26st of September 2018

Meeting in Spain

Update on the business development tool, progress of the project for outreach locations, associated plants and partners of the H2020 project SYSTEMIC

Marieke Verbeke
4-10-2018

Inventory

Participants

<table>
<tr><th>Participant</th><th>Organisation/Company</th><th>Country</th><th>Function in SYSTEMIC</th></tr>
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Patrick Schelfhout</td><td>Biogas Bree</td><td>Belgium</td><td rowspan="4">Outreach Location</td></tr>
<tr><td>Michel Peter</td><td>SCRL Kessler</td><td>Belgium</td></tr>
<tr><td>Tomislav Kitonic
Ante Topalovic</td><td>Bojana</td><td>Croatia</td></tr>
<tr><td>Rubén Wensell</td><td>Biogastur</td><td>Spain</td></tr>
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<tr><td>Claudio Brienza</td><td>University of Ghent</td><td>Belgium</td><td>WP1 member of SYSTEMIC</td></tr>
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1. Introduction

26st and 27nd of September, a meeting was organized in the framework of the H2020 project SYSTEMIC, which aims to stimulate the implementation of sustainable and economically viable business cases for bio-waste, manure, sewage sludge treatment in Europe.

The meeting brought together representatives of 4 outreach locations, i.e. anaerobic digestion plants from different regions in Europe and the SYSTEMIC consortium.

The meeting took place in the meeting room "El liceo" in Navia, Asturias, in the north of Spain, close to Biogastur, one of SYSTEMIC's outreach locations.

The goal of the meeting was:

- To update the participating outreach locations on project results
- To demonstrate the business development tool and start testing with it
- Get their feedback on the tool
- Visit the biogas plant of Biogastur

2. Welcome to Navia

Ignacio García Palacios, Mayor of Navia City Council (Spanish Socialist Workers Party)

Rubén Wensell, agricultural engineer and representative of Biogastur, Outreach Location

The SYSTEMIC consortium and outreach locations were warmly welcomed in the conference room of El liceo in Navia by the Mayor of Navia himself.

The mayor described the region of Navia as the region with the highest milk production in the North of Spain. The region is also characterized by it's agriculture, which is mainly corn, used as feed for the livestock.

In this region there are 134 dairy farms with each 200 cows, resulting in a density of 4 cows per ha and a manure surplus. Using the manure directly as fertilizer caused probles with nitrification of the groundwater. The mayor realized the importance of this issue for the region and was from the beginning very involved in the conception of the Biogastur-project.

This enormous biogas plant had the goal to treat 400.000 tonnes of cattle manure from the region with anaerobic digestion, hereby producing 30 GWel per year and the possibility to upgrade the biogas to biomethane to be used as vehicle fuel for cars and trucks. In full capacity the plants would produce 25.000 tonnes of dried solid fraction (80% DM), 350.000 tonnes of liquid fraction and 300 tonnes of struvite per year.

The mayors influence has undenyibly contributed to the succes of the Biogastur. The biogas plant is now running for a year, but at the moment only working on half capacity since it is still in start up phase. The mayor sees this project as 3 solutions for 1 manure problem:

- The production biomethane as a green fuel for trucks.
- The production of green electricity.
- The creation of an environmentally safe fertilizer (digestate) that is low in nitrogen.

According to the farmers, who have been fertilizing their corn fields with the digestate, an increase the yield with 25% yield can be visually noticed. These numbers will be confirmed when the harvest is measured.

3. Development of Business Development Tool with nutrient recovery


Oscar Schoumans, Projectcoordinator, Wageningen University & Research

Within SYSTEMIC, a Business Development Package is developed, containing a quantitative tool will be developed for supporting cost-benefit analysis (CBA) and the selection of technology combinations.

The objective of the tool is to forecast the

- costs and performances (CAPEX, OPEX, maintenance cost, wearing cost)
- composition and amounts of different end products
- Nutrient recovery & separation efficiency
- Energy requirement
- Chemicals requirement

for technology combinations selected by the user.

For now the techniques that will be included in the tool are:

- Separation:
    - Screw press
    - Centrifuge
    - Dissolved Air Flotation (DAF)
- Ammonia stripping/scrubbing
- Membrane processes: Reversed Osmosis (with possible pre-treatments: MF, UF)
- Chemically induced P precipitation
- Evaporation
- Drying
- Biological treatment as a polishing step

The tool will be based on a database, which will be constructed by the SYSTEMIC consortium.

The goal is to incorporate preferably real life, practical data on different brands and concepts of these techniques. In a later stage, it could be considered to add more techniques in the tool. Requests done by the outreach locations and associated plants will be looked into.

This data on the performance & costs of the the different techniques will be gathered from:

- Literature
- Demonstration plants
- Outreach locations & Associated Plants
- Expert knowledge

Demonstration of the tool

To start with working with the tool, you'll need to input what the composition of your digestate is.

	Select max 5 inputs	code	kg
1	Digestate pig slurry	2	1000
2	Type of input	1	
3	Type of input	1	
4	Type of input	1	
5	Type of input	1	

Obliged parameters are DM%, OS%, tot-N, NH4-N, tP, K. This is preferably based on recent analyses. If these are not available, assumptions will be made based on values from the database.

