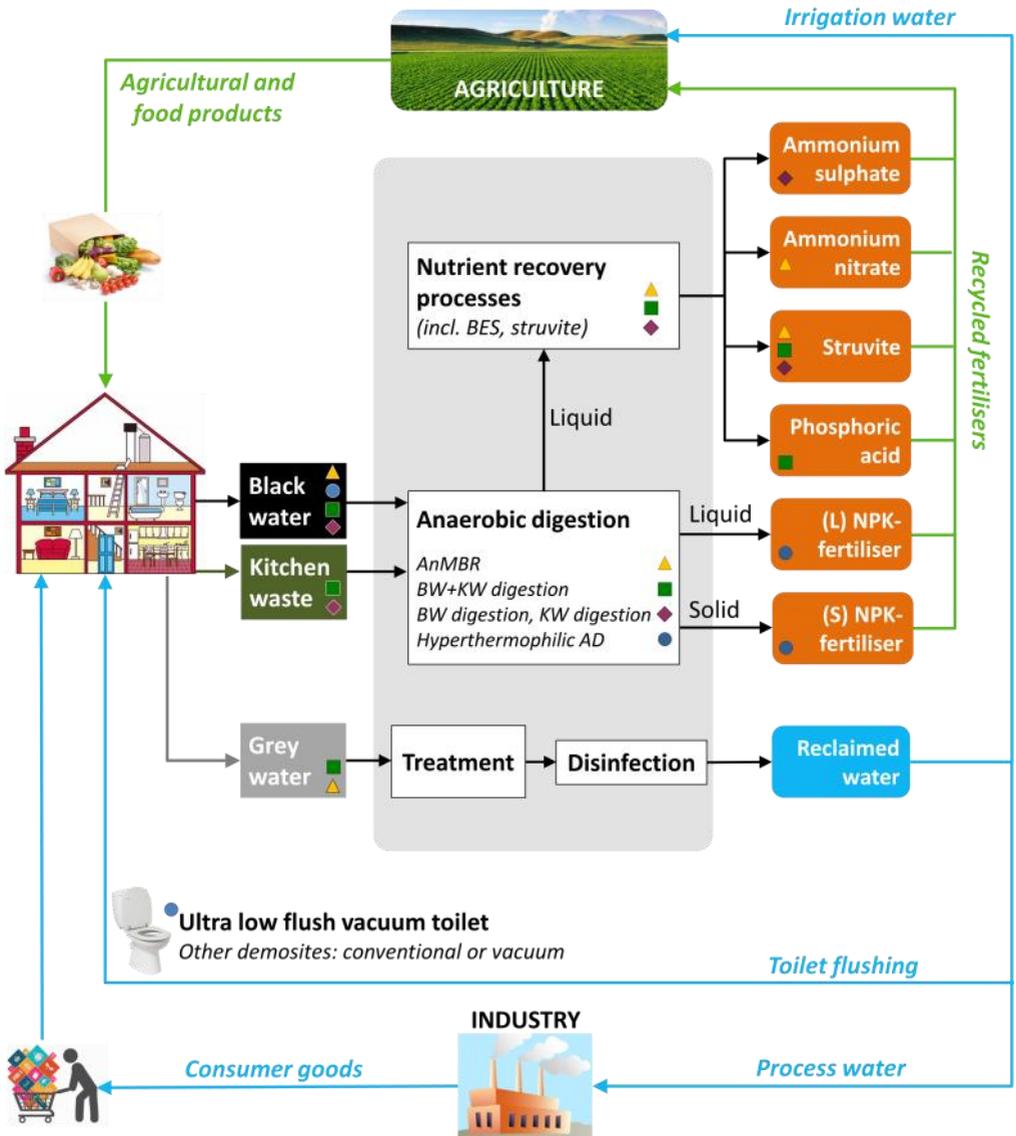


H+ site and triple sewage system (image: NSVA)

# Technologies and products in Run4Life

The schematic diagram below shows the most important elements of the Run4Life concept and their implementation at the four full-scale demonstration sites. The applied technologies and recovered fertiliser products vary between sites.

