

BREAKOUT SESSION: AN INTEGRATED APPROACH TOWARDS METHANE EMISSIONS REDUCTIONS

Moderated by EBA Director Harmen Dekker



Bruno Sander Nielsen, Danish Biogas Association, Copa-Cogeca

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EBA Conference – 27 October

Offsetting methane emissions from agriculture

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26–27 October 2021, Brussels

EBA Conference, 27 October 2021

Offsetting methane emissions from agriculture

Bruno Sander Nielsen

COO Danish Biogas Association



Danish Biogas Association

The organisationen for all stakeholders in biogas

Mission

- Promote production and use
- Promote cirkular economy
- Capacity building
- Networking and knowledge sharing

Members

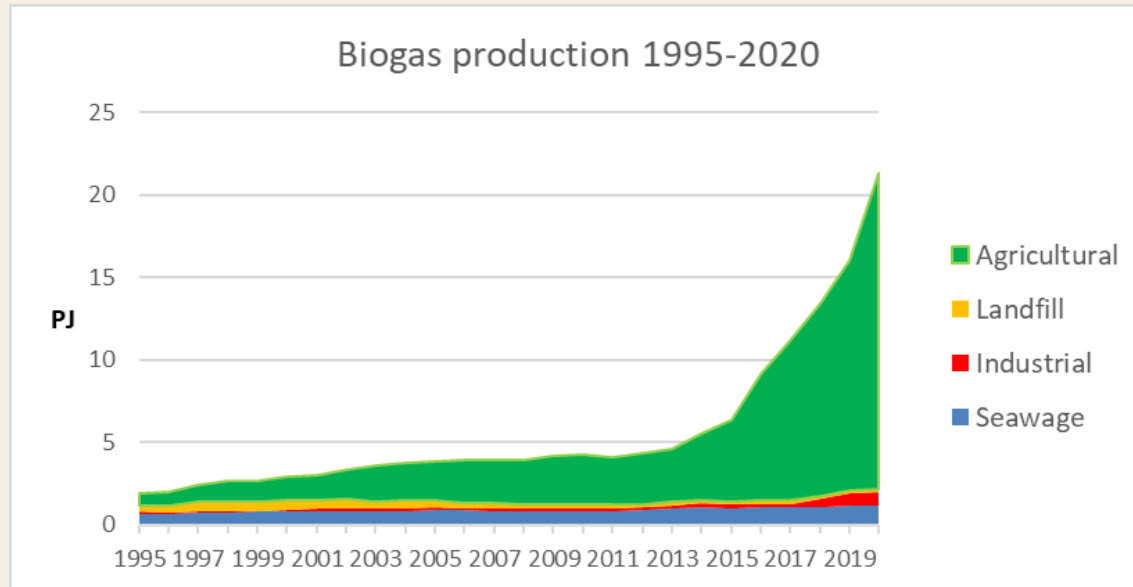
- Producers and users of biogas
- Biomass suppliers and users
- Technology and equipment suppliers
- Consultants and knowledge institutions
- Energy, waste and agriculture sectors
- Approximately 185 members



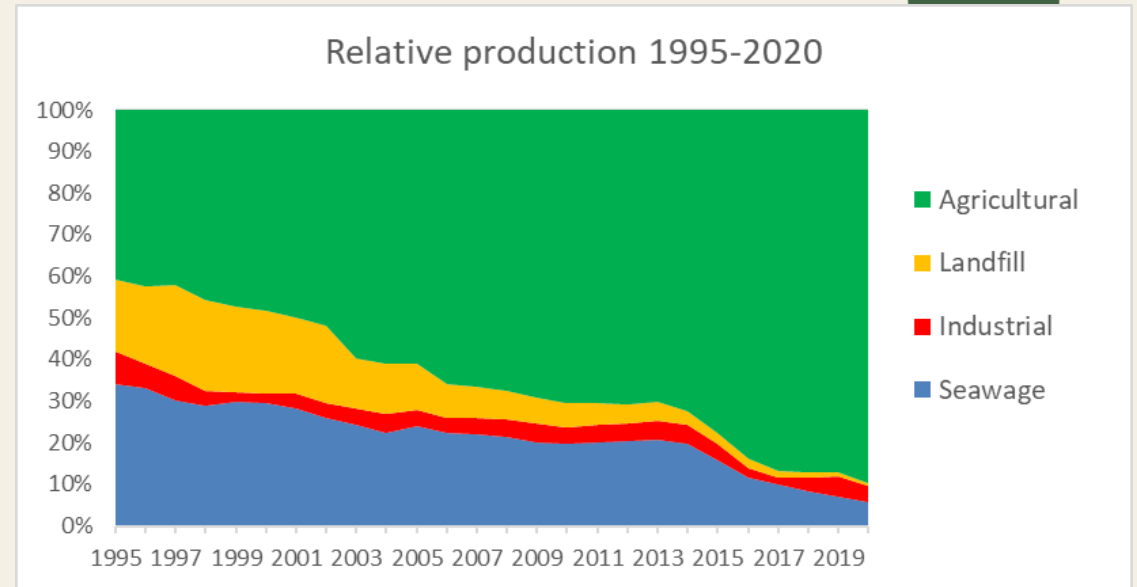
Danish biogas

A developing sector

Production expanding



Danish biogas is agricultural based



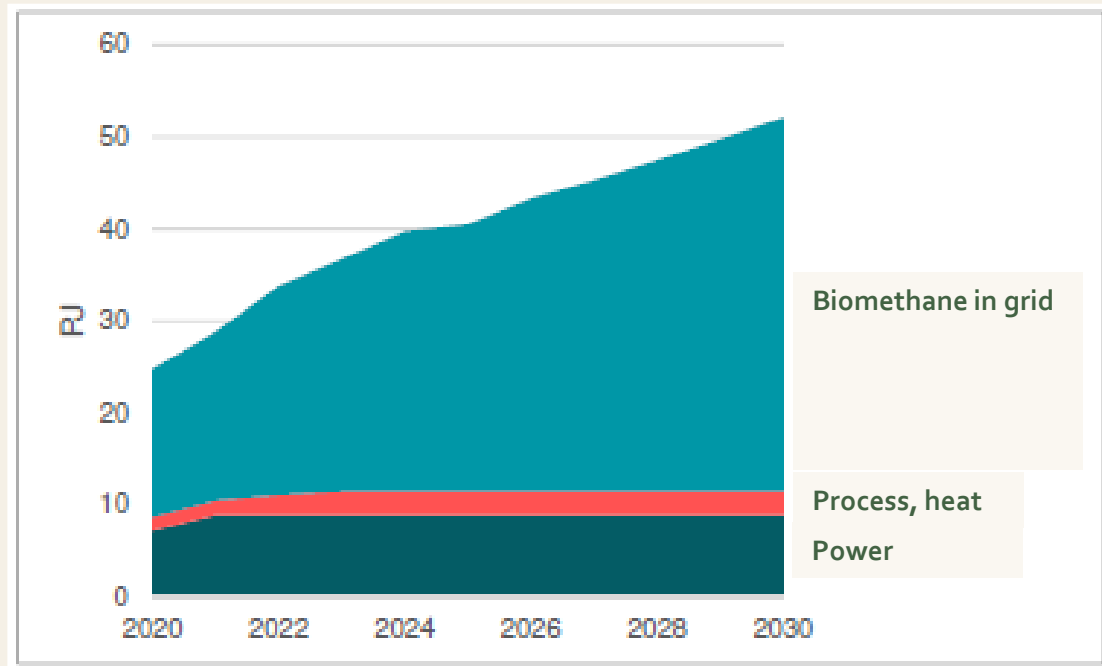
In 2020

20 per cent of Danish livestock manure was digested in biogas plants
Producing 20 PJ biogas which substituted 20 per cent of natural gas

