

This report has been submitted to the EC for approval and as such it is still to be considered as draft

Construction-, monitoring-, or demonstration-activities at demonstration plants



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# Summary

The following report refers to D1.18 of Systemic project: "Construction-, monitoring-, or demonstration-activities at demonstration plants".

The report, compiled in collaboration with the 5 demonstration plants, includes a descriptive chapter for each of them.

In regard with Groot Zevert Vergisting, the status of planning and construction is described for both RePEat and GENIUS processes. Moreover, the demonstration activities organized in the past year and foreseen for the next year are also outlined.

For AmPower, Acqua & Sole and Rika Biofuels, the planning of engineering and construction is described, including an explanation for delay.

Finally, the implementations conducted at Benas installation are reported, and the pathways for further implementation that are under investigation are also summarized.

# 1 Groot Zevert Vergisting

Within the SYSTEMIC project, demonstration plant Groot Zevert Vergisting (GZV) will implement a P-recovery unit, called RePEat, for the separation of a SF of digestate into a phosphate-fertilizer with a high inorganic P content (calcium phosphate) and a soil improver with a low P content (high C-P ratio). This novel technological approach has been developed by Wageningen UR (WUR) in close collaboration with GZV and Nijhuis Industries (NI). Engineering, construction and optimization of the RePEat installation will again be a joined task of WUR, GZV and NI. Besides that, and apart from the Systemic budget, GZV will implement a membrane installation called Genius for the production of NK concentrates and clean water out of the LF of digestate. GZV, WUR and NI will deliver monitoring data of the digestion plant including the digestate treatment technologies RePEat and Genius.

This document gives a brief overview of last-years activities as well an outlook to activities foreseen in the second year of the SYSTEMIC project.

## 1.1 Status and planning of construction and monitoring activities

### 1.1.1 RePEat – treatment of the solid fraction of digestate

During year one of the SYSTEMIC project major progress has been made on the engineering and optimization of the RePEat process based on experiences gained at the pilot installation and additional laboratory tests. The process has been further optimized based on new insights after market research in which potential customers, including fertilizer producing companies (ICL Fertilizers) and farmers, have been contacted. One improvement includes a significant reduction of the organic matter content of the recovered calcium phosphate allowing it to be used for the production of mineral fertilizers at e.g. ICL fertilizers. Another improvement includes a change in one of the separators which allows GZV to produce a more dryer and coarser organic fibres of the soil conditioner which possess physical characteristics that are very similar to peat. Construction and start-up of the RePEat plant is foreseen to last from November 2018 until January 2019. Early 2019, the RePEat installation will be ready to use for testing purposes.

### 1.1.2 GENIUS – treatment of the liquid fraction of digestate

In 2016, GZV envisaged to invest into the GENIUS-Total concept which includes a decanter, DAF, N-stripper and reverse osmosis for the production of ammonium sulphate (AmS) fertilizer and concentrated K fertilizer. In 2017, after more thorough market research, it became clear that there are better market opportunities and business case for NK concentrates as compared to AmS fertilizer. It has therefore been decided to take out the N-stripper for the moment and to invest into the GENIUS concept which produces NK concentrates through a combination of flotation, micro- and nanofiltration and reverse osmosis. Commission of the GENIUS system will take place in December 2018. In January 2019 and onwards, the technical performance will be tested and full scale monitoring of the GENIUS system is foreseen.

### 1.1.3 Planned process scheme of the demonstration plant and planned activities

Figure 1 gives an overview of the whole process scheme of the NRR scheme. Table 1 shows the timing schedule of the upcoming activities, including monitoring.