Characteristics	Variable	Unit	Digestate pig slurry	Assumptions		
content of liquid material in digestate (Water & Solubles)	W	kg/ton	940			
content of DM suspended	DMsus	kg/ton	60			
content of DM in solution	DMsol	kg/ton	13			
content of OM in digestate (completely suspended)	OM	kg/ton	42	70%	of DM	
content of total P in digestate	tP	kg P/ton	1.747	4	kg P2O5/m3	
content of P-PO4 in organic matter structures	OrgP	kg P/ton	0.175	10%	of TP	
content of P-PO4 solid mineral fraction in digestate	MinP	kg P/ton	1.534			
content of P soluble in liquid fraction	oP	kg P/ton	0.038	40	mg P/l	
content of total N in digestate	tN	kg N/ton	6			
content of N-NH4 in organic matter structures	OrgN	kg N/ton	3.3	55%	of TN	
content of N-NH4 solid mineral fraction in digestate	NH4_s	kg N/ton	0.54	20%	of min N	
content of NH4 soluble in liquid fraction	NH4_l	kg N/ton	2.16		2298	mg N/l
content of total K in digestate	K	kg K/ton	3.32	4	K2O	kg/ton
solid	K_s	kg K/ton	1.00	30%		
liquid	K_l	kg K/ton	2.32	70%	2472	mg K/l
content of total SO4 in digestate	S-SO4	kg S/ton	1.66	2	SO4	kg/ton
solid	S-SO4_s	kg S/ton	1.41	85%		
liquid	S_SO4_l	kg S/ton	0.25	15%	265	mg S/l
content of total Cl in digestate	Cl	kg Cl/ton	5.81	7	Cl	kg/ton
solid	Cl_s	kg Cl/ton	0.29	5%		
liquid	Cl_l	kg Cl/ton	5.52	95%	5870	mg Cl/l
content of total Ca in digestate	Ca	kg Ca/ton	6.64	8	Ca	kg Ca/ton
solid	Ca_s	kg Ca/ton	5.31	80%		
liquid	Ca_l	kg Ca/ton	1.33	20%	1412	mg Ca/l
content of total Mg in digestate	Mg	kg Mg/ton	4.98	6	Mg	kg/ton
solid	Mg_s	kg Mg/ton	4.23	85%		
liquid	Mg_l	kg Mg/ton	0.75	15%	794	mg Mg/l

Figure 1: Draft of the input page with examples of input values needed (green fields are assumptions, orange fields are calculations)

The tool would make it possible to virually experiment with different techniques by selecting techniques (Figure 2) .

One of the outcomes of the tool would be scheme of a technology cascades including recovery and separtion effieciencies (Figure 3).

It will also give an estimation of the costs, energy and chemical requirement (Figure 4).

Finally, a list of the different end products is shown, with an estimation of the produced amounts and composition.

Unit	Name	Code		
1	Separator A	2		
2	DAF B	7		
3	Membrane Filtr. A	14		
4	Concentrator C	20		
5	P-Stripper A	22	pH	5
6	DAF D	9		
7	Process unit	1		
8	Process unit	1		
9	Process unit	1		
10	Process unit	1		
11				
12				

Figure 2: Dropdown menu to select techniques.

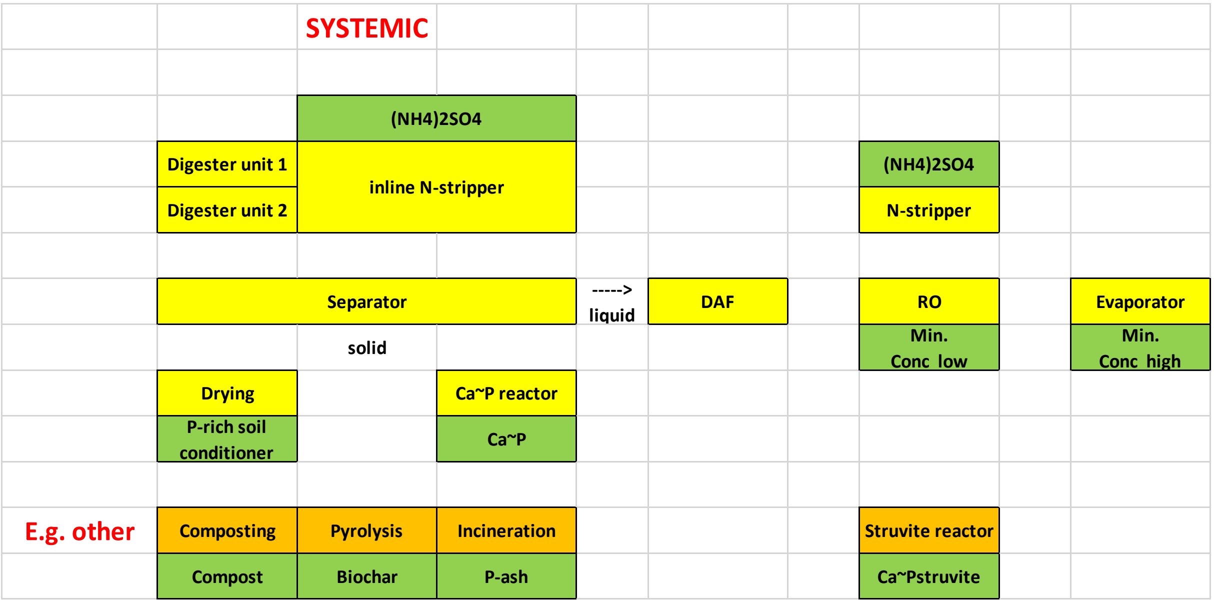


Figure 3: Draft of a cascade of technologies as outcome of the tool.