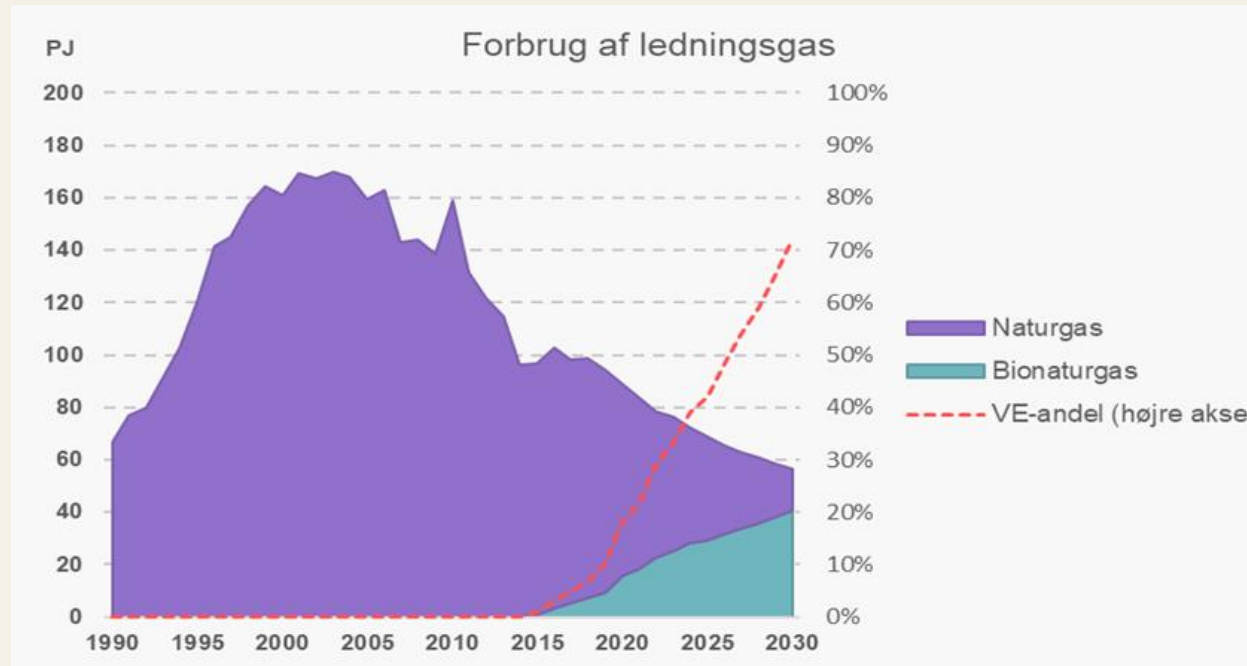
Development to be continued

Minimum 70 per cent biogas in grid by 2030

Projection by Danish Energy Agency, 2021



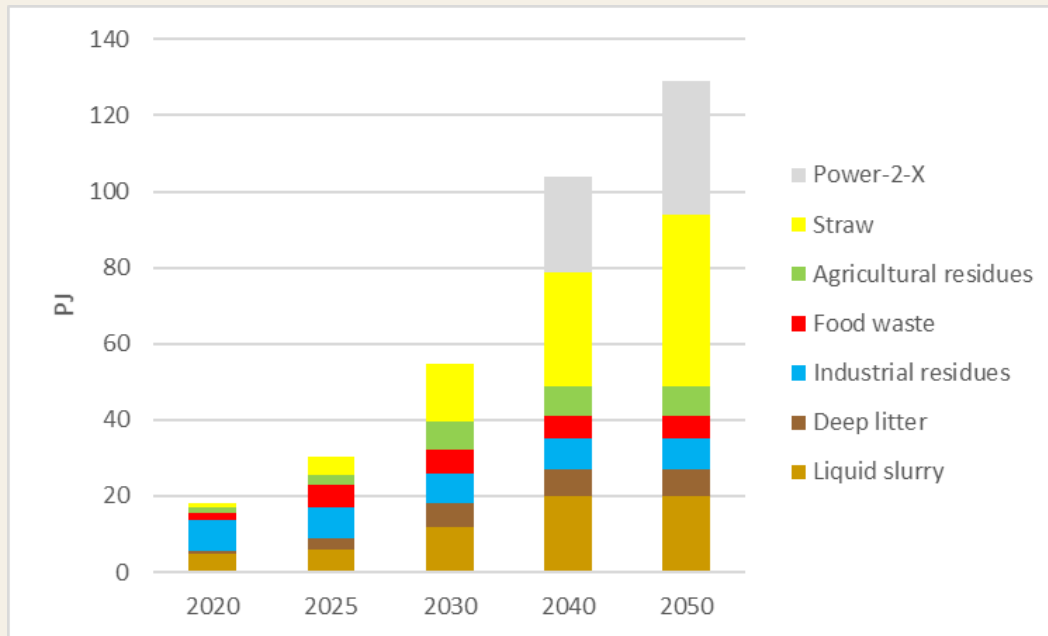
Minimum 70 per cent green gas in 2030



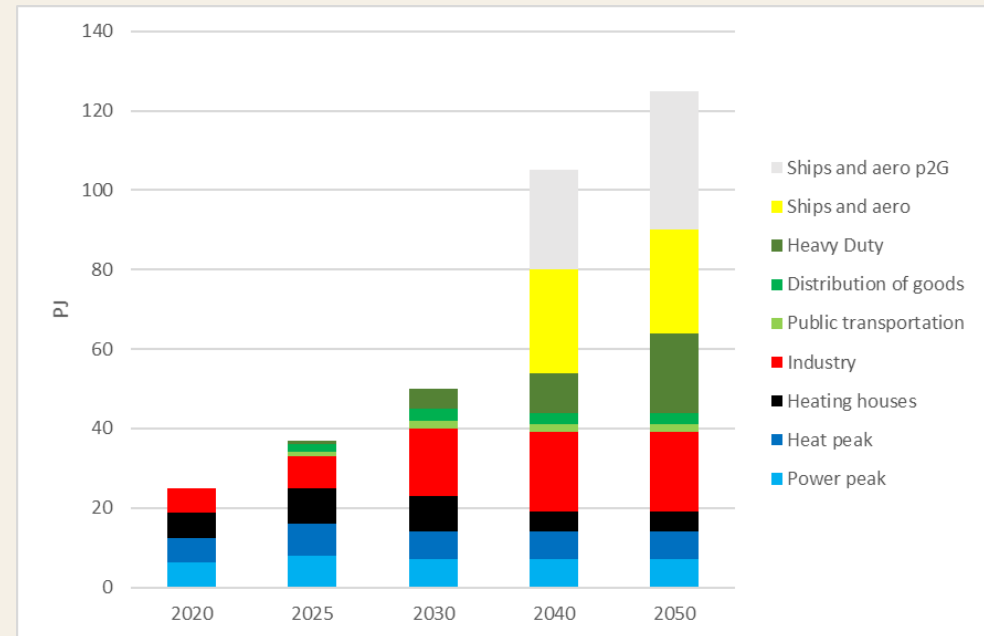
Market demand for more biogas

Danish resources can meet the demand

Biogas production potential 2020 – 2050*



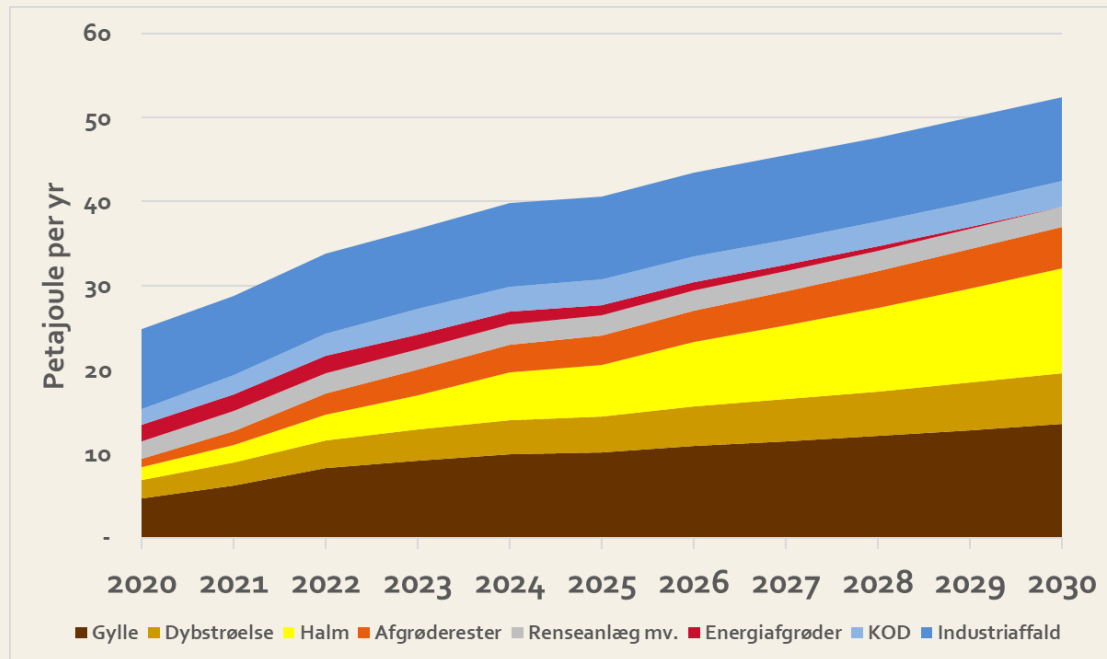
Biogas and P2G demand 2020 – 2050**



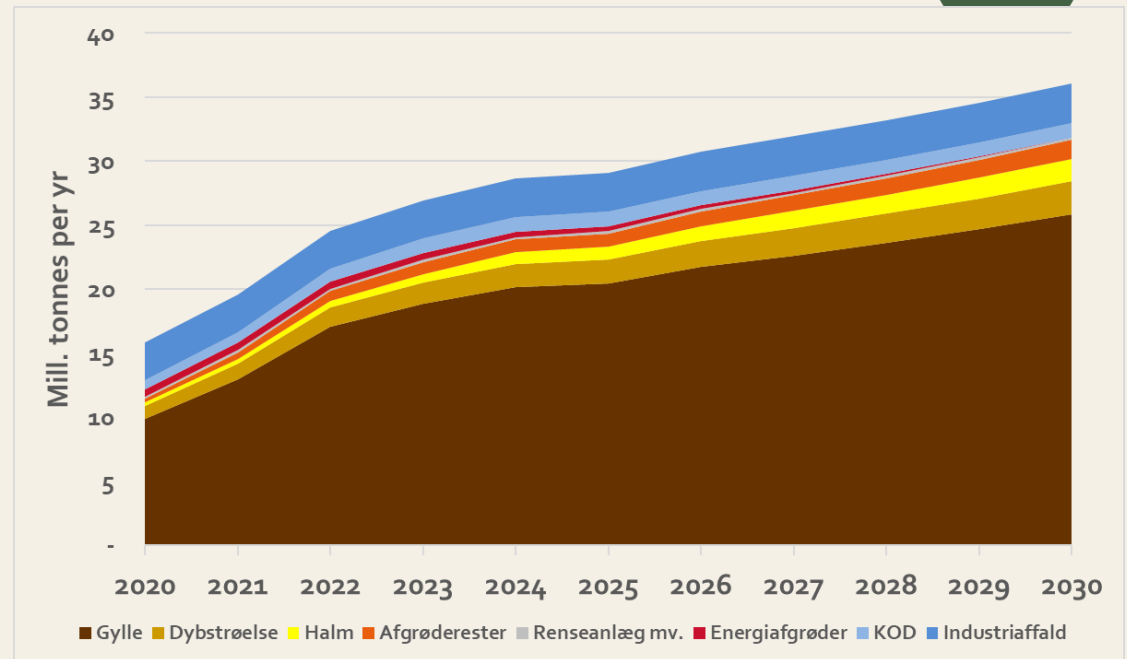
Expected development

Agriculture delivers energy - manure the prime resource

Biomass origin for biogas production



Input for biogas production

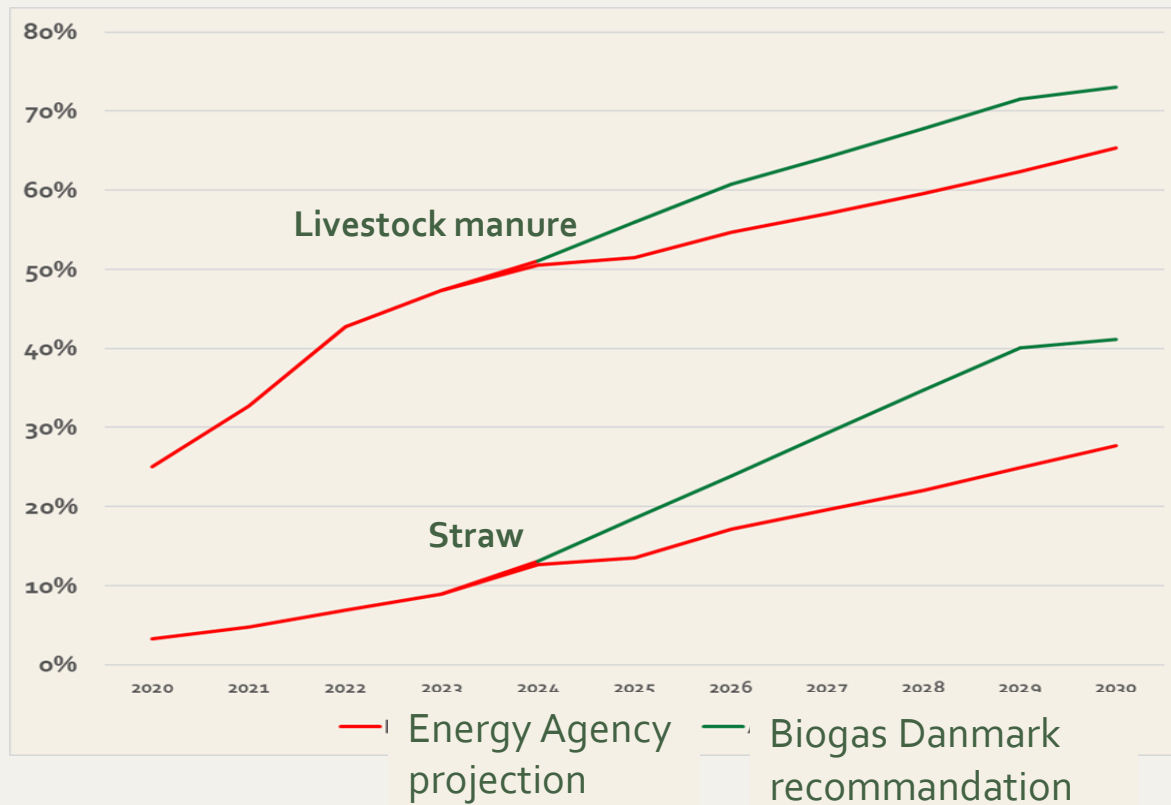


- Liquid manure
- Deep litter
- Straw
- Crop residues
- Sewage
- Energy crops
- Food waste
- Industrial waste

Utilization of resources

70 per cent of livestock manure, 40 per cent of straw

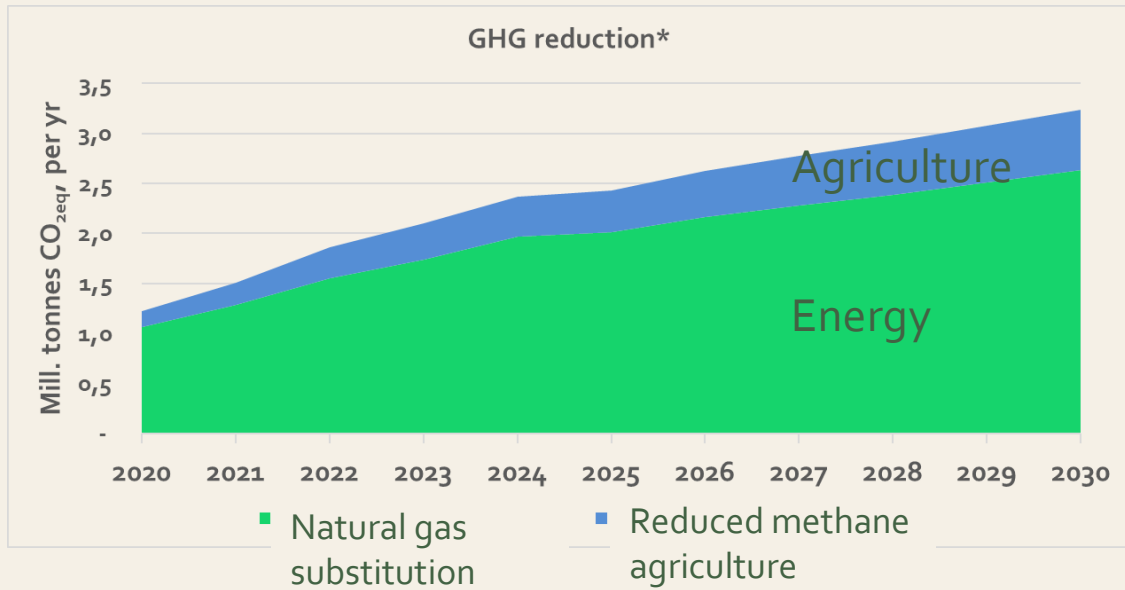
Utilization of livestock manure and straw



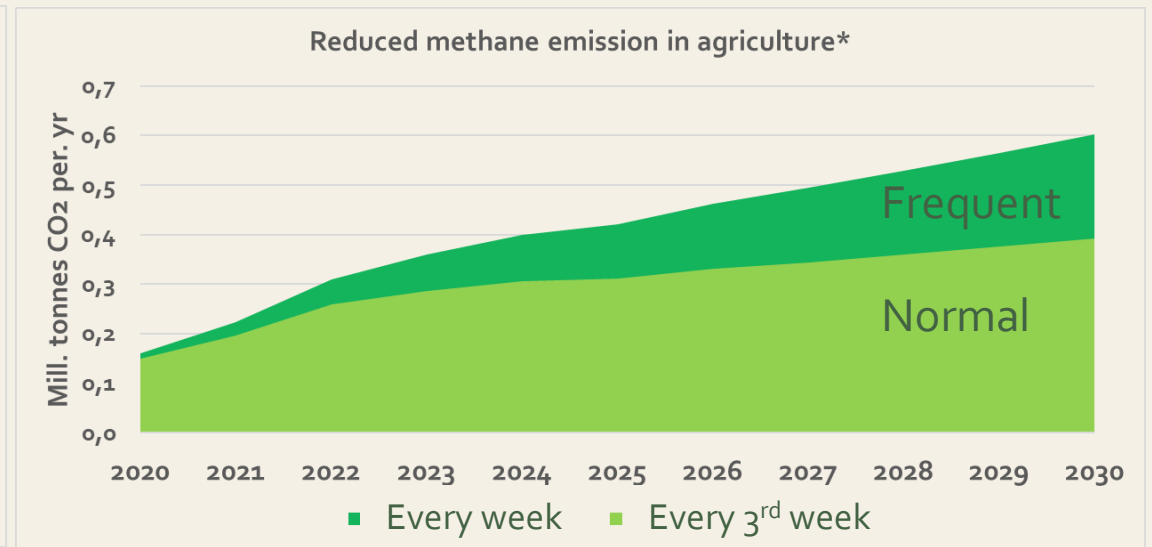
Double climate effect

Agricultural benefit can be increased

Reduce GHG in agriculture and energy sectors



Frequent slurry removal increases positive effect



* Danish Energy Agency projection of 52 PJ in 2030

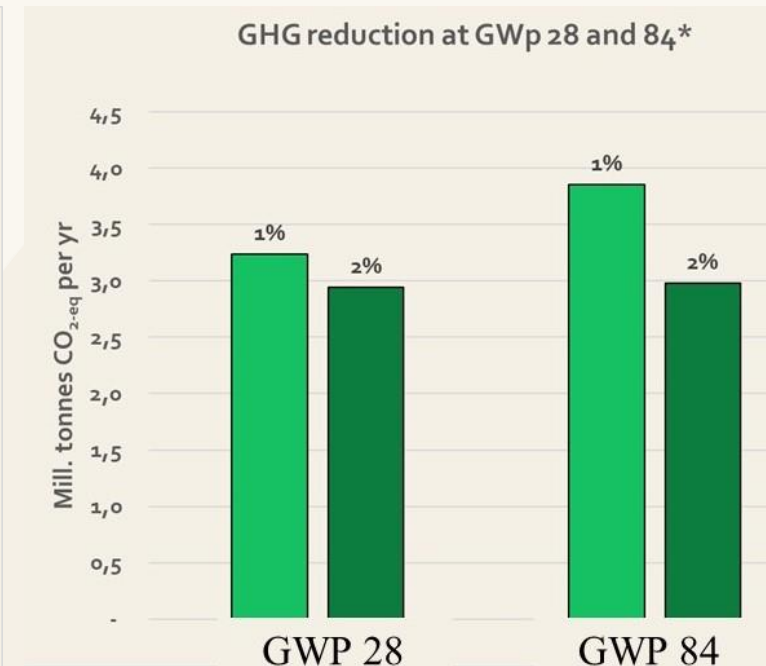
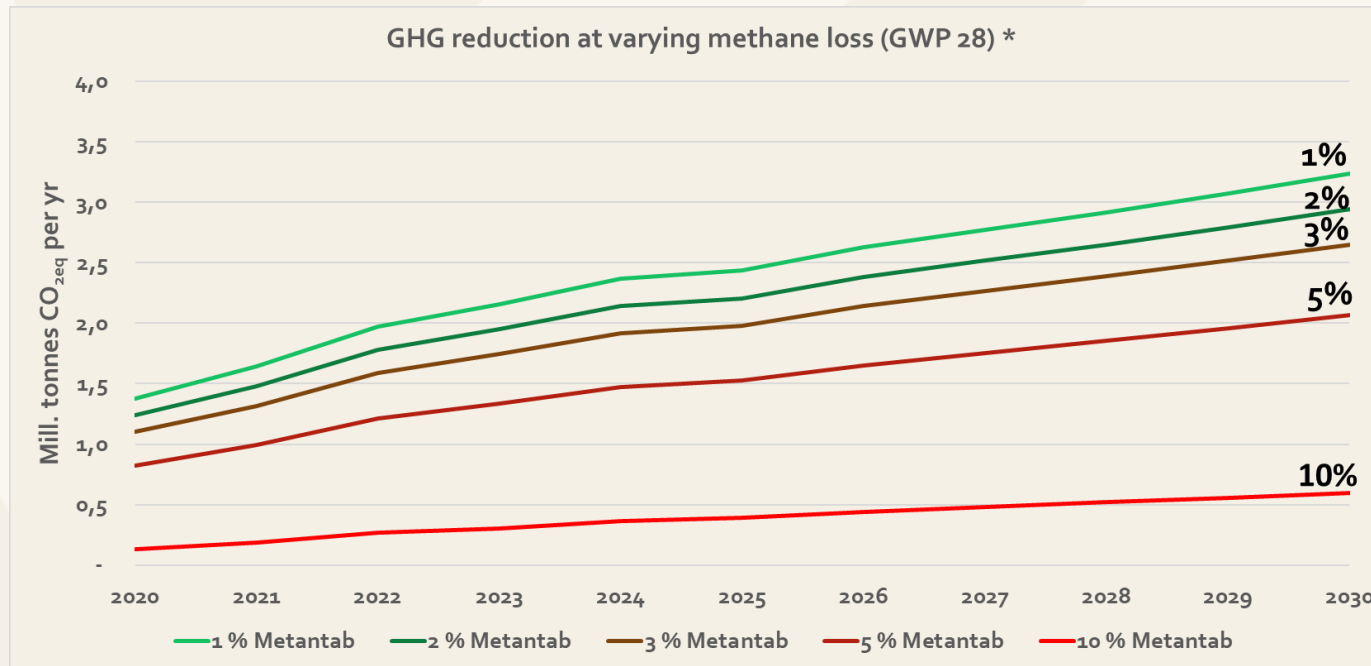
** Incl. proces and transport energy, natural gas substitution and reduced methane emission in agriculture

Methane leakages must be controlled

Methane is a powerful GHG in the short term

Methane loss reduce biogas as effective climate tool**

Funny fact**



* Danish Energy Agency projection of 52 PJ in 2030

** Incl. process and transport energy, natural gas substitution and reduced methane emission in agriculture

Pioneering methane leakage effort

From pilot projects to voluntary programme

Preliminary pilot project 2014

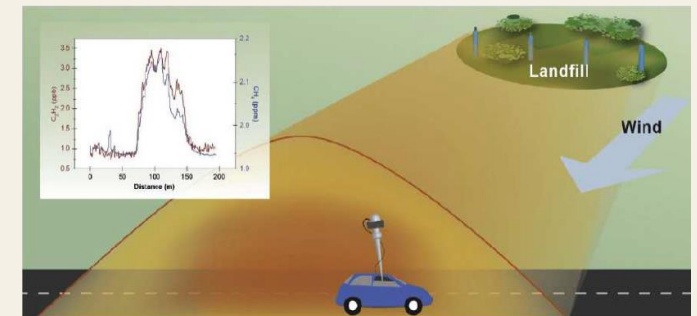
Measurements on 10 biogas plants

- 0 to 10 per cent loss
- Most leakages were easily repairable
- Emission reduced from 4.2 to 0.8 per cent
- Projects not representative
- Presentation on annual conference
- Dialogue with Energy Agency for follow up

Pilot project in 2015

Comparing different technologies

- Farmscale and centralized biogas plants
- CHP and upgrading plants
- Different leakage detection methods
- Different quantification techniques
- 1.1 to 3.3 per cent loss in biogas plants
- Upgrading plants from 0.04 to 4 per cent



Voluntary programme

Launched by Danish Biogas Association in 2016 in co-operation with Ministry

Principles and targets

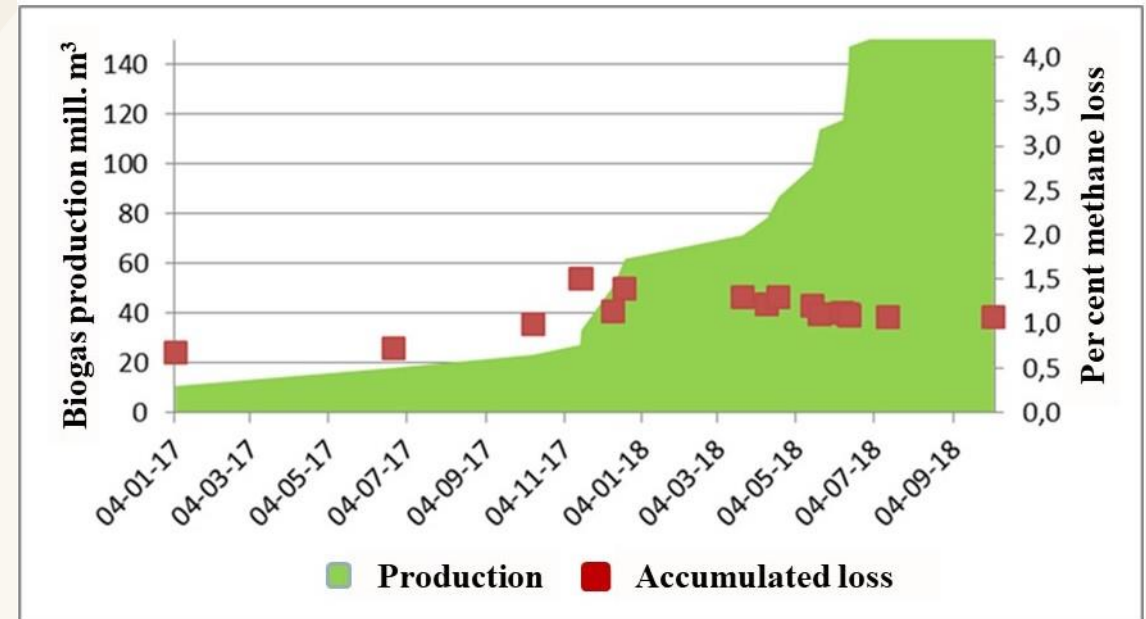
Basic elements

1. Self check programme
2. Leakage detection by third party
3. Quantification of leakages by experts

Target: 1 per cent in 2020

- 2018: Loss 1.1 per cent*

Results 2016 to 2018



* On plants delivering half of Danish biogas production

Government programme

Government subsidy scheme paused the voluntary programme

Content

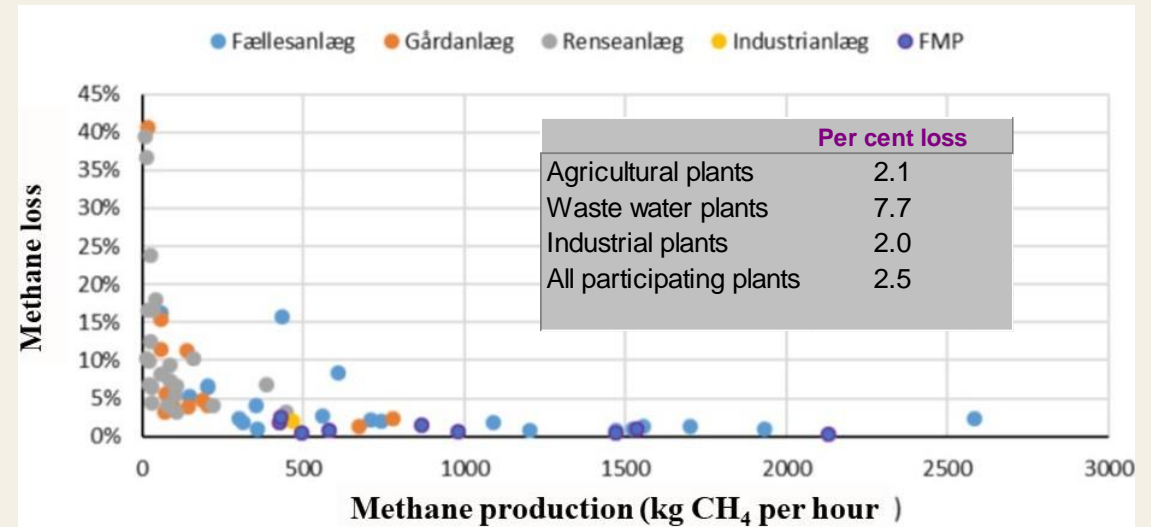
Programme content

1. Self check programme
2. Leakage detection by third party
3. Quantification of leakages by experts
4. Proposal for repair

Minister can within current legislation

- make subsidies dependent on
- the plant has taken action
- to control and document methane leakages

Results



Conclusions

Biogas is a key in reducing carbon foot print of agriculture

Efficient multifunctional climate tool

Reduced emissions of GHG in agriculture

- methane from livestock manure
- methane from organic catch crops
- N₂O from reduced use of fertilizers

Reduced emissions of GHG in energy & waste

- Substituting fossil fuels
- Reuse of residues in circular economy

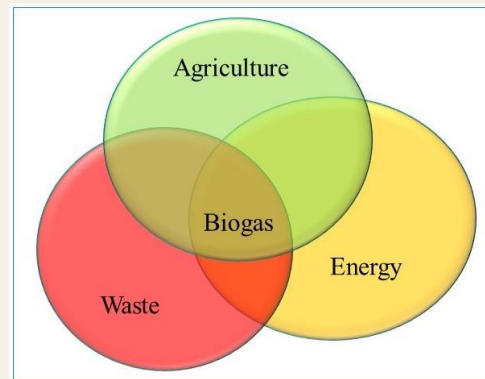
We must and can reduce our own footprint

Methane control programme

- Self check programme (CCP)
- Leakage detection by third party
- Plan for repair and maintenance

BAT

- gas collection/cooling of digestate storage
- maintenance of security valves



In Denmark Parliament has agreed that agriculture must reduce GHG emissions with 8 million tonnes in 2030. Biogas will in 2030 reduce GHG emissions with more than 3 million tonnes.