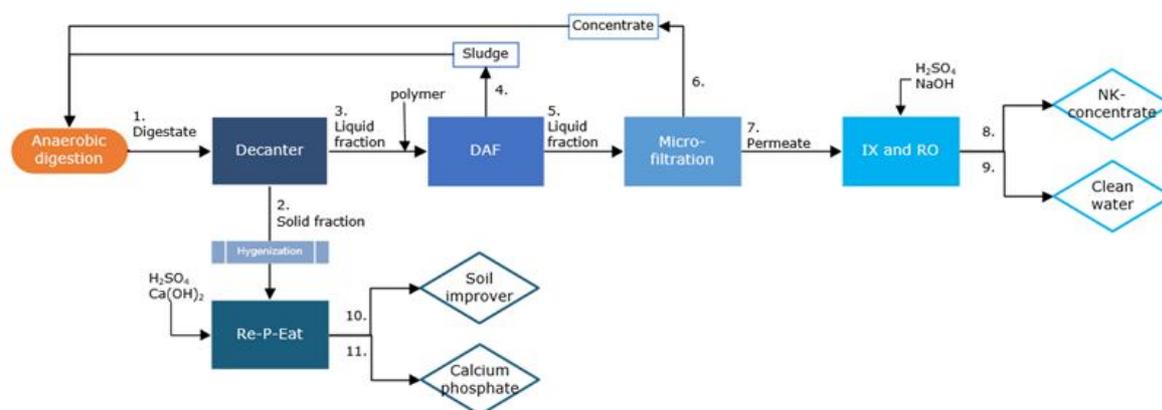


Figure 1. Final process scheme of demonstration plant Groot Zevert

	2018										2019									
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
<b>P-recovery</b>																				
Engineering	█																			
Construction and installation																				
Commissioning																				
Optimalisation tests and monitoring																				
<b>Genius</b>																				
Engineering	█																			
Construction and installation																				
Commissioning																				
Technical performance tests																				
Optimalisation tests and monitoring																				

Table 1. Planning of engineering, construction and testing of RePEat (P-recovery) and Genius (NK concentrates) at the Groot Zevert demonstration plant

## 1.2 Monitoring activities

Monitoring activities in the first year of SYSTEMIC included monitoring of the biogas production, electricity production and digestate production and tests with the pilot installation relevant for the pre-engineering phase. The data of the biogas production will be converted into yearly-average numbers and will serve as a baseline scenario. Monitoring activities on the AD-plant, including GENIUS and RePEat, will start in 2019. This will include monitoring of the mass- and energy balances, consumption of additives and product quality.

### 1.3 Demonstration activities at the demo plant GZV

Since the start of the SYSTEMIC project, there have been over 15 plant visits and demonstration activities held for various target audiences. All these plant visits included a tour over the anaerobic digestion plant and presentation of the upcoming nutrient recovery technologies. Among these activities were an open day for people from the region (2000 visitors), an open day for farmers and engineers (75 people) and the plant visit organised by the ManuResource conference (>80 people). The complete list of all demonstration activities at GZV is included in the dissemination report.

Demonstrations included presentations of the approach and running of the pilot installation at the open days of Groot Zevert Vergisting (2000 people from region, stakeholders). Presenting SYSTEMIC for farmers and manure treatment companies (Groot Zevert) (75 people). Several presentations for visitors during small meetings at GZV like Deputy of the province Noord-Brabant.

Next year's demonstrations will include:

- Main event 2019: Open day of the built NRR installation at GZV (mid 2019) in collaboration with WUR and NI
- Several small presentations for visitors at GZV (requests from several stakeholders, manufactory, end users of products, etc).

## 2 AmPower

AmPower has defined all the technical specification for the installation of the new evaporator, however, they still need to define the financial part. It was planned to have ready the first part of the evaporator by July 2018, but at this moment September/October 2018 is seen as a more feasible date. The start-up of the evaporator is foreseen around November/December 2018 and based on the results it will be decided which improvements will be necessary.

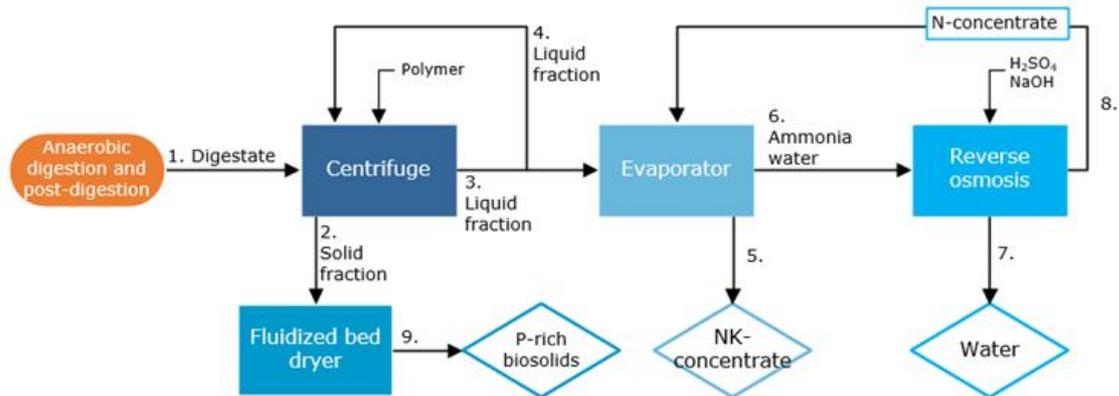


Figure 2. Final process scheme of demonstration plant AmPower

### 3 Acqua & Sole

Acqua & Sole will implement and demonstrate a novel N recovery absorber which enables higher N recovery from digestate. The investment for the N absorber amounts to 0.4 M€.