		OUT						
	IN	Perm	CONC1	Air	SF1	CaP	Total	diff
Mass	1000.00	641.13	112.79	48.08	195.67	2.33	1000.00	0.00
W	940.00	641.12	112.20	48.08	138.13	0.47	940.00	0.00
DMsus	60.00	0.01	0.59	0.00	57.54	1.86	60.00	0.00
OM	42.00	0.00	0.42	0.00	41.21	0.37	42.00	0.00
tP	1.75	0.00	0.05	0.00	0.21	1.49	1.75	0.00
tN	6.00	0.09	1.79	0.00	4.12	0.00	6.00	0.00
K	3.32	0.10	1.89	0.00	1.33	0.00	3.32	0.00
S-SO4	1.66	0.01	0.22	0.00	1.43	0.00	1.66	0.00
Cl	5.81	0.24	4.47	0.00	1.10	0.00	5.81	0.00
Ca	6.64	0.06	1.13	0.00	5.45	0.00	6.64	0.00
Mg	4.98	0.03	0.65	0.00	4.30	0.00	4.98	0.00

Figure 4: Example of an output of the tool: estimated amount and composition of different end products

After this presentation each outreach locations sat together with one of the consortium members to do a first test with the tool.

Afterwards they could give their feedback on the user-friendliness, missing things, desired outputs or links, etc.

Conclusions

After the feedback of the outreach locations, the consortium had a meeting about the further development of the tool.

The following conclusions came out:

- The current tool can calculate the mass balance if you put in the digestate composition and select the technologies. The link with reality is not yet established.
    - Need to link with the database (see Chapter 4)
- No biogas operator has analyses on all parameters described in Figure 1. These will be narrowed to DM%, OS%, tot-N, NH4-N, tP and K, which are essential for the calculation. Analyses on other parameters can be added and will refine the calculation.
    - Viscosity (or another related parameter) is also to be added to the essential parameters since it strongly influences the separation efficacy and the following treatment steps.
- The initial idea that the user of the tool can create his own technology cascade, would give too much options. Therefore it was decided that only from a fixed number "technology trains" can be chosen for the nutrient recovery process. These technology trains are the trains used in the Demo plants, added by these nutrient recovery trains from the Outreach Locations and some of the Associated Plants.
  The use of these trains will make the cost estimation, chemical consumption etc more easy and reliable.
- The user will also need to indicate the input streams that were put in the digester to produce the digestate. This way separation and recovery effiencies will be suggested by my means of a range (min-average-max). The user can then chose the prefered efficiency value to run the calculation.
- The separation efficacy and recovery efficacy

    - Can be manually added together with the amount of chemicals added.
    - Can be calculated based on composition and mass of input and output of each step, which is manually added by the user.
    - Can be looked up in the database:
        - Input streams of the digester and digestate composition will be compared with data in the database from existing plants to get an estimation of the corresponding separation efficacy (Chapter 4).
        - The database will contain also data from lab- and pilot tests on the relation between input streams - digestate – separation efficacy (see Chapter 0)
        - Information on chemicals and water added are gathered from pilot tests, biogas plants and literature (see Chapter 4 and 0).
- The target users for the tool would be biogas plant operators wanting to explore different nutrient recovery technologies.
    - A user-friendly input page will ask the kind of feedstocks put in the digester, the composition of the digestate, the available heat, the selected technology train/the preferred end products.
    - The tool will show the selected technology cascade virtually performed on the digestate that was put in. As output the end products will be given and the estimated costs, amount of chemicals needed, composition of end products, separation- and recovery efficacy of each step will be shown as average value with a minimum and maximum value. The calculation will also indicate if enough heat is available to execute the chosen technology train.
- The cost estimation in the output should include
    - Estimation of the CAPEX and OPEX, personnel costs (manually added), maintenance costs (estimated or manually added percentage), depreciation and cost of chemicals (looked up in database or manually added percentage).
    - Regionally specific subsidies related to nutrient recovery can be manually put in or automatically added by the tool based on "country selection" (see Report on regulations governing AD and NRR in EU member states" , 27.5.2018, 124 pages, R. & L. Hermann, Proman Consulting / SYSTEMIC deliverable 2.1).
    - The market value of the end products can be estimated by the user and manually put in. Possible market options can be consulted in Deliverable 3.4 Market research in Europe (Due in May 2019, see Chapter 9).
- The user of the tool can discuss the outcome of the tool with the systemic consortium or a consultant to develop a business plan from it.
- To reach a broader public of European biogas plant operators and owners, the input- and output page of the tool could be translated in different European languages.
- Currently the consortium had the tendency to develop a downloadable (excel)tool instead of a web based tool to be able to easily update the tool and prevent it from being outdated to soon.