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EBA Conference – 27 October

*Methane emissions from organic waste:
turning a challenge into an opportunity*

VANYA VERAS

Secretary General, Municipal Waste Europe



26–27 October 2021, Brussels

'Methane emissions from organic waste: Turning a challenge into an opportunity'

27 October 2021
European Biogas Association

VANYA VERAS
Secretary General

Municipal Waste Europe

- Non-profit European umbrella association representing public responsibility for waste management. Founded in 2009, based in Brussels (Belgium)
- MWE Members are national, regional or local organisations or authorities who hold public responsibility for Municipal Waste management
- 21 Members and Observers to date

Landfill Directive 2018/850

- Many Member States still landfill over 50% of their waste
- For most of those countries, their landfilled waste is up to 60% organic waste (food and/or garden waste)
- 1 ton organic waste untreated decomposes to release about 1 ton of CO_{2e} (as Methane – CH₄)
- The Landfill Directive requires a reduction in landfilling to 10% of total waste by 2035 with a derogation possible up to 2040 if requested

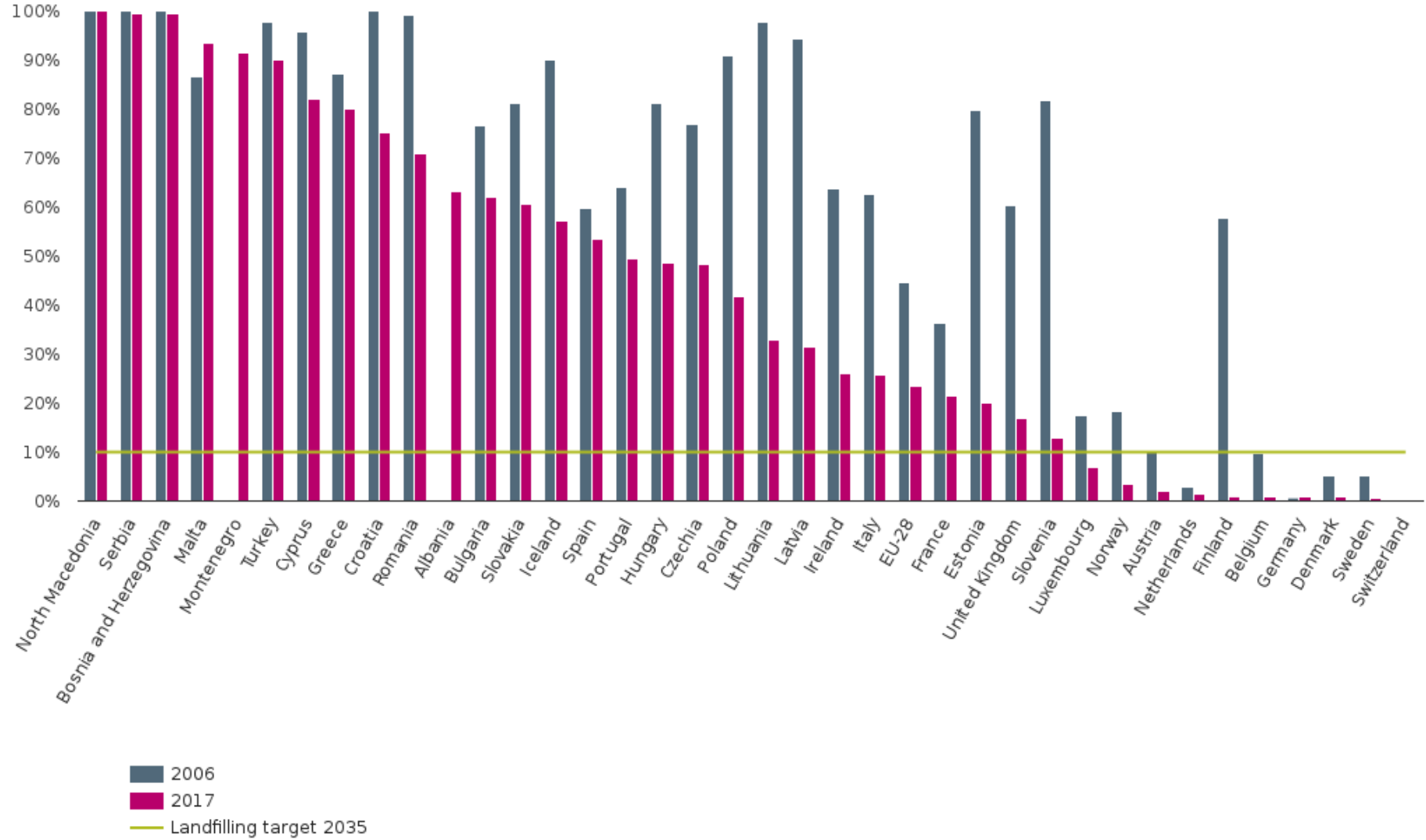
EU Waste Framework Directive (2018)

- Target of 65% recycling by 2035 – new revision in 2024
- Recycling includes the digestion and/or composting of organic waste
- This is a straight-forward opportunity: separate collection, weighing on entry into the plant, reports as recycled (water content)

Methane and Recycling Wins

- **Win-win-win-win:**
 1. Removed from landfill reducing methane emissions and leachate
 2. Gain of renewable energy source and soil amendment
 3. Further carbon capture in soils through use for soil remediation
 4. Achievement of recycling targets and creation of a circular bioeconomy

Chart — Municipal waste landfill rates in Europe by country



Percentages and Current Practice

- In MSs with colder climates the percentage of organic waste in municipal waste is 30-40%
 - The majority of these MSs treat their residual waste in highly efficient, BREF emission limit respecting waste-to-energy plants before landfilling
 - MBT or 'drying' of organic waste before landfilling will not avoid Methane emissions. It rains. Have you ever bought dried mushrooms? Then reconstituted them in water? Or simpler yet...have you ever boiled pasta? Then you understand what I am getting at.
- In the MSs with 50-90% landfilling still today, 40-60% of their municipal waste is organic waste, either directly landfilled or after MBT.

The Potential is Huge

- There has been progress but there is still huge potential for removing organic waste from municipal, commercial and industrial waste through separate collection
- Measured: 88 million tons food waste per year (EU 2018)
- Through food waste prevention measures the quantity of this food waste arriving at MBT plants and/or directly to landfill is diminishing.
- Every ton of food waste in a landfill is 1 ton of CO_{2e} (0.04ton Methane assuming 25 x potency)
- 225 million tons municipal waste generated in 2019
 - 24% landfilled (2017) = 54 million tons
 - Assume 50% landfilled untreated of which 50% organic waste = 13.5 million tons CO_{2e} (as Methane)

The Potential is Huge

- Obligation to separately collect biowaste or treat at source is almost here (end 2023)
- Technology is available
- Implementation is the next step
- Don't forget about food waste from HORECA
 - The 88 tons of food waste also come from supermarkets, restaurants, catering, hospitals which are not included in the separate collection obligation nor in the landfill reduction target
- Municipal Waste is LESS THAN 10% of total waste.

Importantly

- AD is a Local solution to a Local problem
- Low cost, financially viable solution
- Recognised as a sustainable investment giving access to funding

www.municipalwasteurope.eu

SINCE 2009



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*Performance of biogas plants
towards methane emissions*

VIKTORIA WECHSELBERGER

Research Associate, University of Natural Resources
and Life Sciences of Vienna



26–27 October 2021, Brussels



Performance of biogas plants towards methane emissions

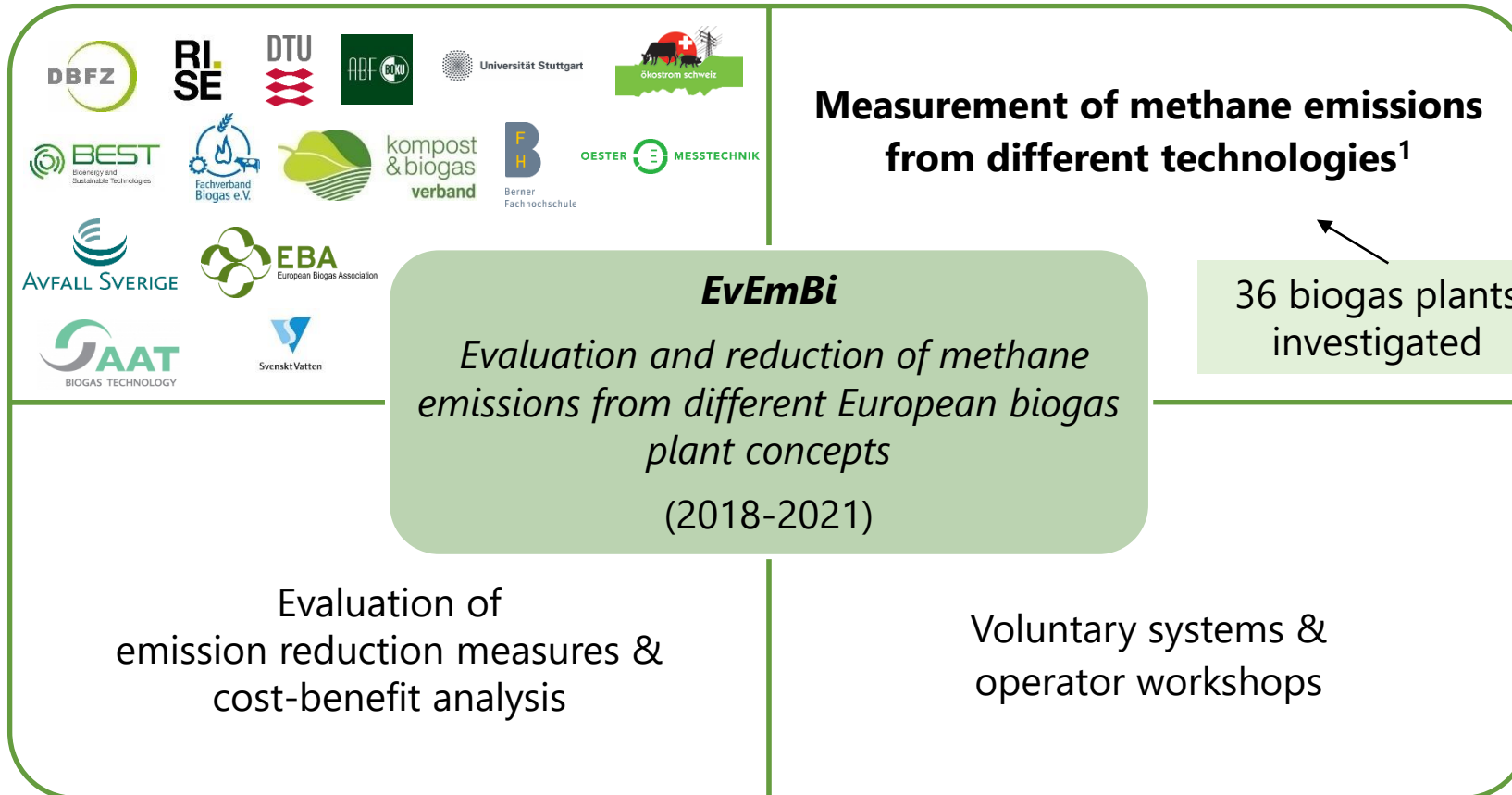
Viktoria Wechselberger

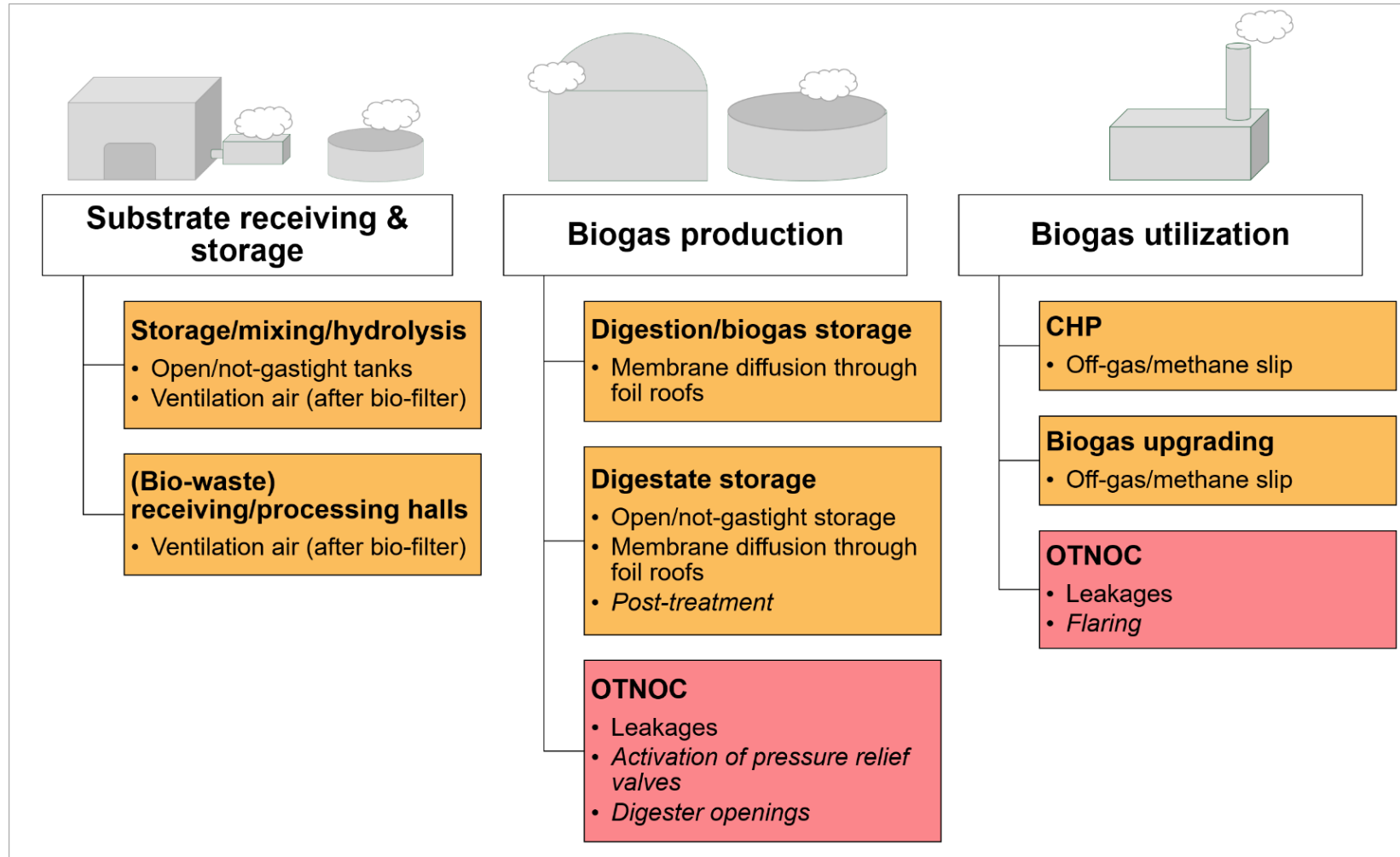
University of Natural Resources and Life Sciences, Vienna

Department of Water, Atmosphere and Environment

Institute of Waste Management

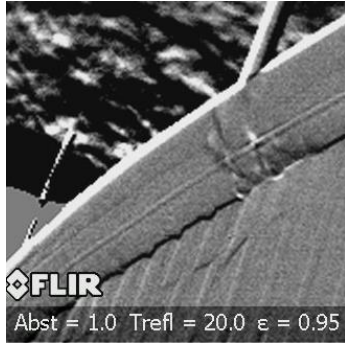






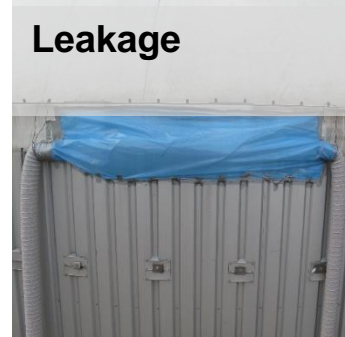
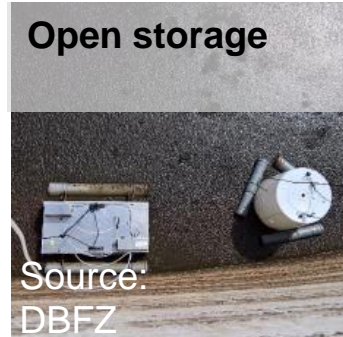
CHP: combined heat and power, OTNOC: other than normal operating conditions

1. Leak detection



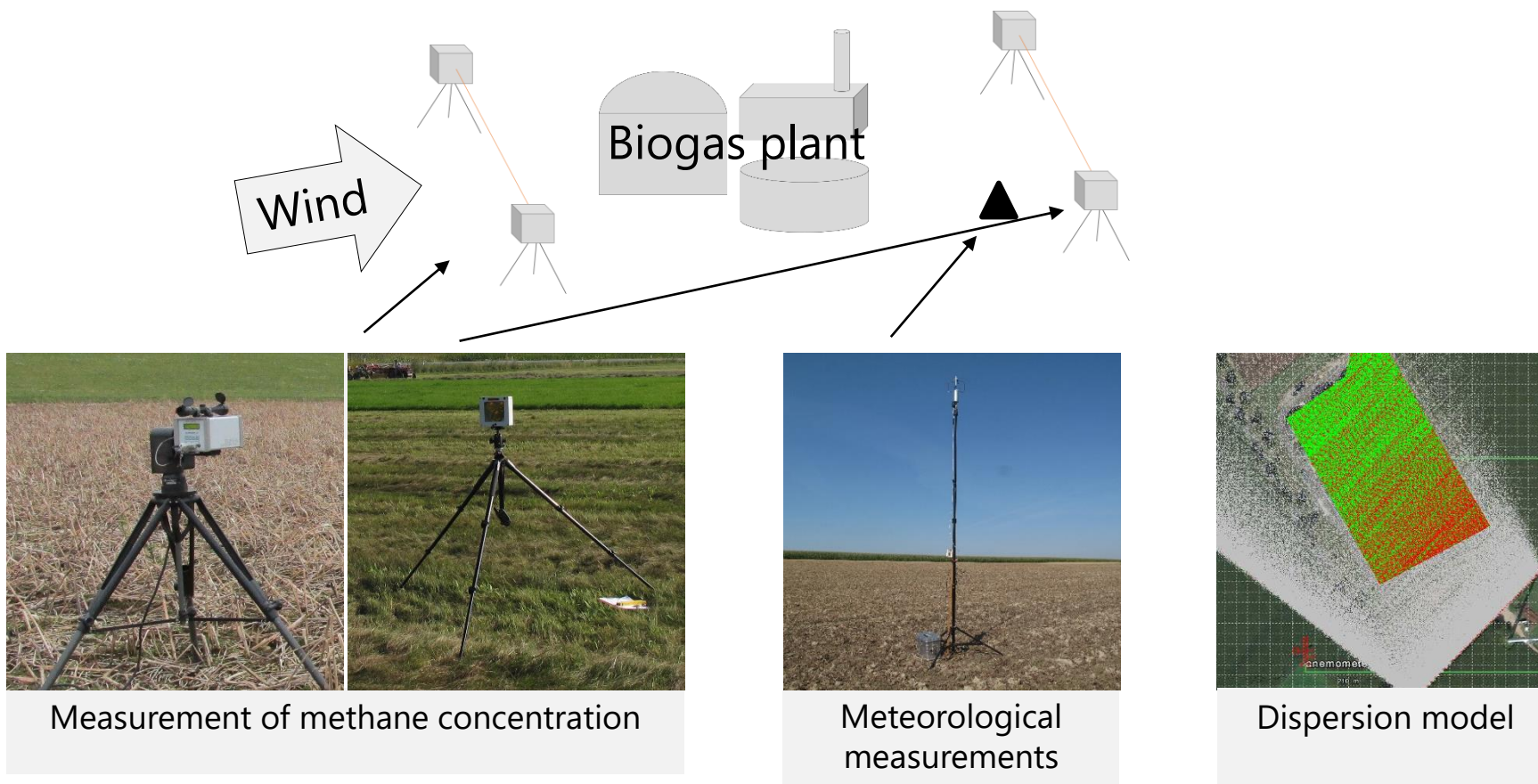
- Component emissions
- Deduction of emission reduction measures