- Sneek
- ▲ Vigo
- Ghent
- ◆ Helsingborg



# Demonstrated at large scale at 4 sites in Europe

## ● Sneek, The Netherlands

- » Existing neighbourhood of 32 houses (75-100 people)
- » Ultra low flush vacuum toilets for production of highly concentrated black water, developed in the first phase of the project.
- » Hyper thermophilic anaerobic digestion at 70°C aimed at obtaining safe solid and liquid fertilisers in a one-step energy positive treatment.
- » Recovery of hygienised organic liquid and solid (NPK) fertilizer.

## ▲ Vigo, Spain

- » Existing business centre, currently 200-250 people.
- » Flush toilets receiving treated grey water (recycling system already present).
- » Black water treated in anaerobic MBR
- » Nutrient recovery technologies: bio-electrical systems for the recovery of ammonium nitrate and struvite precipitation.
- » Integrated value chain with online monitoring tool.

## ■ De Nieuwe Dokken / Ghent, Belgium

- » Redevelopment district in old harbour area, currently being built.
- » The Run4Life concept will be implemented for approx. 1200 p.e. (400 living units, offices, commercial area, one school, sport complex). Vacuum toilets will be used.
- » Concentrated black water + grinded kitchen waste will be processed in an anaerobic digester, followed by the recovery of struvite, phosphoric acid and N-fertiliser.
- » Grey water to be treated for industrial reuse (not included in Run4Life).

## ◆ H+ / Helsingborg, Sweden

- » The Run4Life concept is part of the H+ urban renovation project, to be implemented for 320 apartments (1800 people). Vacuum toilets will be used.
- » Separate collection and treatment of black water, grinded kitchen waste and grey water.
- » BW and KW will be treated in separate anaerobic systems for energy recovery and subsequent nutrient recovery (struvite and ammonium sulphate).
- » Additional facilities: a technology testbed and showroom for visualisation and education.

# Objectives

The Run4Life project works towards the following results, that can be translated into the main objectives shown in the diagram on the right:

- » Decrease dependence on primary nutrient resources and increase European resource security.
- » Reduce the adverse effects of nutrient emissions on the environment.
- » Closing water and nutrient cycles throughout the production and consumption value chain.
- » Improve the quality of collected data on nutrient flows to support investments in the recycling of recovered nutrients.
- » Create new business opportunities in the EU, to generate new green jobs and export industries around the recovery and recycling of nutrients, contributing to the exploitation of innovative solutions in the global market.
- » Improve policy and market conditions in Europe for large-scale deployment of innovation, providing evidence-based knowledge on the framework conditions that facilitates a wider transition to a Circular Economy in the EU.

Within the objectives of the project, it is essential to ensure that the treatment systems developed by Run4Life, as well as the products obtained, are safe and of a consistent quality, environmentally friendly, socially accepted and techno-economically viable.

**RUN4LIFE aims to:**

Improve innovative nutrient recovery technologies

Demonstrate large scale nutrient recycling from domestic wastewater

Evaluate impacts on environment, society and economy

Promote full product acceptance and review legal framework

Implement a value chain for the products, including new business models

# Impressions



*June 2017: Kick-off meeting at DeSaH headquarters in Sneek, the Netherlands*

*The Run4Life Stakeholder Engagement Workshop at the IFAT trade fair, May 2018 (image: Aqualia).*



*The EU Road Trip Project visited the Vigo desmitte to learn about resource recovery from wastewater. Read more on [roadtripproject.eu](http://roadtripproject.eu) (image: Aqualia).*



*Visionary image of the finished first area of H+ in Helsingborg (image: NSVA)*

## A joint force of 15 well-matched partners

The Run4Life consortium represents the entire value chain, consisting of universities, research centres, technology providers, public utilities, end users, experts in social sciences and specialists in innovation and market uptake of new technologies. This optimal combination of partners increases the market success of the proposed solutions and enhances social acceptance.