4. Literature study separation efficiency

Marieke Verbeke, member of Work Package 3, VCM (Flemish Coordination centre for Manure Processing)

In many cases the separation of digestate is the first step in the nutrient recovery technology "train" or "cascade". It appears to have a lot of influence on the following steps and is also linked closely to a large proportion of the costs (e.g. chemicals to improve separation).

The separation efficiency is defined as the percentage of the initial amount of organic matter, nutrients (N, P, K) or minerals that end up in the end product. For example 70% of the nitrogen in the digestate ends up in the liquid fraction after separation by a centrifuge.

Meanwhile the separation efficacy is influenced by many factors (see *Figure* 5).

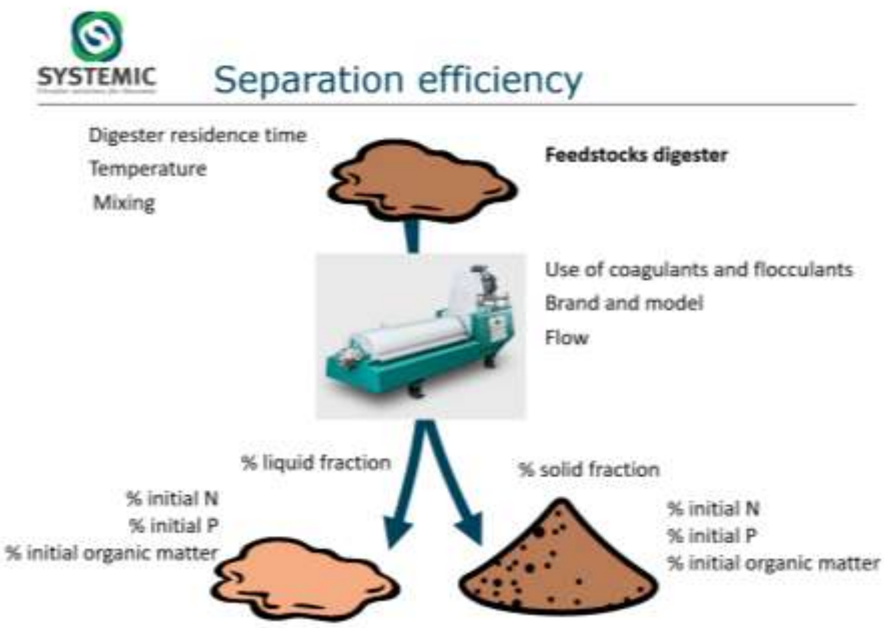


Figure 5. Factors influencing the separation efficiency

On top of this variation, the separation efficiency is also influence by the use of coagulants and flocculants and the type of separator (screw press, centrifuge, belt press, …).

Data on the link between separation efficiency and feedstocks, different separators and chemical use is necessary to contribute to a good estimation calculated by the tool to be developed in SYSTEMIC.

Therefore a database was started to be built, including data from literature (studies including full scale tests), demo plants, outreach locations and associated plants (all kept anonymous).

Nonetheless, the amount of data is still insufficient to have a reliable calculation with the tool (Figure 6).

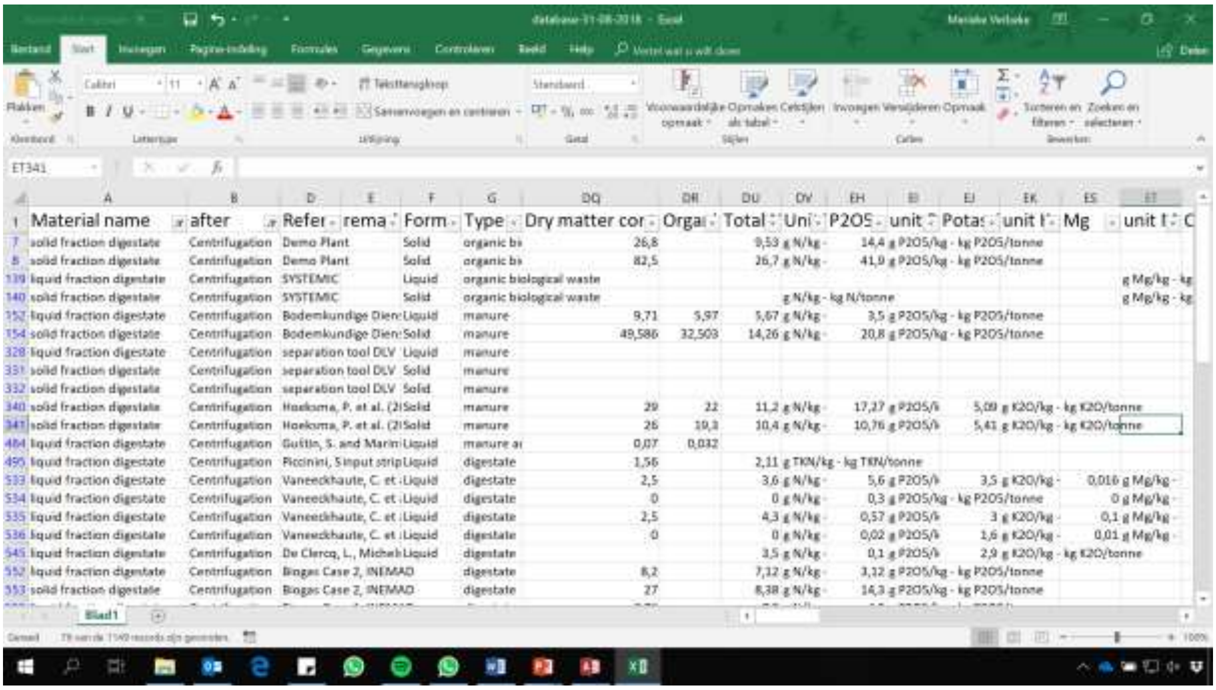


Figure 6. Example of the acquired data so far.