2. Emission mass flow



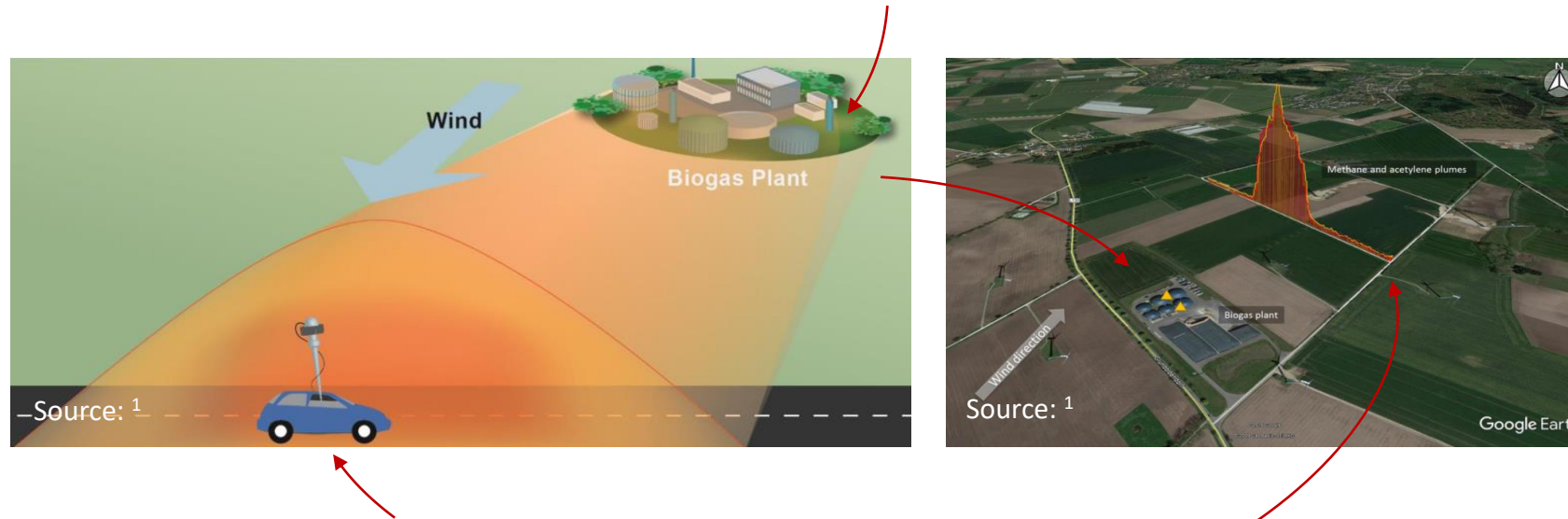
CHP: combined heat and power, BUU: biogas upgrading unit

Inverse dispersion modelling method (IDMM) ^{1,3}



Tracer gas dispersion method (TDM) ^{1,4}

Controlled release of tracer gas



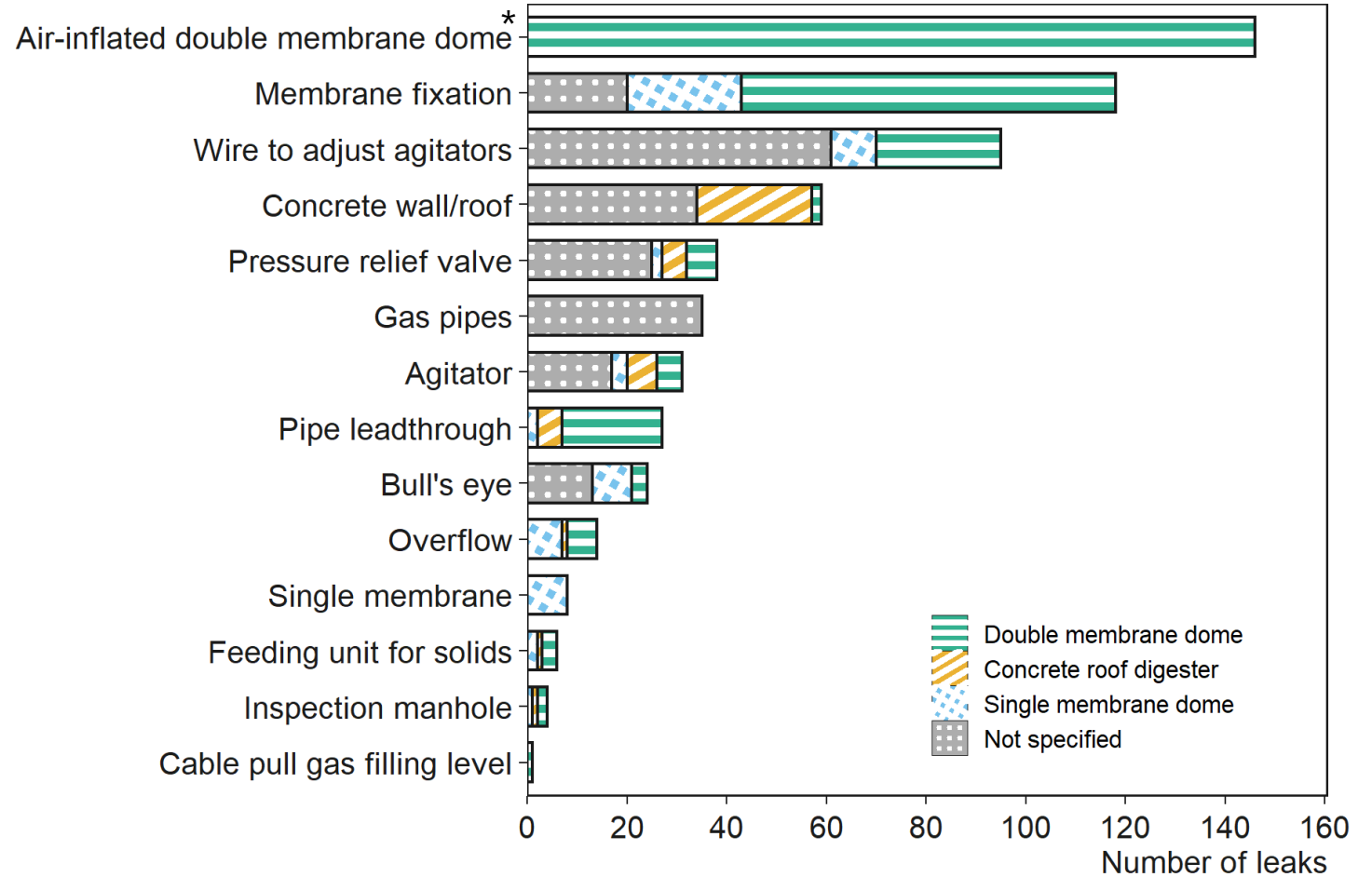
Gas concentrations measurements (methane, tracer gas)

* Digesters & gastight digestate storage tanks

Study	Country	Number of biogas plants	Number of investigated tanks*	Tanks with ≥ 1 leak
<i>EvEmBi</i>	AT, CH, DE	33	48 double membrane	44%
			13 single membrane	15%
			26 concrete roof	35%
Clemens et al. (2014) ⁵	DE	Not specified (n.s.)	202 double membrane	n.s.
			35 single membrane	n.s.
			55 n.s.	n.s.
Sax et al. (2013) ⁶	CH	12	9 double membrane	33%
			9 single membrane	11%
			3 concrete roof	67%
Schreier et al. (2011) ⁷	DE	10	21 double membrane	38%
			10 single membrane	50%

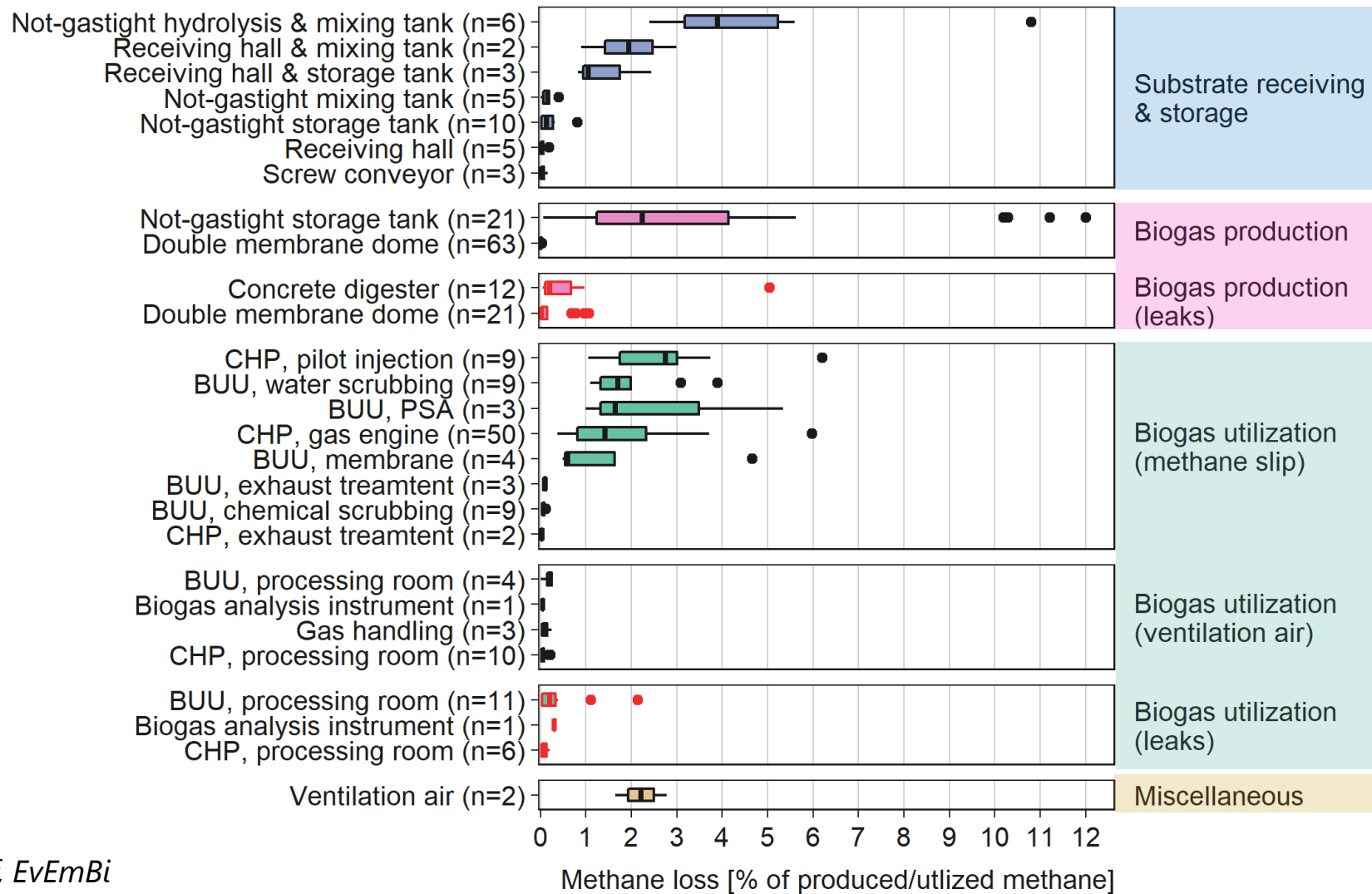
Number of leakages

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* $> 1 \text{ L CH}_4 / (\text{m}^2 \cdot \text{d} \cdot \text{bar})$ or $> 0.1 \text{ vol\% CH}_4$

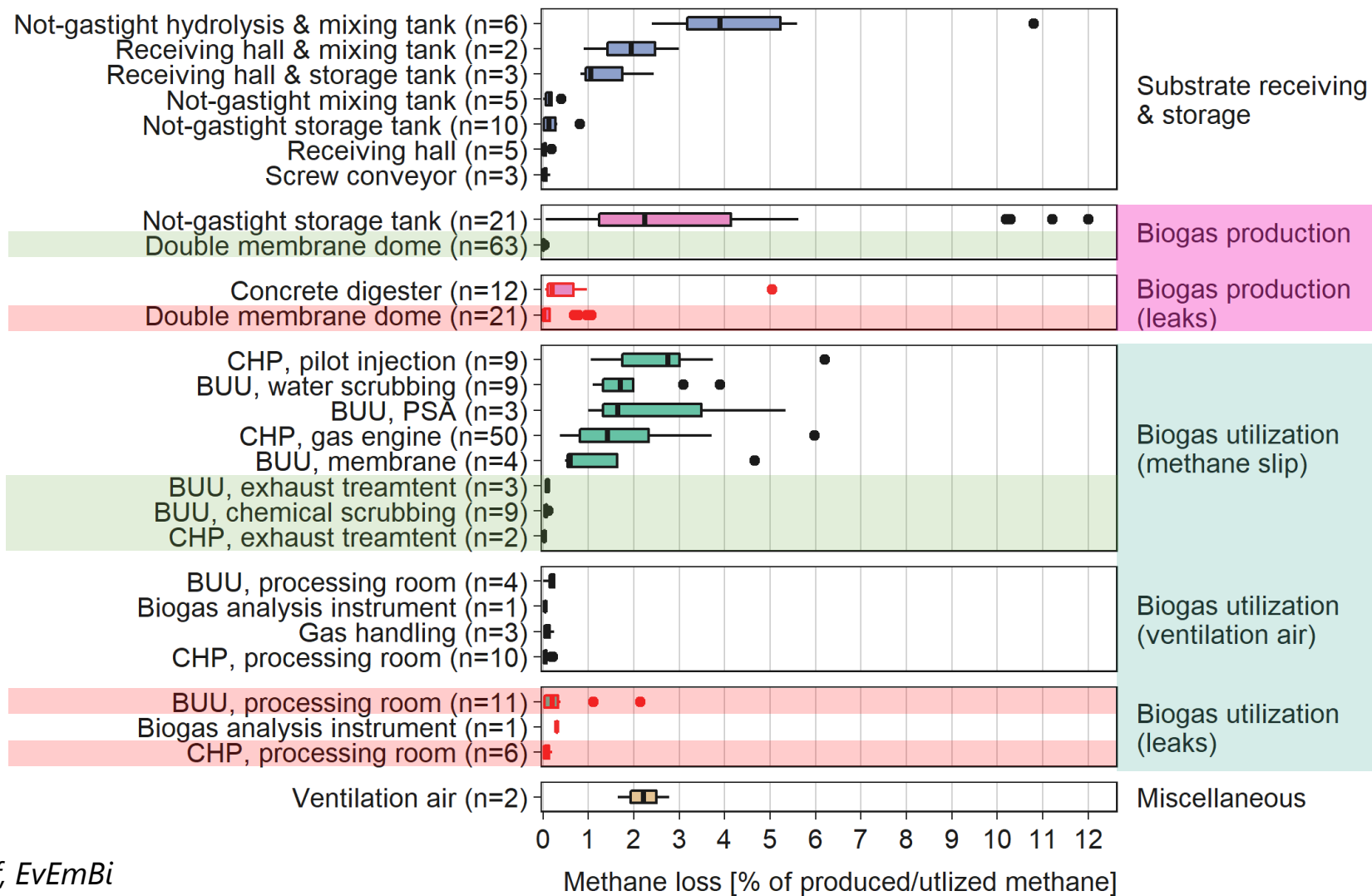
Technology specific CH₄ losses



BUU: biogas upgrading unit,
CHP: combined heat and power

Sources: ⁸⁻²⁰, Klimoneff, EvEmBi

Technology specific CH₄ losses



BUU: biogas upgrading unit,
CHP: combined heat and power

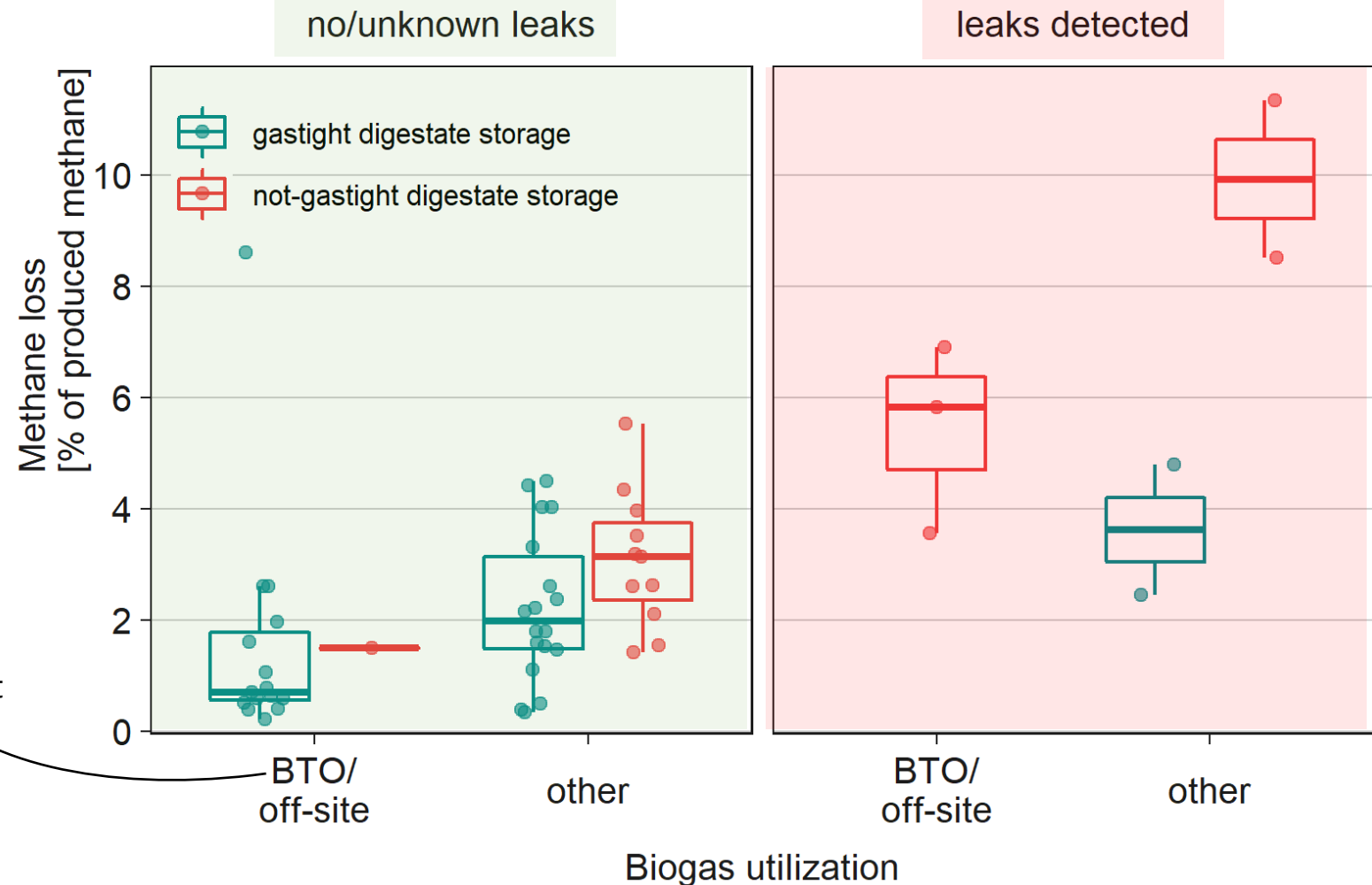
Sources: ⁸⁻²⁰, Klimoneff, EvEmBi

Methane loss:

0.2(±0.1)% - 11.3(±2.8)%
of methane production

BTO (best technology option):

- BUU (chemical scrubbing)
- BUU/CHP + exhaust gas treatment



Sources: ²¹⁻²², Klimoneff, MetHarmo, UTE B., QuantiSchluMBF, EvEmBi

- **Choice of best technology options** (for newly constructed biogas plants)
 - gas-tight construction of tanks (hydrolysis/mixing, digestate storage)
 - biogas upgrading:
 - So far, chemical scrubbing or exhaust gas treatment have shown the lowest CH₄ emissions.
 - Measurements are necessary for newly installed membrane separation units.
- **Plant operation: preventing/minimizing OTNOC** (*other than normal operating conditions*)
 - regular leak detection (self- and external inspection)
 - gas storage - pressure relief valves (accurate measurement of filling level, adjustment of operational parameters - i.e. target value for filling level = 50%)

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Assumptions:

- Economic lifetime: 10 years
- Interest rate: 2 %
- CO₂ equivalents (CO_{2eq}) of CH₄: 28
- Emission trading course: 40 €/t CO_{2eq}²³

Mitigation measure	CH ₄ loss (before measure) [%] ¹	Emission reduction [%]	Net present costs	Evaluation
1. Maintenance of CHP unit after malfunction	3.2	34.9	0 € (covered by maintenance contract)	+++
2. Chemical scrubber: exchange of amine	0.1	45.4	0 € (covered by maintenance contract)	+++
3. Exchange of leaking inner membrane of air-inflated double membrane dome	0.7	99.7	15.000 € (material & construction costs) + costs of lost biogas production²	++/+++⁴
4. Gastight cover of digestate storage tank	1.3	98.5	90.000 €	++

NPV A, B < 0 (+)
 NPV A < 0 < NPV B (++)
 NPV A, B > 0 (+++)

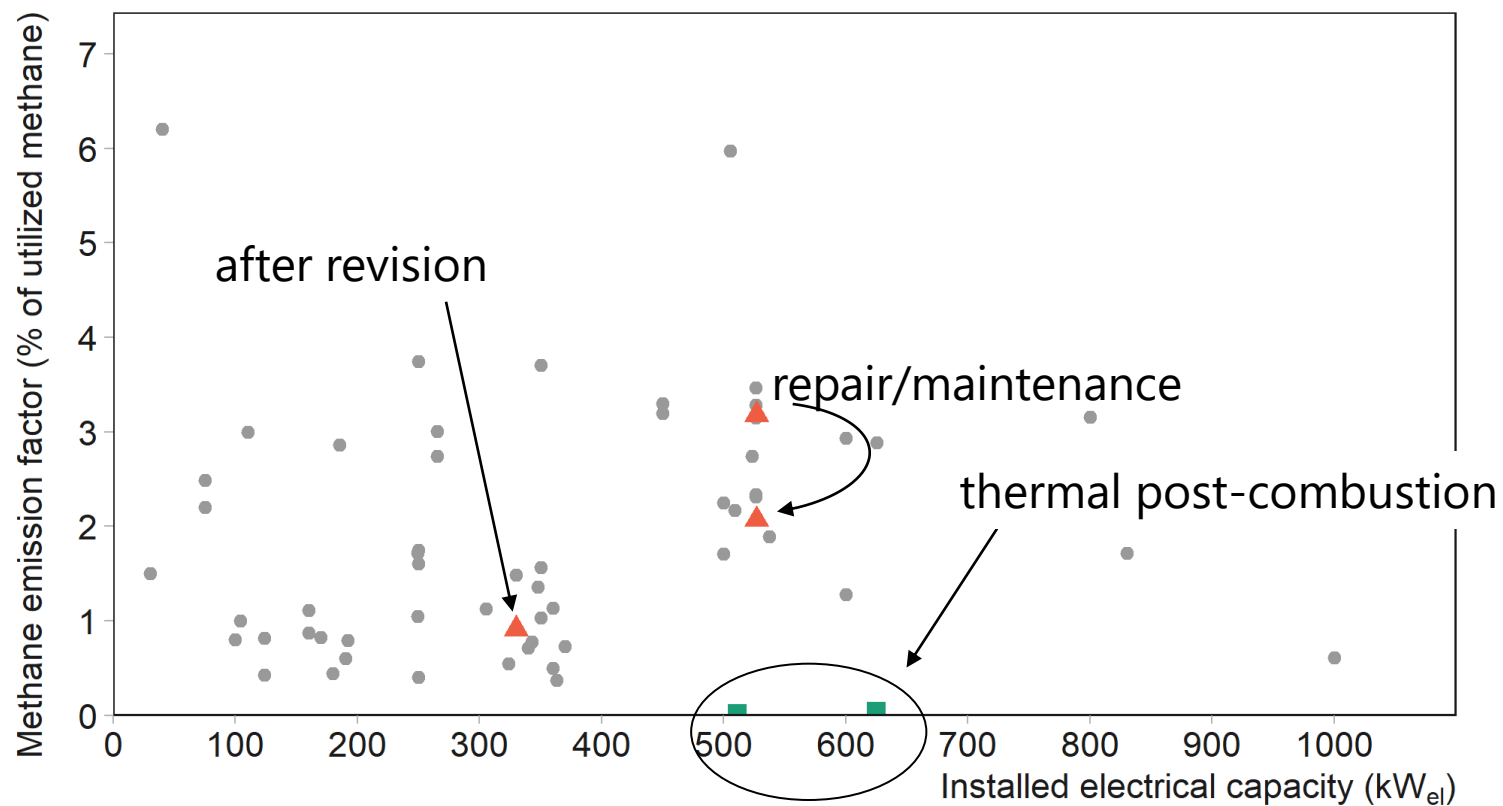
+++ , in case measure is implemented during next scheduled revision/emptying of the digester

¹ in % of produced/utilized methane

² By emptying the digester, 1/3 of the biogas production is lost over a period of 3 months.

CHP: combined heat and power, NPV = net present value;

Methane slip CHP units: **1.6 % (median)**



Sources: ¹⁰⁻¹³, EvEmBi

EBA Conference – 27 October

*Drone-deployed Methane Emissions
Detection & Quantification – a Case Study*

MICHAEL SUTCLIFFE

Business Development Director for Europe, SeekOps



26–27 October 2021, Brussels



Drone-deployed Methane Emissions Detection & Quantification – a Case Study

Michael Sutcliffe - Business Development Director, Europe

SeekOps: Methane Leak Detection and Quantification (LDAQ™)

01

DETECTION

SeekOps sensors can be deployed through our complete aerial solution or on the ground while correctly detecting 100% of leaks 100% of the time without false positives.

02

LOCATION

At the first sign of an emissions detection, the exact locations of the leaks are rapidly localized and our software provides comprehensive emissions data to triage repair activities.

03

QUANTIFICATION

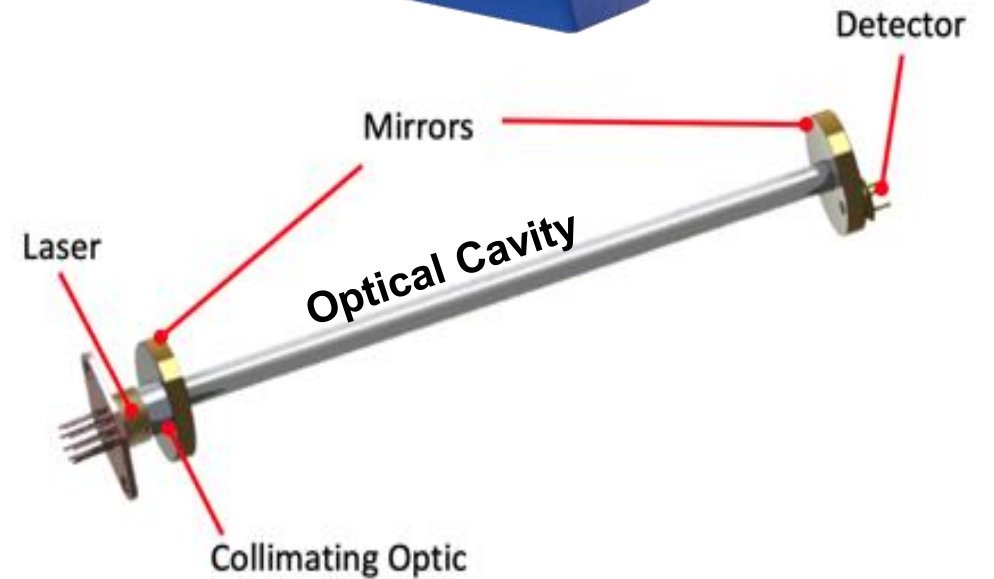
Our analytics engine provides accurate measurement of emissions rates to prioritize operational repair planning.



Technology: Unique, Field-Proven

SeekIR® Laser Spectrometer: designed for industrial applications

- Tunable Diode Laser - Open Cavity
- Ruggedised
- High Sensitivity - PPB
- Methane detection limit: 0.1 kg/hour
- Drone Agnostic & Lightweight < 600g
- Self-Contained Power/Communications
- Low Power (< 2W)
- Actionable Reporting
- Automation
- Field-Proven, Repeatable & Consistent Workflows

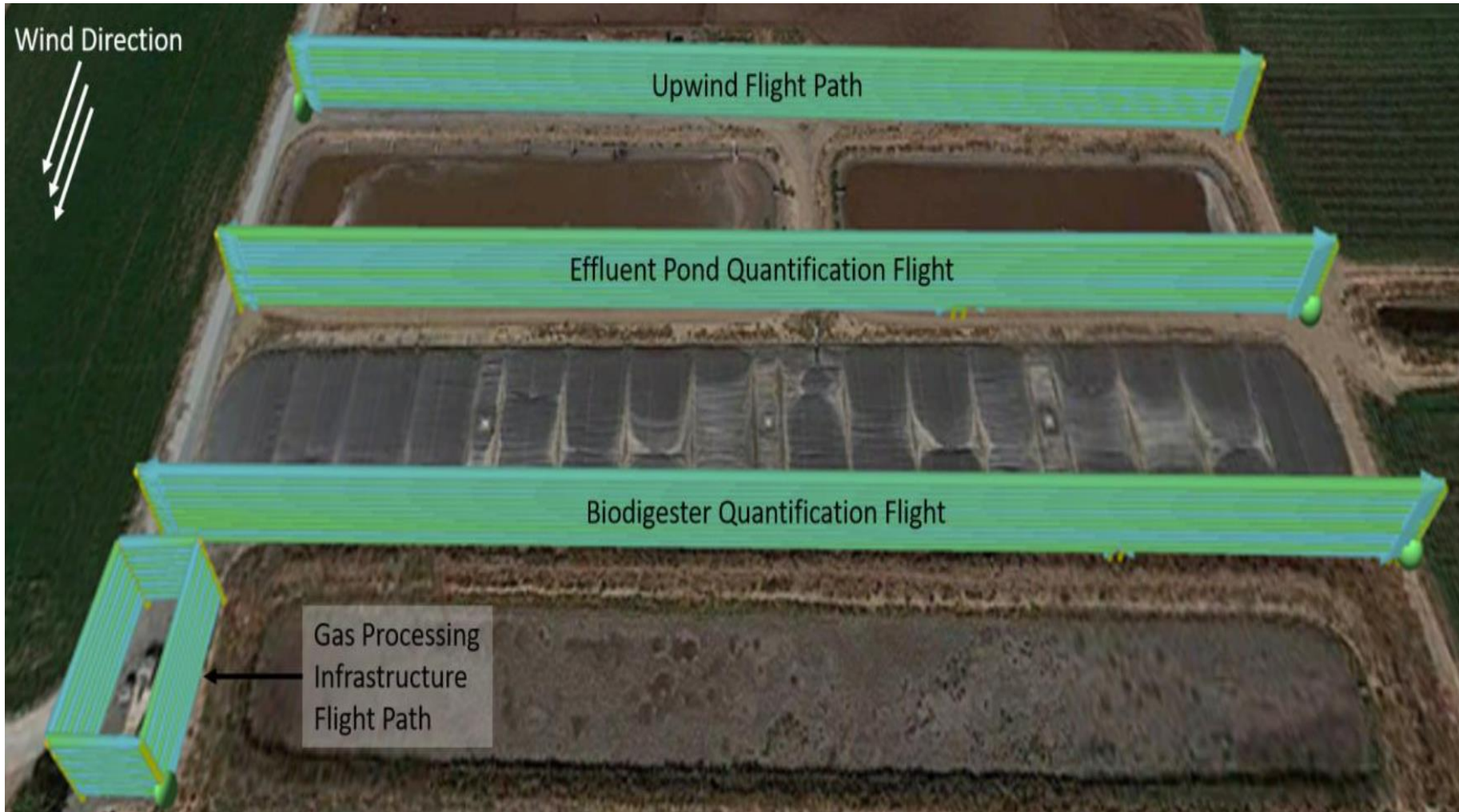


Technology: Immediate On-Site Feedback

- Ground Control Station
- Methane concentration
- Satellite base map
- Wind speed and direction
- Drone telemetry
- Equipment status lights
- On site flight planning
- Waypoint file upload



Drone Flight Plans for Biogas Facility LEAK QUANTIFICATION



VERTICAL RASTER FLIGHT PATTERN

Emissions rates from all detected sources

- Biodigester
- Effluent ponds
- Gas Processing Infrastructure

Case Study: Biogas Facility - has high methane leak potential



Pilot Biogas Project

- Surveyed 8 Biodigester facilities and associate gas upgrade stations:
 - 5 concrete digesters & 3 metal dome digesters
- Capable of completing 3 to 4 digester sites/day:
 - Automated / Repeatable - efficiency gains 5-10x
 - Captured Hi-Res Map - comprehensive 3D Inspection
- Localisation & quantification of emission sources
- Sensor used as handheld device for component level identification (removed OGI requirement) - faulty components tagged for repair
- Used data gathered to develop actionable biogas report – quantification of methane emissions



Actionable Biogas Reporting

➤ Project Overview

- Prioritise equipment from highest emitters to lowest emitters

➤ Site Emission Overview

- Provides an overview of emissions on site by area/equipment

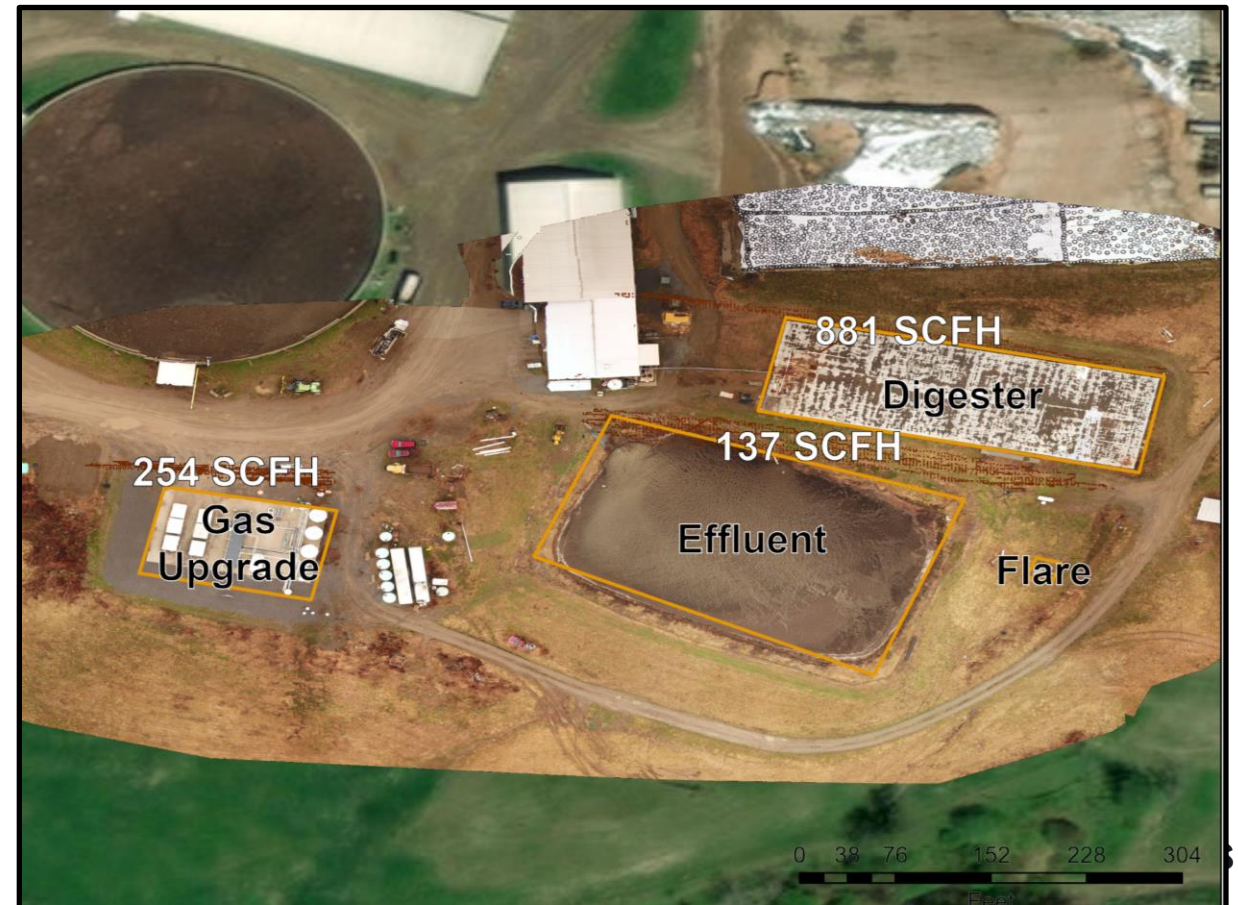
➤ Emission Source Overview

- Provides an overview of where emission sources were found in each area

➤ Emission Source Figures

- High resolution image identifying the emission sources identified

Emission Rank	Site	% of Total Emissions	Total Site Emissions (SCFH)
1	Digester 2	28%	3199
2	Digester 7	25%	2837
3	Digester 1	15%	1738
4	Digester 4	11%	1272
5	Digester 5	10%	1129
6	Digester 6	7%	750
7	Digester 3	2%	251
8	Digester 8	1%	94
Total			11270



Typical Biogas Facility Emissions Sources



Biogas Facility - Survey Results & Lessons Learnt

- Highly effective at rapid detection & quantification of wide range of biodigester site emissions
- Digester zone localisation key to prompt repair action
- Leaks found in low oversight areas
 - Mixers/open ports – not typically surveyed
 - Equipment may not be sealing as designed
- Upgrader/Digester system leaks above slippage assigned – typically 3%
 - **Measured leaks 5 times higher**
- Cost impact of methane losses for some facilities:
 - **Over €3,000/day lost revenue**



Key Benefits: SeekOps Drone-deployed Biogas Site Surveys

- Survey costs quickly recovered by corrective actions identified
- Quantification of emissions reveal extent of under/over reporting
- Rapid & cost-effective service for:
 - **Differentiated gas valuation**
 - **Leak detection & quantification**
 - **ESG reporting**
 - **Carbon credit & offsetting applications**





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Europe

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Web: www.seekops.com



BREAKOUT SESSION: AN INTEGRATED APPROACH TOWARDS METHANE EMISSIONS REDUCTIONS

Question & Answer Session



Bruno Sander Nielsen, Danish Biogas Association, Copa-Cogeca

Vanya Veras, Municipal Waste Europe

Viktoria Wechselberger, BOKU Vienna

Michael Sutcliffe, SeekOps

BREAKOUT SESSION: DRIVING INNOVATION

Moderated by TV & Radio presenter Sasha Twining



Marieke Verbeke, Systemic EU project

Francesca Magnolo, Gent University

August Bonmati Blasi, IRTA

Ann-Kathrin van Laere, DiBiCoo EU Project

EBA Conference – 27 October

Mainstreaming of demonstrated innovative nutrient recovery and recycling systems in EU biogas plants

MARIEKE VERBEKE

Representative of Systemic EU project



26–27 October 2021, Brussels



Horizon 2020



SYSTEMIC
Circular solutions for biowaste

Mainstreaming of demonstrated innovative
nutrient recovery and recycling systems in
EU biogas plants

27-10-2020

Groot Zevert Vergisting



AM-Power



Benas



Acqua e Sole



Waterleau NewEnergy



**Visionaries / pioneers
5 demonstration plants**

Schemes of NRR
Performance of the demo plants
Product quality information
Field tests (agronomical)
Experiences demo plant owners?