The designing phase has started on April 26<sup>th</sup> and will last until the end of May 2018. The contract with suppliers will be finalized in the first week of June, followed by purchase of materials. Construction works will start in October and are planned to be concluded by December 2018. The equipment will be finally installed and tested between December 2018 and January 2019.

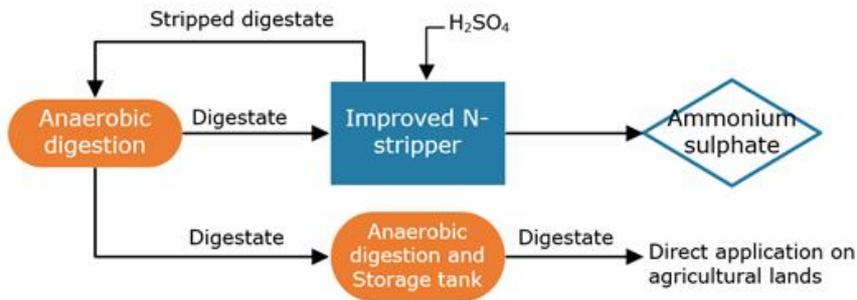


Figure 3. Final process scheme of demonstration plant Acqua&Sole

## 4 Rika Biofuels

The reason for the delay in the construction of Oaklands biogas plant is that the Environmental Agency demanded design detail at a very late stage in the planning application. Rika Biofuels completed the design work and successfully attained planning permission for the project. However, in September 2016, changes in renewable energy policy occurred and Feed In Tariff (Rika's renewable subsidy) for projects with an output over 500 kW electricity (kWe) has been effectively removed. Other potential uses of the gas (biomethane injection and liquid biomethane as a transport fuel) were explored, but the business case could not sustain without the CHP Feed In Tariff.

Fortunately, Rika Biofuels has another site under development at Fridays Eggs in Kent which will substitute Oaklands demonstration installation. This project is identical to Oaklands as it will rely on DVO technology to process at least 50 000 tonnes per annum of poultry manure. This is a gas to grid project and as such does not rely on the Feed in Tariff over 500 kWe like Oaklands. The project has a planning permission, a grid connection and funding. After a delay of more than a year, the UK Government finally introduced new renewable heat tariffs in May 2018 for which Rika have applied. Subsequently, construction of the Fridays project is due to start in September 2018 with the commissioning targeted to take place in October 2019.

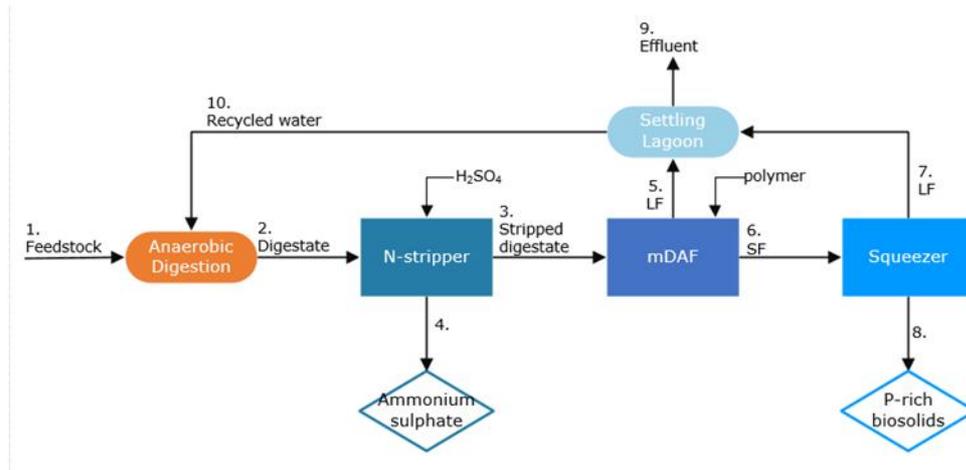


Figure 4. Final process scheme of demonstration plant Rika Biofuels

## 5 Benas

In order to make the electricity production more flexible, Benas has started with construction of an additional storage tank with a volume capacity of 12 100 m<sup>3</sup> (ensuring the storage of a biogas production of 8 870 m<sup>3</sup>). The installation is already in operation and it will be completed by June 2018. The subsequent step will be the introduction of two additional CHPs with 3 MW electricity production each (planned for November 2018).