The database is already exclusively available for Demo Plants, Outreach locations and Associated Plants (contact Marieke).

A new strategy to acquire more data was developed:

First, all plants already involved in SYSTEMIC will be encouraged again to supply this essential information on separation efficiency and feedstocks, different separators and chemical use.

Second, a large scale (online) survey will be distributed amongst European biogas plants. The incentive for the biogas plants to complete the survey will be a chance to win a participation to one of the Living Labs meetings (with site visit) including the hotel -and dinner costs (Figure 7). The survey will be launched in October 2018.

Figure 7. Incentive to complete the survey.

And last, Claudio Brienza, project member of WP1 of SYSTEMIC at the University of Ghent will focus in his PhD on the link between the (viscosity of) feedstocks and separation efficiency of digestate (see Chapter 5).

5. Characterization of anaerobic digestate with reference to separation

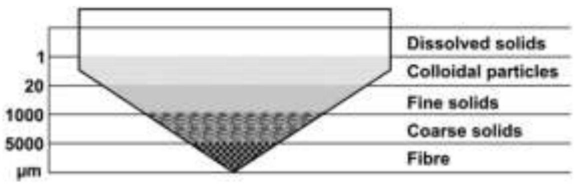

Claudio Brienza, member of Work Package 1, Ghent University

As mentioned in the previous presentation certain parameters influence the separation efficiency and it could therefore be useful to characterize digestate before and after solid-liquid separation from full-scale installations treating different type of substrates.

Origin of substrate

A quick-scan of the literature already revealed some important parameters from the feedstock that could be related with the separation efficiency and could be worth to investigate and analyse.

- Focus on size fractionation of digestate before and after separation to quantify the contribution of suspended particles, colloids and dissolved matter on physical, chemical and biological parameters. (Burton et al. 2007)



- The higher the fraction of manure, the higher the COD (chemical oxygen demand, i.e. chemically degradable organic solids) in the liquid fraction.
- Distribution of Phosphorous between the particles, colloids and dissolved fraction of different pig slurries. Also, animal diet reflected in the variation of total solids found in different categories of animals.

- Electrical conductivity (i.e. dissolved salts and ions) influences flocculation & presence of cations affects crystallizations of compounds (i.e. struvite). Animal diet reflected in the variation of Na, K, Ca found in different categories of animals.

Chemical additions

Addition of chemicals (coagulants and flocculants) have and influence on the separation efficiency and hereby the distribution of total Nitrogen in solid and liquid fraction. Centrifugation efficiency depends on particle density, therefore it may be advantageous to produce small dense flocs, with branched small-molecular-weight polymers.

Operating parameters

Thermophilic digestion has a higher total COD in coarse colloids and fine colloids in comparison with mesophilic digestion.

Research focus

As seen above, there are many factors that could be investigated within this topic so the focus of the PhD needs to be determined and the research questions defined.

Claudio indicated the following approach:

- Focus on only one separation technique: the (decanter) centrifuge
- Look into different digester feedstocks
- What is the influence of chemical addition
- Which physico-chemical parameters are scientifically related to the separation efficiency?
    - Particle size and contact area
    - Viscosity

Research is already conducted on the determining the relation between the viscosity (particles settling velocity) of different types of manures and the separation efficiency in a centrifuge. Yet, this has not been done for different digestates, since the composition and texture is very variable.

It is already researched that the viscosity of digestate is amplified by a large content of small particles, thus reducing settling velocity.

The methodology, strategy and experimental design of the PhD still needs to be determined and discussed with Claudio's promotor, Prof. Erik Meers.

The outreach locations thought this PhD could provide valuable results for practice and offered to be included in the research.

Suggestions were made to try to find an easy way to measure viscosity or any other related parameter of the digestate (and feedstocks mix) that can somehow predict the separation efficiency and/or the amount of flocculants needed.

Also trials on pilot scale/full scale were perceived more valuable and reflecting reality than lab trials.

6. Demo plants: construction updates, laboratory experiments and field trials


Claudio Brienza, member of Work Package 1, Ghent University

Construction updates

Groot Zevert Vergisting (NL)

Re-P-Eat – treatment of the solid fraction of digestate

- GZV together with WUR conducted a market research for the P-salts and P-free organic fraction at potential customers, including fertilizer producing companies and farmers.
- A significant reduction of the organic matter content in Ca-P product was realized.
- November 2018: Construction and start-up
- March 2019: Optimization tests and monitoring

GENIUS – treatment (Nijhuis Industries) of the liquid fraction of digestate

- In 2016, GZV envisaged to invest into the GENIUS-Total concept which includes a decanter centrifuge, DAF, N-stripper/scrubber and reverse osmosis for the production of ammonium sulphate (AmS) fertilizer and concentrated K fertilizer.