**Minimize barriers – political
embedding
Nitrates Dir., FPR, ...**

Legislative aspects regarding products
Policy recommendations → Policy Roadmap

**Sustainable approach
EIA & LCA**

Environmental aspects --> potential issues?
LCA --> More/less sustainable?

**Outreach
10(+24) plants as first
followers**

**Economically feasible
Business cases -
nat. legislation / subsidies**

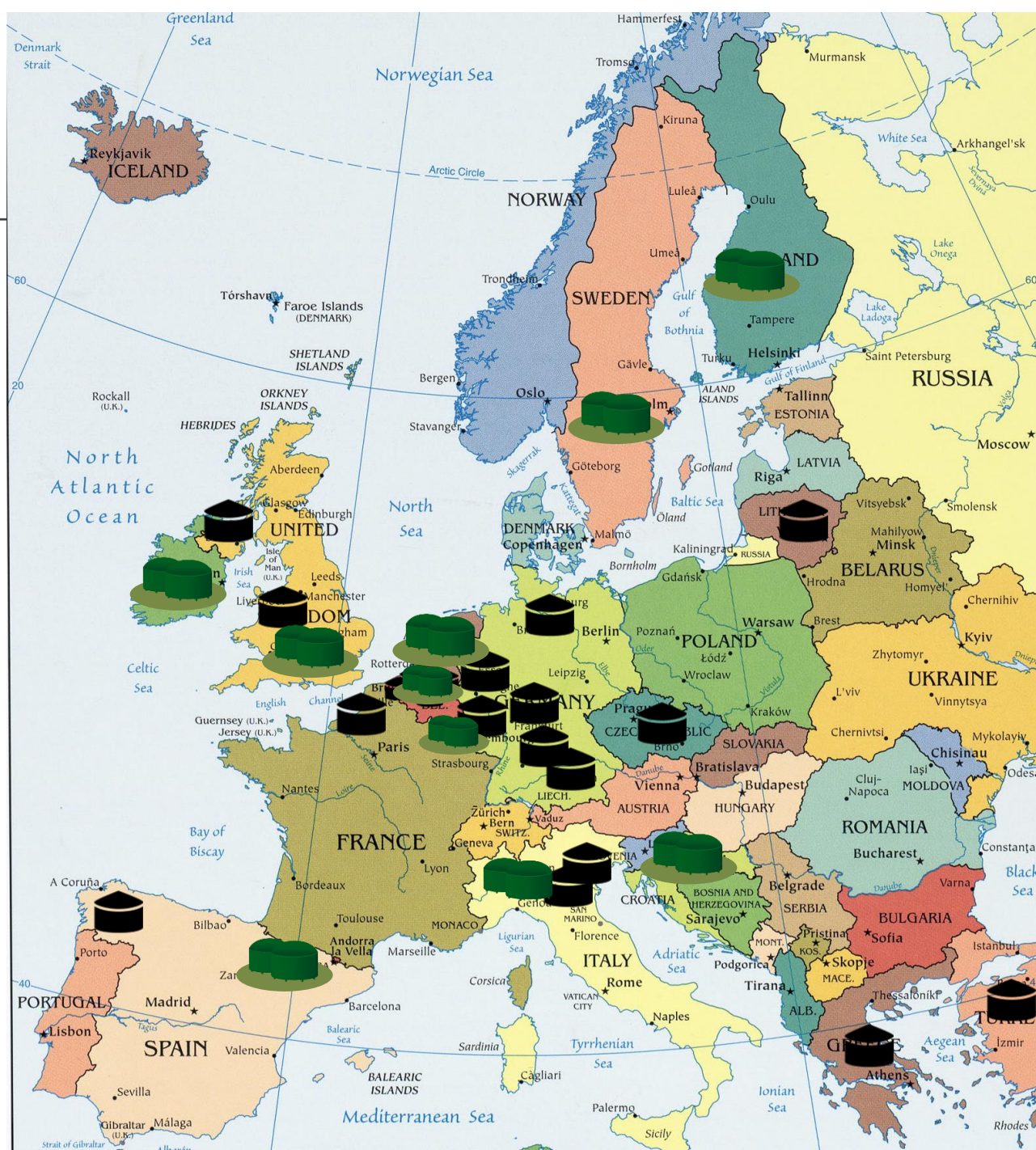
KPI's definitions
KPI calculation tool
Business case evaluation of Demo Plants
Business models for Demo Plants
Financial advantages / subsidies



10 Outreach Locations



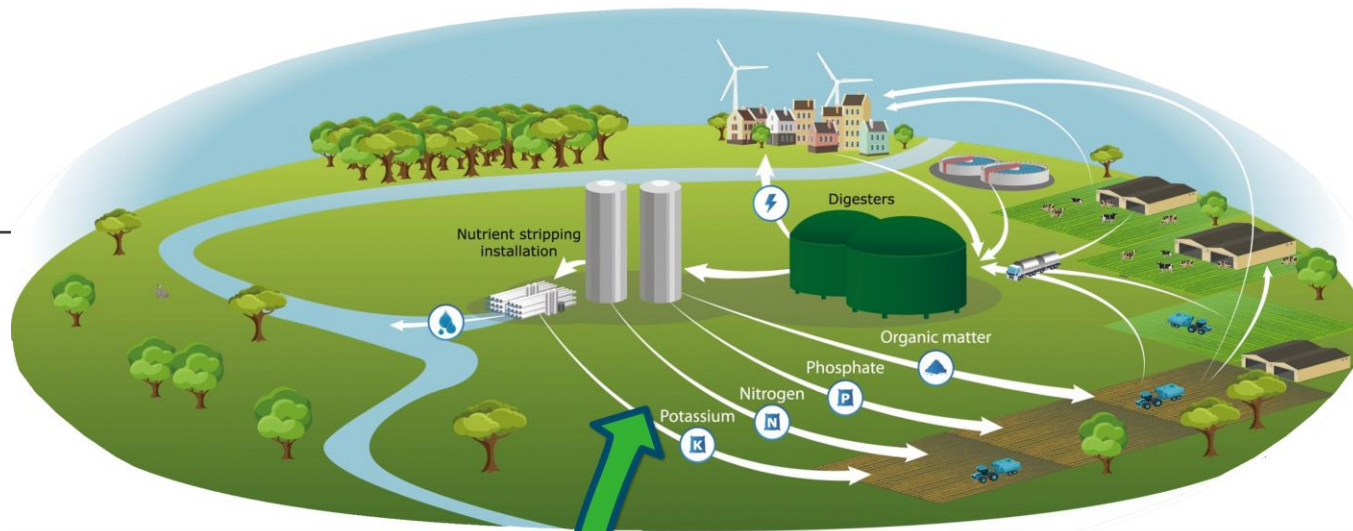
31 Associated plants



Consortium functions as

- initiator
- stakeholder
- Intermediate
- facilitator

for setting up and supporting
Living Labs /co-creation sessions



Learning &
experience
exchange



Living Lab
Meetings



Living Lab
Visits



Living Lab
Exclusive
newsletter &
webpage



Continued transfer of knowledge, network → EU biogas plants?

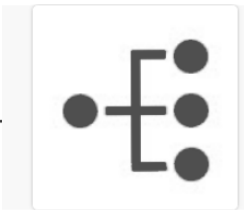
“Business Development Package”

<https://systemicproject.eu/bdp/>

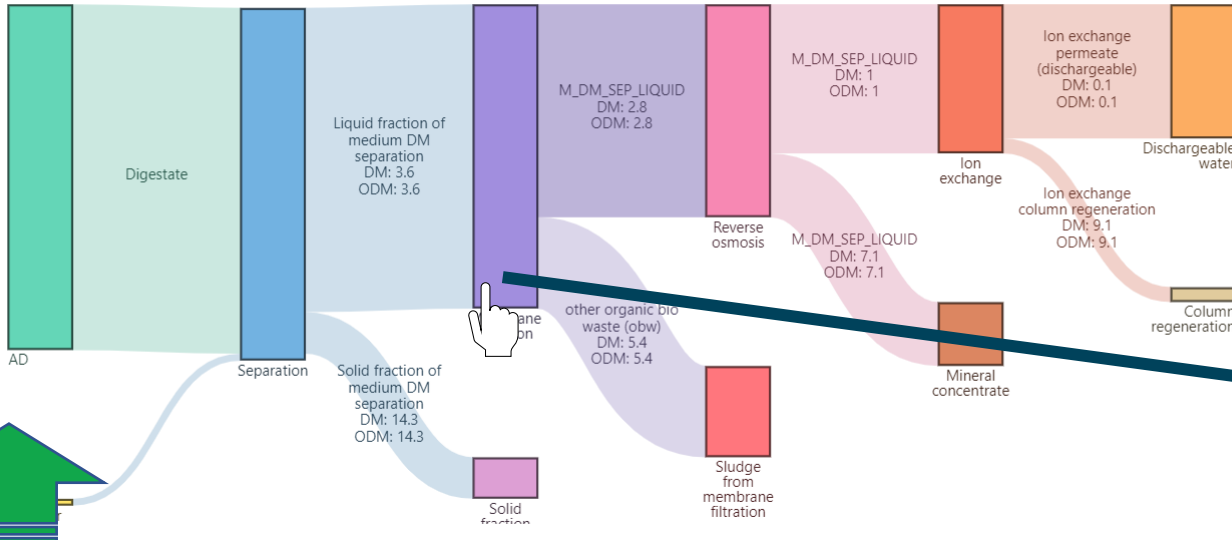
BUSINESS DEVELOPMENT PACKAGE

The Business Development Package will help biogas plants explore the possibilities of recovering nutrients and water from digestate by means of technology.





21 pre-set NRR cascades for digestate



TECHNOLOGY FACT SHEETS



Configure the separator View fact sheet

Digestate from "AD" 85000 ton/year + Polymer 20 l / ton Change Add additive

will result in output of

86.27% Membrane filtration 74796 ton/year

11.76% Solid fraction 10196 ton/year

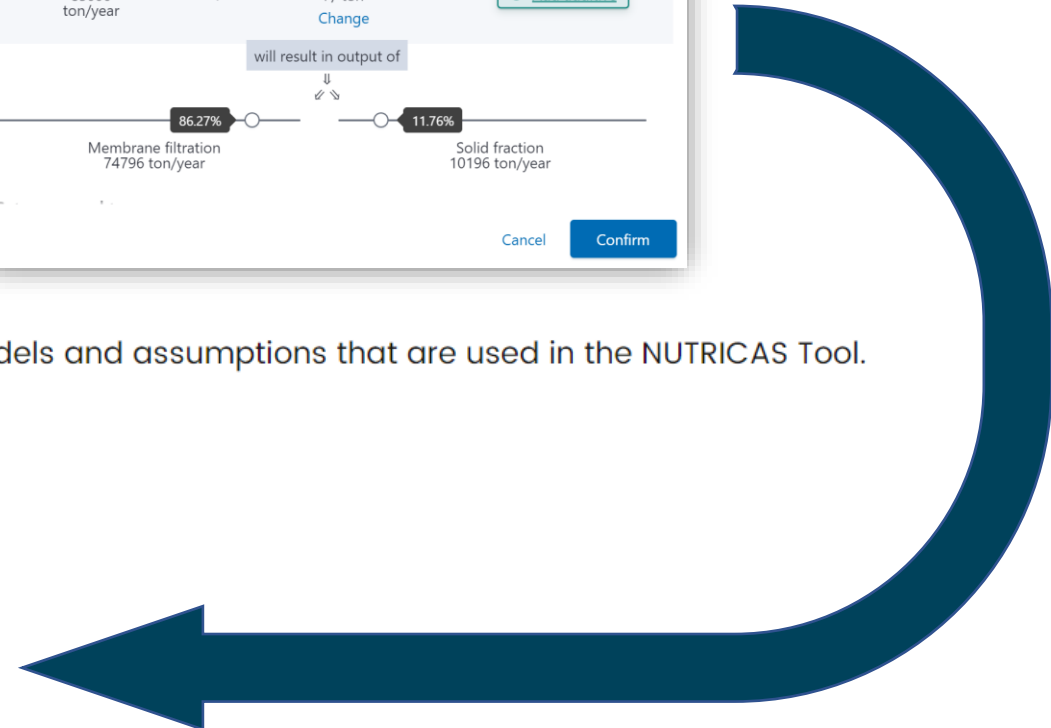
Cancel Confirm

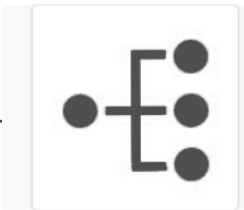
THE NUTRICAS MANUAL AND TOOL DESCRIPTION

The NUTRICAS Manual contains the most recent description of the calculation models and assumptions that are used in the NUTRICAS Tool.

SYSTEMIC DATABASE

This excel file contains recovery rates for NH3 stripping-scrubbing, evaporation, drying, membrane filtration,...





Configure the separator [View fact sheet](#) Current status ×

Technology

▼

Decanter Centrifuge

Decanter Centrifuge

Belt Press

Screw Press

Default models



Future?

▼

Decanter Centrifuge

Decanter Centrifuge

GEA Environmental Decanter

Pieralisi Magnum

Belt Press

Screw Press

+ specific company models

or

Configure N stripper-scrubbing technology [View fact sheet](#)

Technology

▼

CO2 stripping to pH 8.8, 65°C, 80% of NH4-N stripped

CO2 stripping to pH 8.8, 65°C, 80% of NH4-N stripped

No pH increase, 50°C, 50% of NH4-N stripped

Default models



CO2 stripping to pH 8.8, 65°C, 80% of NH4-N stripped

CO2 stripping to pH 8.8, 65°C, 80% of NH4-N stripped

AMFER (Colsen)

AECO-NAR (Nijhuis Industries)

Valu-TRAC (Cooperl)

No pH increase, 50°C, 50% of NH4-N stripped

Technologies and mass balances



NUTRICAS Tool

for exploration and inspiration on technologies for nutrient recovery

PROCESS SCHEMES OF DEMONSTRATION PLANTS

FACT SHEETS OF THE DEMONSTRATION PLANTS

SANKEY DIAGRAMS MASS- AND NUTRIENT BALANCES FROM DEMO PLANTS

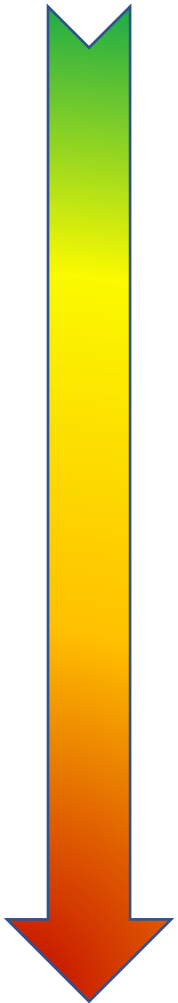
BIOGAS PLANT DISCUSSIONS ON TECHNOLOGIES

WEBINAR ON THE USE OF POLYMERS FOR OPTIMIZATION OF DIGESTATE SEPARATION



REPORT: SCHEMES AND SCENARIOS FOR TECHNOLOGIES OF NUTRIENT RECOVERY

Per technology, estimations are given for
separation efficiency and recovery rate





Economic **Key Performance Indicators** can help to understand how an organisation is performing. KPI's are quantifiable and KPI's are quantifiable and are understood as a pillar of the biogas plants' performance management system. They can be associated with targets which the organisations should set and pursue and aim at quantifying their achievement.