In order to meet the new discharging limits imposed by the German Fertilization Regulation, different NRR technologies have been implemented at Benas. N recovery is achieved by means of the FiberPlus N-stripper developed by GNS, while P is removed in the form of fibers. However, the latter does not ensure high recovery rates and therefore it is not optimal for the treatment of P-rich substrates. For this reason, from January 2018, Benas has reduced the amount of chicken manure treated.

The FiberPlus plant is operating continuously since October 2016 and dried fibers have been tested on large-scale trials in the fiber industry. Nonetheless, the full automatic operation of the FAN fiber separation and washing unit with two screw presses in line can still be improved to get a more cost effective fiber production.

Since mid-2017, GNS started investigating how to selectively separate P, discovering that the proportion of dissolved P from P total after the N recovery step is very low. Separation experiments are ongoing to understand to which extent is possible to separate P compounds using simple methods. Among other approaches, the dissolution of P in acid and re-precipitation into a P-concentrate was also studied. This method did not proved to be suitable at Benas due to the use of iron compounds for desulfurization which reduces in turn the biological availability of P. In order to circumvent this bottleneck, Wageningen University suggested the introduction of an hydrolysis step for P separation.

At the moment GNS is investigating two different ways to improve P uptake:

- Increasing by ten-fold the fiber production
- Producing a valuable P-concentrate from the LF generated by the screw press 2.

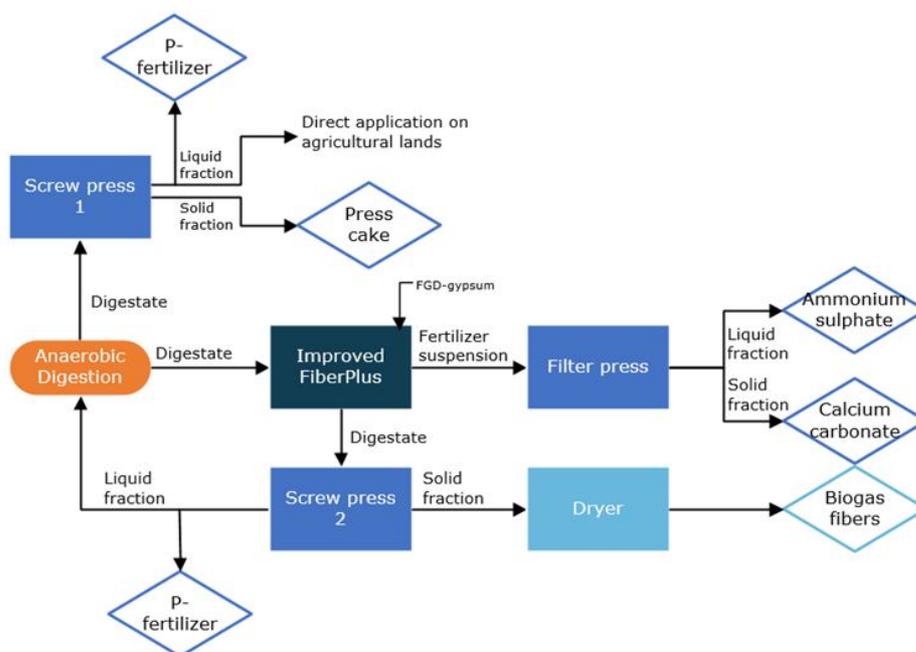


Figure 5. Final process scheme of demonstration plant Benas



Systemic large-scale eco-innovation to advance circular economy and mineral recovery from organic waste in Europe

### Consortium

Wageningen University and Research (NL)  
AM Power (BE)  
Groot Zevert Vergisting B.V. (NL)  
Acqua & Sole S.r.l. (IT)  
RIKA Biofuels Development Ltd. (UK)  
GNS Gesellschaft für Nachhaltige Stoffnutzung mbH (DE)  
A-Farmers Ltd (FI)  
ICL Europe (NL)  
Nijhuis Water Technology (NL)  
Proman Management GmbH (AU)  
Ghent University (BE)  
Milano University (IT)  
Vlaams Coördinatiecentrum Mestverwerking (BE)  
European Biogas Association (BE)  
Rural Investment Support for Europe (BE)

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