  After more thorough market research, better market opportunities for NK concentrate were found as compared to AmS fertilizer and the N-stripper/scrubber was deleted from the design. The nutrient recovery will be mainly based on membrane filtration system (current AM-Power process).
- September 2018: Construction and installation
- January 2019: Optimization tests and monitoring

Open day of the built NRR installation at GZV is planned for September 2019 in collaboration with WUR and Nijhuis. It might be possible to visit the plant earlier (March 2019?) with the Outreach Locations and Associated Plants.

Acqua e Sole(IT)

- Novel absorber to ensure higher N recovery (working at higher temperatures)
- October 2018: Construction and start up
- January 2019: Optimization and monitoring

AM-Power (BE)

By the end of February 2019 the multiphase evaporator will be completed.

Rika Biofuels (UK)

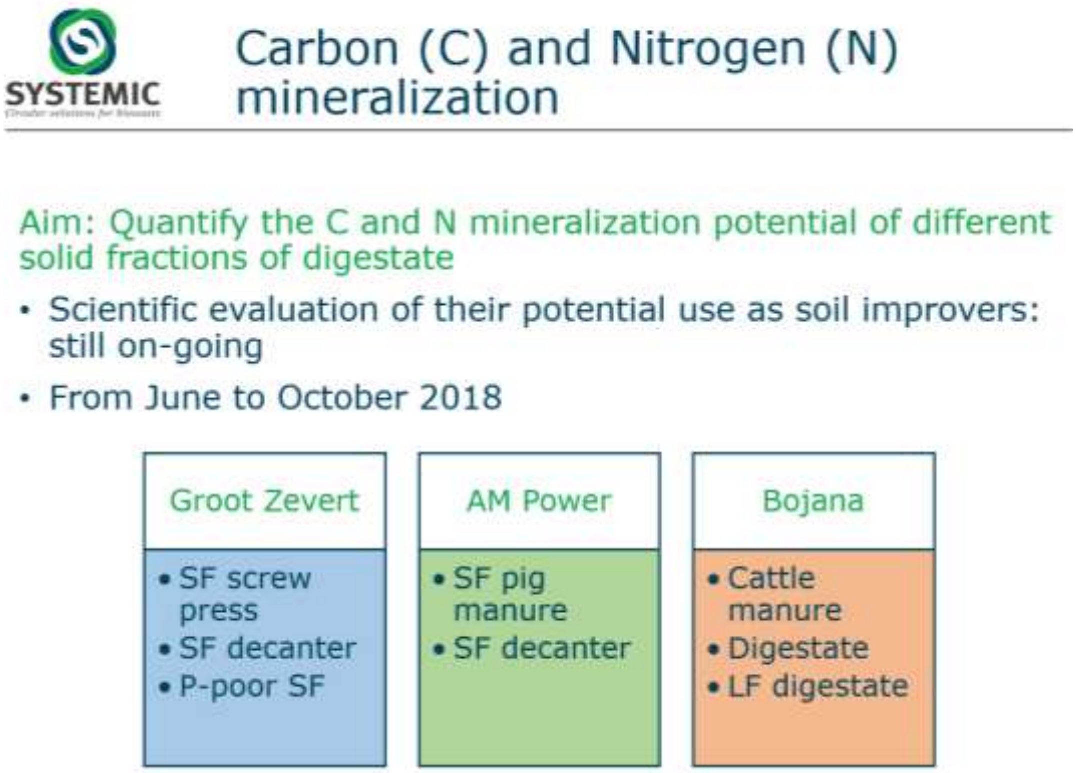
In September 2016 the government changed the feed-in tariffs for electricity in the UK. Their would be no more feed-in tariff for producers of >500 kW electricity (kWe). This made the initial business case of the plant in Oakland not sustainable anymore and the design of the plant was moved to another location "Fridays Eggs", a large chicken farm in Kent which has 50 000 ktonnes of poultry manure per year. The difference is that at Fridays there is a possibility to inject biomethane to the grid and so this business case does not rely on the electricity feed-in tariffs.

- November 2018: The construction of the biogas plant will start.
- December 2019: Commissioning of the plant.

Benas - GNS (DE)

- January 2018: the amount of chicken manure reduced in order to meet the new discharging limits for P, imposed by the German Fertilization Regulation. Currently GNS is focussing on research to produce valuable P-concentrate from the LF digestate.
- Summer 2018: additional storage tank with a volume capacity of 12 100 m^3 and new roofs for all digesters
- December 2018: 2 additional CHPs with 3 MW electricity production each.
- Research to increase the production of biogas-fibres® is still ongoing.