Raw feed cost / revenue

material	substrate	tons of material treated	cost (-) / revenue (+)
energy crops	corn	85000	<input type="text"/> revenue
pig slurry		20000	<input type="text"/> revenue
TOTAL RAW FEED COST			€ 49857 / year

Disposal or usage of end products

end product	technology used	amount	disposal cost	amount to be used as fertiliser on own land	yearly disposal cost (-) / revenue (+)
solid fraction	centrifuge	8500 ton / year	<input type="text"/> € / ton	<input type="text"/> ton / year	- € 2,295 / year cost
mineral concentrate	reversed osmosis	20335 ton / year	<input type="text"/> € / ton	<input type="text"/> ton / year	€ 20335 / year revenue
TOTAL DISPOSAL REVENUE					€ 18000 / year revenue

User gives this information on their business case

(which we can (anonymously) store in our database)

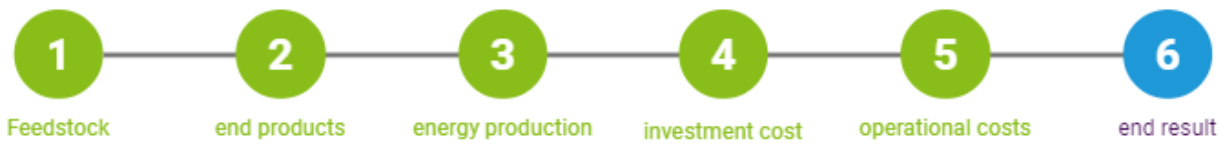
Energy balance

energy production	amount	cost
feed-in electricity	<input type="text"/> MWh/year	<input type="text"/> € / year
electricity used on-site	<input type="text"/> MWh/year	<input type="text"/> € / year
Green certificates	<input type="text"/> MWh/year	<input type="text"/> € / year
Heat certificates	<input type="text"/> MWh/year	<input type="text"/> € / year
TOTAL ENERGY REVENUE		€ 39940 / year

Other certificates MWh/year € / year

[add certificate](#)

bio methane products	amount	cost
Feed-in biomethane		
Bio-LNG/CNG		
TOTAL BIOMETHANE ENERGY COST		€ 4000 / year



End result: KPI overview







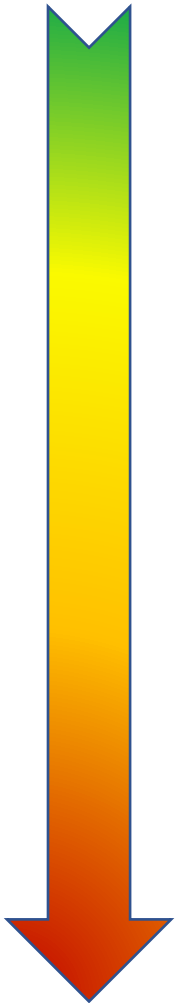


KPI Calculation Tool

this tool will calculate the KPI's for your biogas plant's business case

PRACTICAL INFORMATION

-  PRESENTATION ON ATRIA BIOGAS PLANT (FI) WITH LBG PRODUCTION AS MAIN REVENUE - 2021
-  BROCHURE: HOW BEST PREPARE FOR A LOAN APPLICATION FOR NRR TECHNOLOGIES ON DIGESTATE?
-  **REPORT: DEVELOPMENT AND APPLICATION OF ECONOMIC KEY PERFORMANCE INDICATORS (KPIs)**
This report gives and overview of the developed commercial key performance indicators (KPIs) for biogas plants and their application to the Demonstration Plants.
-  **REPORT: BUSINESS CASE EVALUATION OF THE DEMO PLANTS**
The five demonstration plants operate according to individual business models and policies within determined regulatory and economic frameworks. The report evaluates the factors that make the difference between a viable and non-viable AD+NRR business in the states where the demonstration plants are located.





CONTACT POINTS FOR LEGISLATIVE ASPECTS

+ Europe

+ Austria

+ Belgium

...



REPORT: REGULATIONS GOVERNING ANAEROBIC DIGESTION AND NUTRIENT RECOVERY IN EU MEMBER STATES

This deliverable in the framework of the SYSTEMIC project in 2019 provides an overview of the current European Policies which are followed by European Regulations that must be enforced by all Member States.

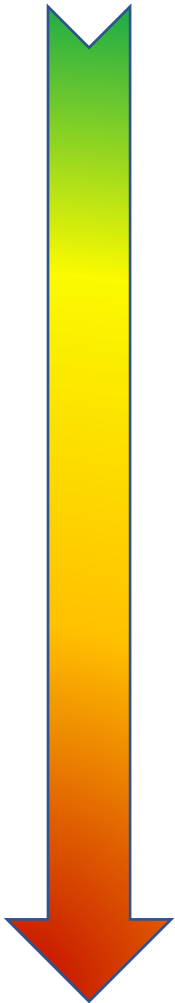
European Directives which must be adopted by Member States but not literally. Directives typically stipulate a target but leave room for selecting the strategy and pathway by the Member State.

Therefore, comprehensive legislative information is given for the countries with demonstration plants and outreach plants.



NUTRI2CYCLE REPORT: EFFECTS OF THE CURRENT LEGAL FRAMEWORK ON CNP IN MAIN FARMING SYSTEMS IN EUROPE

This deliverable in the framework of the Nutri2Cycle project in 2021 provides an update of the SYSTEMIC report and focusses more on the legal framework on CNP flows in place in EU agriculture and includes animal husbandry and plant production. The report considers carbon, nitrogen and phosphorus in European and national legislation.





PRODUCT FACT SHEETS FOR FARMERS

The product fact sheets for farmers provide extra information on the product composition and how the products should be practically applied in an environmental friendly way.

PRODUCT FACT SHEETS

Ammonium nitrate solution



Technical description

Ammonium nitrate (AN) and ammonium nitrate (AN) are both the same basic compound and for this reason the same safety rules should be followed. The safety rules for AN are described in the European Directive 92/69/EEC on the transport of dangerous goods. The safety rules for AN are described in the European Directive 92/69/EEC on the transport of dangerous goods. The safety rules for AN are described in the European Directive 92/69/EEC on the transport of dangerous goods.

Product description

Ammonium nitrate (AN) is a white crystalline solid. It is highly soluble in water. It is used as a fertilizer and as an oxidizing agent. It is highly soluble in water. It is used as a fertilizer and as an oxidizing agent.

Parameter	Value
Ammonium nitrate (AN)	30%
Water	70%

Ammonium sulphate solution



Technical description

Ammonium sulphate (AS) is a white crystalline solid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Product description

Ammonium sulphate (AS) is a white crystalline solid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Parameter	Value
Ammonium sulphate (AS)	20%
Water	80%

Ammonium solution



Technical description

Ammonium solution is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Product description

Ammonium solution is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Parameter	Value
Ammonium	10%
Water	90%

Mineral concentrate



Technical description

Mineral concentrate is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Product description

Mineral concentrate is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Parameter	Value
Mineral	10%
Water	90%

Liquid fraction digestate



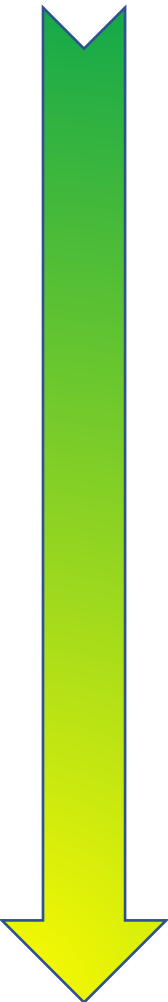
Technical description

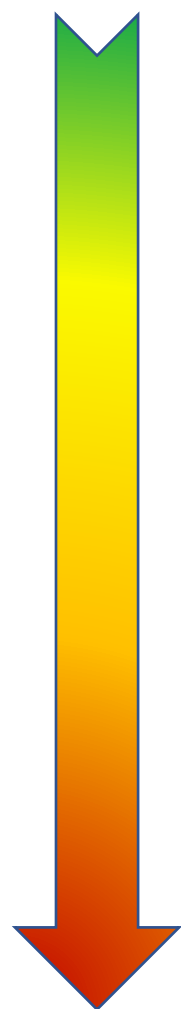
Liquid fraction digestate is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Product description

Liquid fraction digestate is a clear, colorless liquid. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner. It is highly soluble in water. It is used as a fertilizer and as a soil conditioner.

Parameter	Value
Liquid fraction digestate	10%
Water	90%





SYSTEMIC
Brochure
Recovery of nutrients and resources from digestate
2021

User preferences for digestate derived products

SYSTEMIC
Brochure
Recovery of nutrients and resources from digestate
2021

Tips for setting up a market strategy

SYSTEMIC
Brochure
Recovery of nutrients and resources from digestate
2021

Success Stories

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Fertilisers with tailor-made nutrient content

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Recovered nutrient fertilisers for organic farming

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Digestate derived gardening and horticulture products

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Nutrient source biological WWT

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Applications in chemical industry

SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Ammonia as DeNOx reductants



REPORT: MARKET RESEARCH IN EUROPE

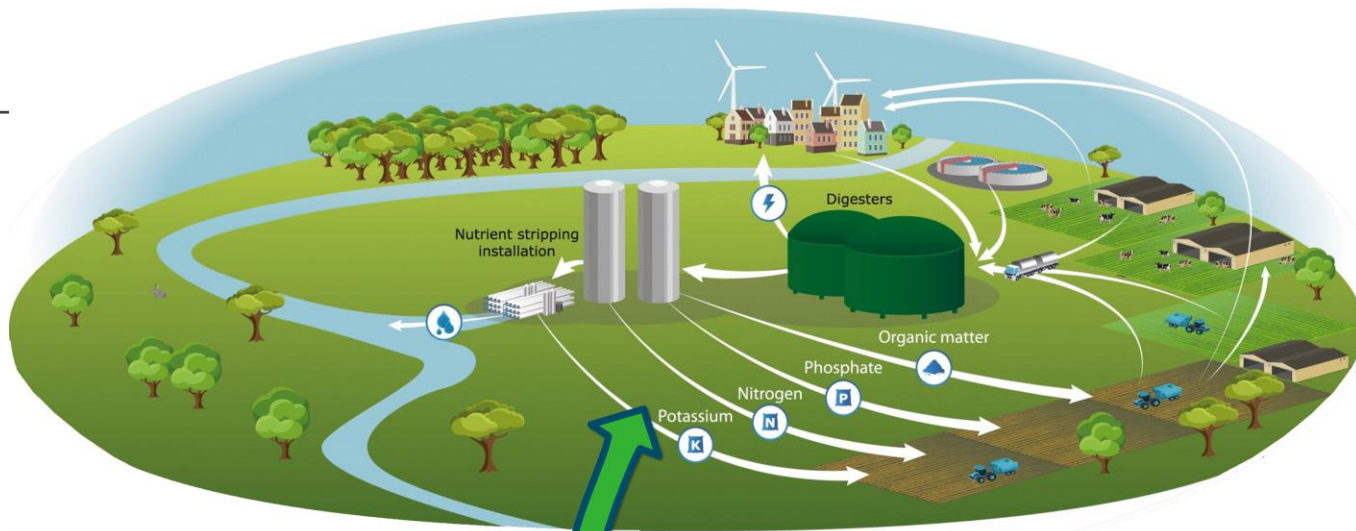
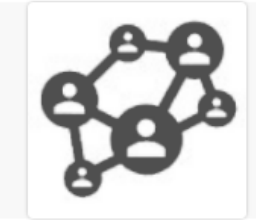
This report describes the needs for recovered nutrients and NRR technologies in different regions in Europe



REPORT: BUSINESS MODEL DEVELOPMENT AND APPLICATION TO THE DEMONSTRATION PLANTS

This report exhibits the opportunities and threats of certain business models (based on the evaluation of the demonstration plants) with regard to determined regulatory and commercial frameworks. It serves as a guideline for stakeholder for the preliminary, quick evaluation of projects.

Outreach and contact



Consortium functions as

- initiator
- stakeholder
- Intermediate
- facilitator

for setting up and supporting Living Labs /co-creation sessions

Learning & experience exchange



Living Lab Meetings



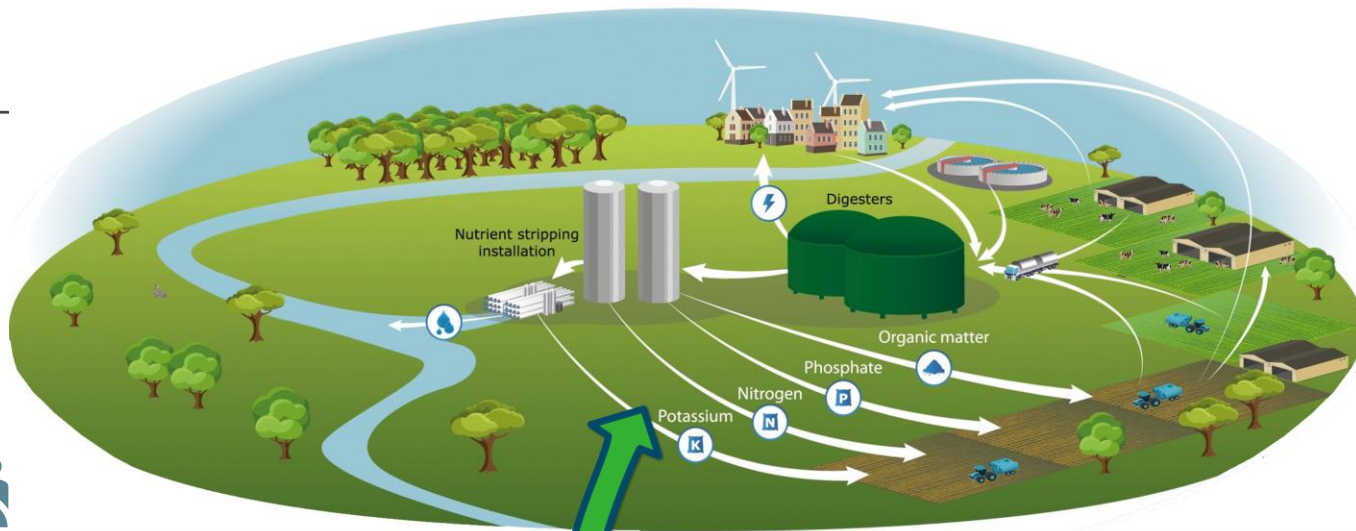
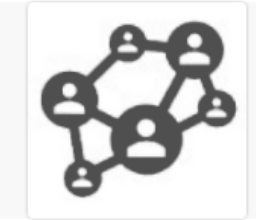
Living Lab Visits



Living Lab Exclusive newsletter & webpage




Outreach and contact



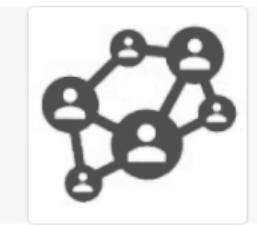
YEARLY Living Lab Meetings 

Facilitate Living Lab Visits 

Learning & experience exchange

Business Development Package 



SUMMARIES OF LIVING LAB MEETINGS

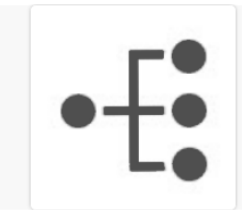
DISSEMINATION TOOLS FOR BIOGAS PLANTS

- Information sheets for farmers, citizens and policy makers
- Plant video's
- Educational presentations
- list of key publications



REPORT: APPLICATION OF BUSINESS DEVELOPMENT PACKAGE TO OUTREACH LOCATIONS

In the last part of the SYSTEMIC project, the BDP will be implemented all outreach locations. It will include information on their current business case, regional market for their current digestate-derived products and bottlenecks in digestate treatment and disposal. After application of the BDP, it will be able to describe different scenarios for NRR implementation and their feasibility and estimated impact on the current business case.



Our tools

Below you'll find a list of all our available tools, each with their own specific purpose. They are all at your disposal under the Systemic Tools toolset

Application end products of different cascades

NUTRICAS

What does it do?

Calculation tool for mass balance calculation and cost estimation for technology cascades to recover nutrients, organic matter and water from your digestate

Why would I use this?

It will give you a cost estimate as well as a full product breakdown in a sankey diagram for the selected cascade.

LAUNCH

proudly powered by  **SYSTEMIC**
Circular solutions for biowaste

KPI Tool

What does it do?

Calculation tool for mass balance calculation and cost estimation for technology cascades to recover nutrients, organic matter and water from your digestate

Why would I use this?

It will give you a cost estimate as well as a full product breakdown in a sankey diagram for the selected cascade.

LAUNCH

proudly powered by  **SYSTEMIC**
Circular solutions for biowaste

Other tool

What does it do?

Calculation tool for mass balance calculation and cost estimation for technology cascades to recover nutrients, organic matter and water from your digestate

Why would I use this?

It will give you a cost estimate as well as a full product breakdown in a sankey diagram for the selected cascade.

LAUNCH

proudly powered by  nutri 2 cycle

Other tool

What does it do?

Calculation tool for mass balance calculation and cost estimation for technology cascades to recover nutrients, organic matter and water from your digestate

Why would I use this?

It will give you a cost estimate as well as a full product breakdown in a sankey diagram for the selected cascade.

LAUNCH

proudly powered by **Nitroman**



- Specific mass balances and cost estimation of*
- *N stripping scrubbing on manure (Detricon)*
 - *Membrane filtration and RO (Strocon)*

- Questions?



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Projectmember H2020-project SYSTEMIC

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marieke.verbeke@vcm-mestverwerking.be





Gesellschaft für
Nachhaltige
Stoffnutzung mbH



Rika Biofuels
INTEGRATED BIOGAS SOLUTIONS



EBA
European Biogas Association



ICL Fertilizers
EUROPE C.V.



Horizon 2020



UNIVERSITÀ DEGLI STUDI DI MILANO



www.systemicproject.eu



EBA Conference – 27 October

Biogasdoneright™ and the biomethane potential of sequential cropping in Europe

FRANCESCA MAGNOLO

PhD student, Gent University for AgRefine ETN



26–27 October 2021, Brussels

Biogasdoneright™ and the biomethane potential of sequential cropping in Europe

Francesca Magnolo

PhD student at Gent University, Department of Agricultural Economics

Early Stage Researcher (ESR14) AgRefine ETN



About AgRefine - European Training Network

- 15 PhD students working on interdisciplinary bioeconomy projects on AD and advanced biorefinery systems
- 6 months in 2 partner organizations

My project:

Sustainable business models in the BE: territorial biorefineries and organizational and economic challenges of local feedstock integration

Secondment: EBA



“The role of sequential cropping and Biogasdoneright™ in enhancing the sustainability of agricultural systems in Europe”
F. Magnolo, H. Dekker, M. Decorte, G. Bezzi, L. Rossi, E. Meers, S. Speelman



Technical
University of
Denmark



TECHNISCHE
UNIVERSITÄT
WIEN



WAGENINGEN
UNIVERSITY & RESEARCH



BANTRY
MARINE RESEARCH STATION



CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS



Avecom
Bioproducts & Apps

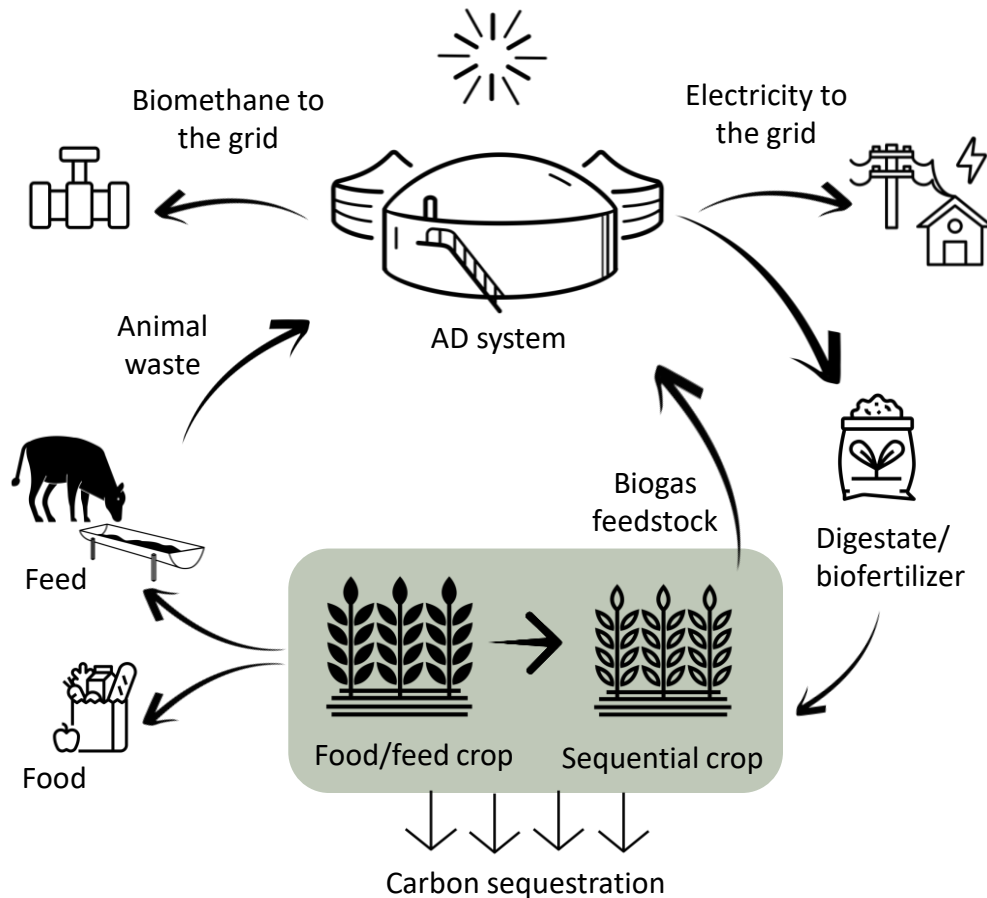


Comhairle Contae Thiobraid Árann
Tipperary County Council



Biogasdoneright systems and sequential crops

Why are these systems attractive?