Laboratory experiments and field trials



Field trials overview

Demo plant	Location	Test crop (years)	Test product	Current status	Expected results
Am Power	Belgium	Maize	Ammonia water	Not started yet	End of 2019
Acqua & Sole	Italy	Winter wheat (1)	• Digestate • Urea	Ongoing	End of 2018
		Rice (1)	• Digestate • Urea	Ongoing	End of 2018
		Maize (3)	• Digestate + AS • Urea + AS	Ongoing	End of 2020
Bojana	Croatia	Maize (2)	• Cattle manure • Digestate • LF digestate • Mineral fert.	Ongoing	End of 2019
		Maize (2)	• Digestate + LF digestate • Mineral fert + digestate • Mineral fert + LF digestate	Ongoing	End of 2019

7. Biogas Plant visits

A Living Lab meeting is like the one done in February 2018 in Amsterdam. A meeting, inviting all Demo Plants, Outreach Locations and Associated Plants combined with a visit to one of the biogas plants. For the Living Lab meetings, the travel- and hotels costs of the outreach locations are reimbursed to stimulate maximum participation.
The next Living Lab meeting will be at Groot Zevert (and/or AM-Power) end 2019-beginning 2020.

The last Living Lab meeting will be beginning 2021, probably at the newly built outreach location Atria in Finland.

In between these Living Lab meetings, visits to other biogas plants will be organized or plant owners can visit eachother at own initiative.

Anyhow, if there are preferences for visits in small or larger groups, SYSTEMIC can assist you with the organisation (contact Marieke).

To get more familiar with the available technologies at the Demo Plants, Outreach locations and Associated Plants, an excel has been made (Figure 8, downloadable at The web area for Outreach Locations and Associated Plants – login with OL&AP)

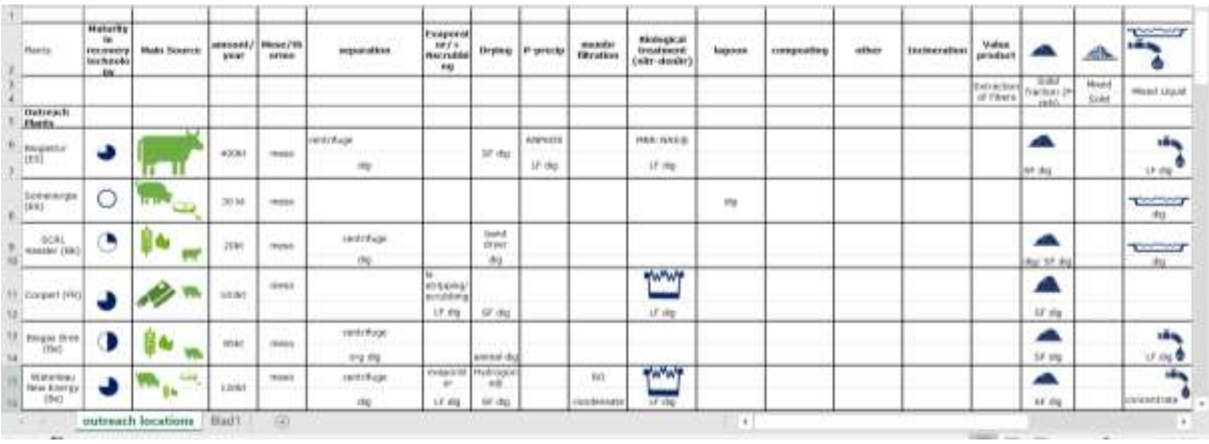


Figure 8.Print-screen of the excel with each technology step of the SYSTEMIC plants.

From each visit, a summary and learnings will be put on The web area for Outreach Locations and Associated Plants and you will be informed through the newsletter if new information is available.

Other possible visit planned are:

- (Combined) visit to Groot Zevert (and/or AM-Power) in March-June of 2019
- Visit to Outreach location SCRL Kessler (Wallonia, Belgium), including a seminar about their Interreg project "Persephone", SYSTEMIC and and update on projects regarding end products of anaerobic digestion in Wallonia and Flanders.
  This especially to reinforce the ties between Flanders-Wallonia.

8. Europe's SAFEMANURE study

Marieke Verbeke, member of Work Package 3, VCM (Flemish Coordination centre for Manure Processing)

Introduction

There are two important European regulations in relation to digestate and digestate products:

- **The Fertilizer Regulation**: regarding the trade of these products across European borders.
- **The Nitrates Directive**: regarding the protection of the quality of surface and ground water, in specific the nitrate concentrations in it. In this directive, rules for the use and application of(processed) manure (e.g. digestate) is described.

The Nitrates Directive states that in nitrate vulnerable zones (NVZ) the application of (processed) manure is limited to 170 kg of N/hectare per year. Mineral N fertilizers can be applied above this limit.

However, Europe has set up a Action plan to stimulate the implementation of Circular Economy, which means more recycling, reducing waste and emissions at an economical sustainable way.

Therefore, they would like to encourage the use of **recycled nutrients** derived from manure. Yet before this can happen, Europe want's it proven that these manure derived products are environmentally safe and have an adequate agronomical performance.

JRC's SAFEMANURE study

To achieve this, the European Commission has give the task to the Joint Research Committee (JRC), their official research entity to conduct a study (e.g. SAFEMANURE) to determine harmonised 'safe processed manure criteria'. If these criteria can be determined for certain manure derived products and Europe agrees on them, the products complying with these criteria would be recognized to be applied as mineral fertilizers in NVZ (above 170 kg of N/hectare per year).

At the same time, it should be clear that "safe status" should not be awarded to processed manure products that satisfactorily address the problem of nitrogen losses, but create unacceptable environmental and human risks.

Also, "safe" products do not automatically receive an end-of-waste status (e.g. Fertiliser Regulation) and vice versa.

The SAFEMANURE study is limited to investigate candidate processed manure materials, containing nitrogen, that will be used on agricultural land. This means that the following are excluded from the scope of the study:

- Sewage sludge, bio-waste compost, OBW digestate,... since they do not contain manure.
- Processed manure products without residual nitrogen (f.e. ashes from incinerated manure)
- Life cycle analyses (LCA), environmental and human health impact of processing steps or (side-)streams that are not used on agricultural land.

Project methodology proposal

In June, a proposal of the methodology of the SAFEMANURE study was presented to the member states, which could give their comments until 16 July 2018.

In general, the project run for 2 years and will consist of the following actions:

Assessing existing techno-scientific literature with regard to processed manure

Performing computer based modelling of processed manure products to investigate leaching to soil, water and air emissions

Laboratory analyses on the composition of these products

Laboratory trials and field trials to investigate the fate of nitrogen and other pollution mechanisms to soil, water and air

The methodology was discussed during the policy workshop of SYSTEMIC on 31-05-2018 with researchers, constructors and people from the government.

Next to feedback from the member states on the methodology, the JRC also asked to provide them information and data on production and composition of processed manure materials (point 1 of methodology) and suitable test sites and manure product samples (point 3 and 4 of methodology).

JRC received input from 7 member states: Belgium, The Netherlands, Germany, Spain, Denmark, Hungary and Italy.

Also the SYSTEMIC consortium supplied their most recent database (see Chapter 4), a long list with literature on agronomical properties and a list with all products available by the Demo Plants, Outreach Locations and Associated Plants.

Methodology after member state feedback

Candidates for "Safe processed manure materials" cannot all be investigated within SAFEMANURE. Therefore, the products have be put in categories based on priority to be considered for safe use.

Priority high

- Ammonium sulphate/nitrate from manure and air
- Mineral concentrates (NK)
- Precipitation salts (fe struvite)

Priority medium

- AD liquid fraction

Priority low

- Separated manure
- Digestate
- Thermally treated/dried/pelletized manure

For the medium an low priority products, some nitrogen issues remain due to considerable organic nitrogen and/or organic matter content.

For each product the focus will lie on the product's chemical parameters and not on treatment process used to obtain the product.

For the determination of agronomic efficiency and environmental impacts, the following parameters were confirmed.

Agronomic value	Environmental
Mineral N (NH4, NO3)	Organic pollutants
Organic nitrogen	Soil mobility
P-content	Standard pathogen info
K-content	
Cu, Zn	
Dry matter content	
Ash content	
pH	
C/N ratio and total N	
EC	
Crops/year	

An important notice is that agronomical effects will not be investigated by new pot trials or growth studies by JRC, but information will be used that is retrievable from large field studies.

The assessment of organic pollutants will be part of an exploratory research project (CHEMPRINT). Here, "compound fishing" will be used, which is a hybrid between single-substance analyses and non-target screening used in pilot trials on manure, digestate and exposed fields in Nitra (Slovakia). 550 substances (pesticides, pharmaceuticals and personnel care products) will be checked.

The member states listed the following products to be available for testing.

NH4NO3 (LF dig)
(NH4)2SO4 (air and manure)
Pig urine
Manure+dig
LF dig
SF dig
Concentrate NF+RO
NPK pellets
Effluent RO
Raw manure
digestate
UF concentrate and permeate
RO concentrate and permeate

Strangely, struvite was not included (although it was listed by the SYSTEMIC consortium).

Reference mineral fertilizers against which the processed manure products will be compared are: ammonium nitrate and urea.

Timeframe of SAFEMANURE

The sample identification will start in September 2018 and lab testing will continue until February 2019. In September, the review of received and available scientific and technical literature will start to be reviewed. At the same time, bio-geochemical modelling will start.

The JRC will present the research results to the Nitrate expert group and selected relevant stakeholders during a dedicated workshop (Seville, tentative date January 2020).

9. Progress on market study

Marieke Verbeke, member of Work Package 3, VCM (Flemish Coordination centre for Manure Processing)

One of the deliverables of Work Package 3 is a market study on recovered nutrient products in Europe. The nutrient products that will be investigated in the market study are:

- Ammonia water (condensate evaporator)
- Ammonium sulphate/nitrate
- P-salts (struvite, Ca-P)
- Mineral concentrates

The starting point for the search for marketing opportunities will be Flanders. After the most important marketing opportunities for the different products are listed for this region, we will try to extrapolate these opportunities to the other SYSTEMIC countries.

This will be done by asking feedback and experiences of the partners and outreach locations with these marketing options.

The final report will be an easy to read booklet listing the prospects of different marketing options for each product. It will include in which sector or process the product can be used, how big volumes are needed, details on require specification of the product (if available).

For each outreach region, it will contain a list of companies/sectors that might include the described marketing opportunities and can be contacted.

The Market Study report is due for May 2019. The powerpoint of the first draft of the market study that was presented during the meeting in Navia, is downloadable here.