Adaptation of agricultural systems to provide food, materials and sustainable bioenergy

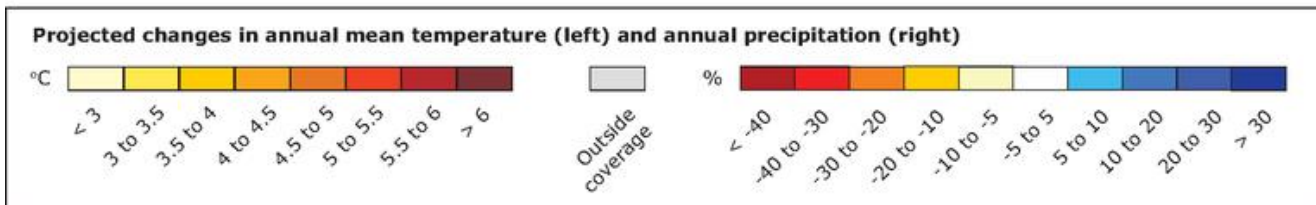
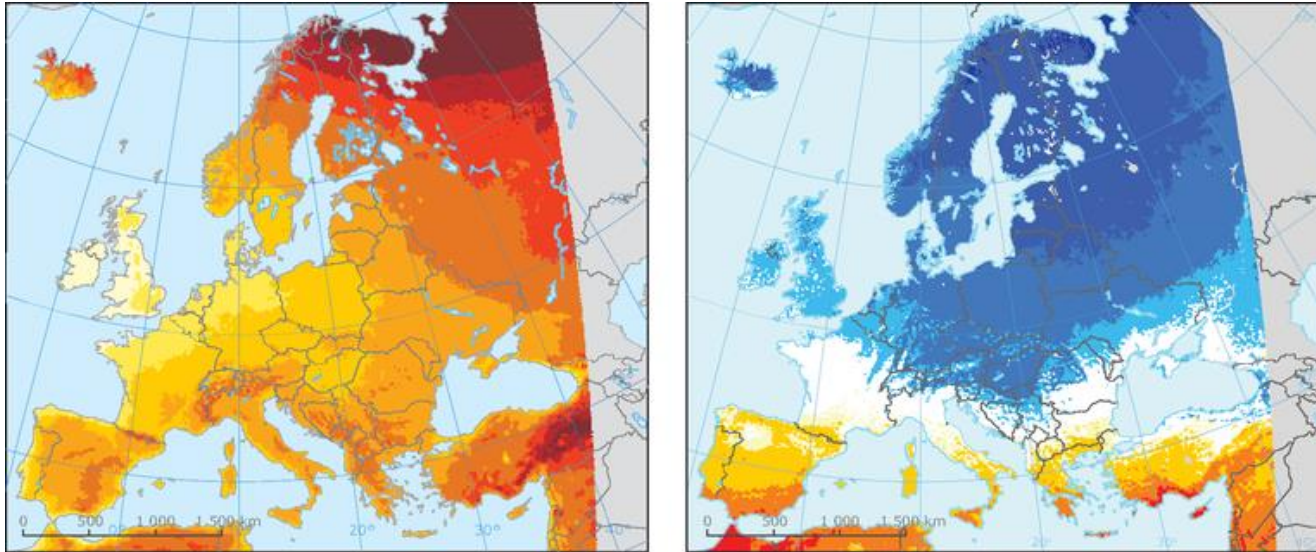
Conservative use of natural resources, lowering emissions, safeguarding biodiversity

Circular use of resources

Production of bioenergy and bio-based products with no interference with food production (no ILUC)

Equitable participation to bioeconomy value chains: farmers not only as raw material producers

Sequential crops in a changing climate



EEA (2016) - Projected changes in annual mean temperature (left) and annual precipitation (right) or 2071-2100, compared to 1971-2000

🕒 Duration of the thermal growing season is increasing (frost-free season extending)

🌿 Winter crops cycle become shorter

☀️ “Mediterraneization” process



The time window available to grow a sequential crop will tend to increase

Sequential cropping could be designed and managed to improve crop production and provide important ecosystem services

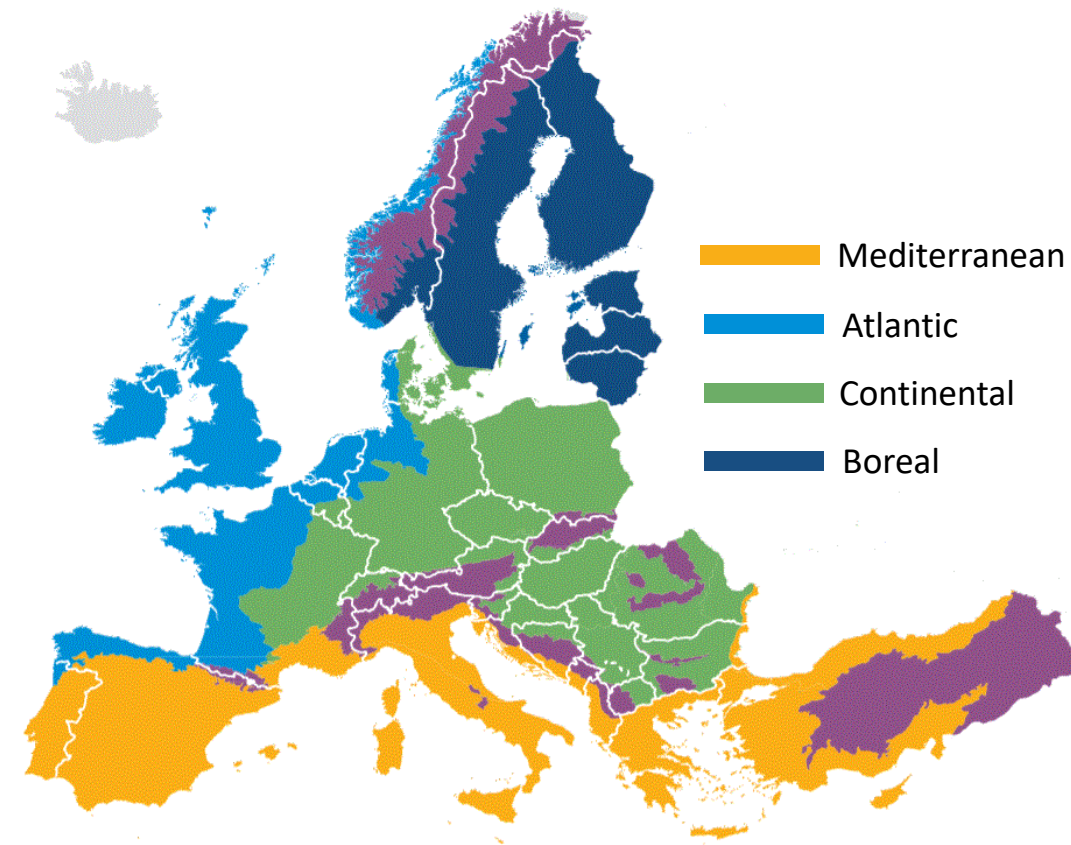
Aim of our work

How can sequential cropping be applied in other regions of Europe?
What would be the biomethane potential?

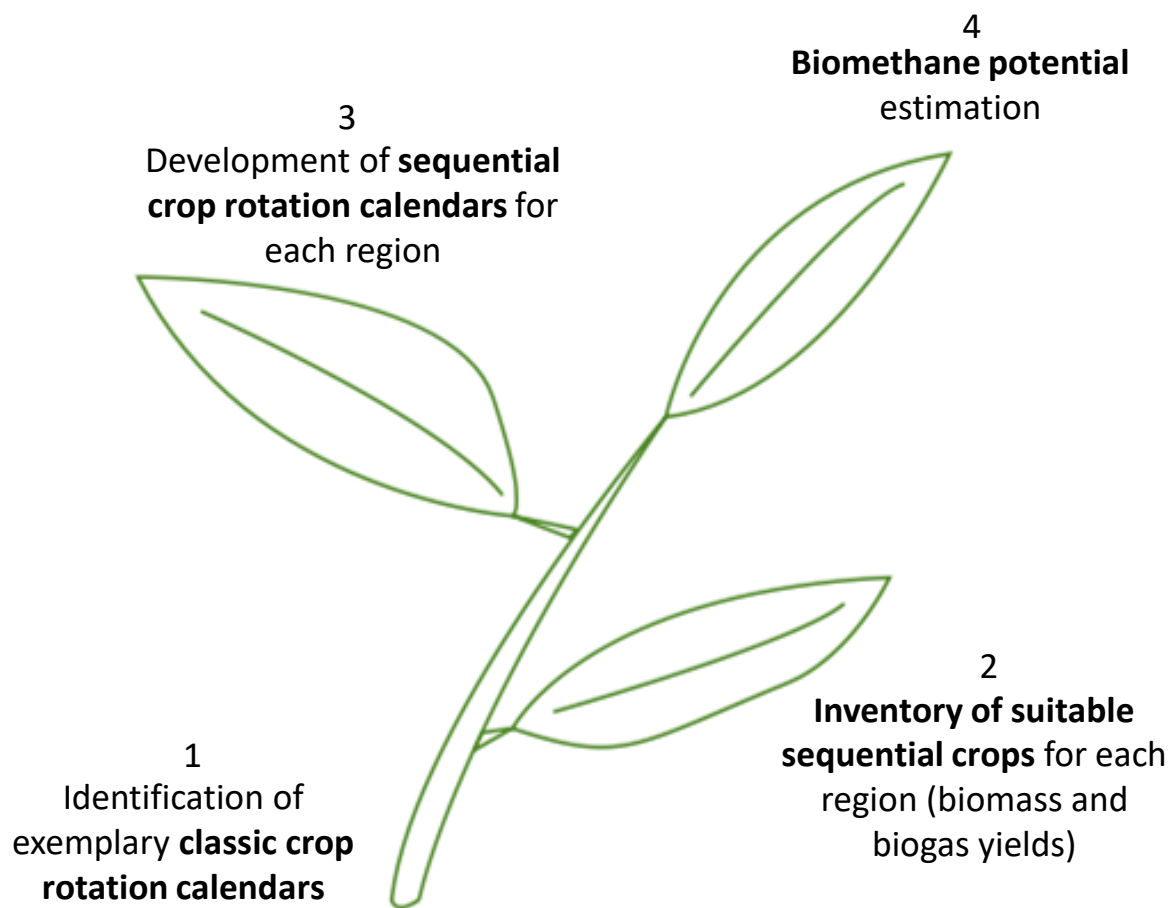


Develop exemplary cropping calendars for different EU climate regions





Evaluate the biomethane potential from the AD of the sequential crops across different agroclimatic conditions.



Methodology

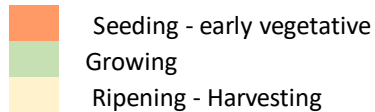


Scenarios
Land suitable to sequential cropping
(% primary crop land)

<p>Conservative Scenario 20%</p> <p>$\frac{\sum \text{hectares summer crops}}{\text{tot hectares primary crops}}$</p> <ul style="list-style-type: none">  Account for the water limitation in the Mediterranean region  Crops for which the practice of SC is commonly practiced  Leave free irrigated land and improve water use efficiency 	<p>Maximum Scenario 80%</p> <p>Theoretical maximum potential, excluding marginal and small fields</p> <p> SC would be practiced on 60-70% of the total arable land in EU</p>
---	---

Classic rotation calendars and sequential crops inventory

CROP CALENDARS	CLASSIC ROTATION																																																
	Agricultural Year 1												Agricultural Year 2												Agricultural Year 3												Agricultural Year 4												
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mediterranean (North)	WINTER CEREAL (Wheat/Barley)												SPRING CROP												WINTER CEREAL (Wheat/Barley)												WINTER CEREAL (Wheat/Barley)												
Mediterranean (South)	WINTER CEREAL (Durum Wheat)												Legumes / Horticultural												WINTER CEREAL (Durum Wheat)												WINTER CEREAL (Durum Wheat)												
Atlantic	WINTER CEREAL (Wheat/Barley)												SPRING CROP												WINTER CEREAL (Wheat/Barley)												WINTER CEREAL (Wheat/Barley)												
Continental	WINTER CEREAL (Wheat/Barley)												SPRING CROP												WINTER CEREAL (Wheat/Barley)												WINTER CEREAL (Wheat/Barley)												
Boreal	WINTER CEREAL (Wheat/Barley)												SPRING CROP												WINTER CEREAL (Wheat/Barley)												WINTER CEREAL (Wheat/Barley)												



Agri4Cast database

■ Mediterranean: maize, triticale, barley, sorghum, legume cover crops

■ Atlantic: sorghum, maize, oats, triticale, barley

■ Continental: maize, green rye, sorghum, ryegrass

Sequential crop rotation calendars

CROP CALENDARS	SEQUENTIAL CROPPING																																															
	Agricultural Year 1												Agricultural Year 2												Agricultural Year 3												Agricultural Year 4											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Mediterranean (North)	WINTER CEREAL						SORGHUM			TRITICALE/WINTER CEREAL						SPRING CROP			TRITICALE/WINTER CEREAL						SPRING CROP			WINTER CEREAL						SORGHUM														
Mediterranean (South)	WINTER CEREAL						TRITICALE/WINTER CEREAL						LEGUMES/HORTICULTURAL			SUNFLOWER/HEMP			TRITICALE/WINTER CEREAL																													
Atlantic	OATS/TRITICALE/BARLEY						SPRING CROP			SPRING CROP						OATS/TRITICALE/BARLEY			OATS/TRITICALE/BARLEY																													
Atlantic	WINTER WHEAT/BARLEY						SPRING CROP			SPRING CROP						OATS/TRITICALE/BARLEY			WINTER WHEAT/BARLEY						SPRING CROP																							
Continental	WINTER CEREAL						GREEN RYE (EARLY HARVEST)						SPRING CROP			Catch Crop			SPRING CROP			WINTER CEREAL																										
Continental	WINTER CEREAL						GREEN RYE (EARLY HARVEST)			MAIZE (RYEGRASS US)			RYEGRASS						WINTER CEREAL																													

Food/feed crop
 Sequential crop

- Established sequential cropping cycles in the Mediterranean region
- In the Atlantic and Continental regions where cycles are longer: three crops in two years and intercropping

Biomethane potential

	<i>Conservative</i>		<i>Maximum</i>	
	Potential BioCH ₄ (bcm/yr)	Suitable land (ha)	Potential BioCH ₄ (bcm/yr)	Suitable land (ha)
Mediterranean	9.9	2,651,058 (12% of arable land)	37.9	10,604,232 (48% of arable land)
Atlantic	10.2	3,943,126 (15% of arable land)	42.5	15,772,504 (59% of arable land)
Continental	25.8	8,945,212 (17% of arable land)	104.9	35,780,848 (69% of arable land)

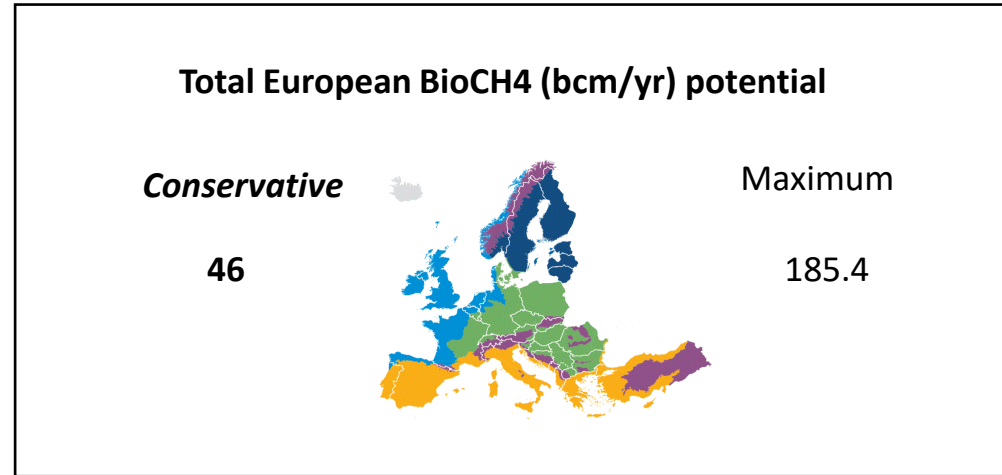
⌄ **Continental region highest potential** in both scenarios (highest ha of suitable land)

↓ **Mediterranean region lower potential** (least ha of suitable land). In the conservative scenario, this accounts for ≈2.6 million hectares, corresponding to about 30% of the total irrigated land in the region (≈ 9,6 million hectares)

🌱 In the Mediterranean region the **summer sequential crops that would need irrigation would only take 13% of the irrigated land**

☁ In the Atlantic and Continental regions, the suitable land for sequential cropping in the two scenarios **exceeds the hectares available for irrigated land**

Biomethane potential



⊗ Tot land for sequential cropping/ tot arable land in EU = 15% suitable land in a conservative scenario



Comparable to the estimated potential of Navigant (2019) – Tot EU biomethane potential:



Sequential cropping in combination with BDR principles

Carbon sequestration and soil quality enhancement

- Sequential cropping
- Crop varieties with higher residue and root production
- Minimum/no tillage
- Return of digestate to the soil (solid and liquid fraction)
- High-efficiency digestate distribution
- No chemical fertilizers
- Use of renewable energy



Biological carbon-capture and sequestration (BECCS) process



Result-based payment scheme
EU carbon farming initiative

Avoidance of emissions

- Reduced use of chemical fertilizers
- Optimized manure storage and by-products handling
- Reduced use of fossil resources



Predicted

- 30% emissions for the Italian agricultural sector



Quantification of carbon sequestration effects and emissions reduction in other climatic regions



Avoided ILUC emissions of using sequential cropping for biogas production?

Conclusions



Tailored solutions to different agroclimatic conditions in EU can be found in terms of crop management to expand the application of sequential cropping



Biomethane produced SC as essential element for renewable gas production and for achieving European decarbonization targets, which manure, agricultural residues and food waste could not reach alone



Additional benefits of SC in terms of carbon sequestration and soil fertility when applied in circular systems such as the BDR™ in Mediterranean case studies



SC in BDR™ systems could be agronomically feasible for at least 15% of arable land in EU, contributing to a more sustainable, circular and optimized use of biomass feedstock for the European bioeconomy.





Thank you for your attention!

francesca.magnolo@ugent.be

EBA Conference – 27 October

Closing nutrient loops. Catch crops to reduce nutrient losses and increase biogas production by anaerobic co-digestion

AUGUST BONMATI BLASI
IRTA



26–27 October 2021, Brussels

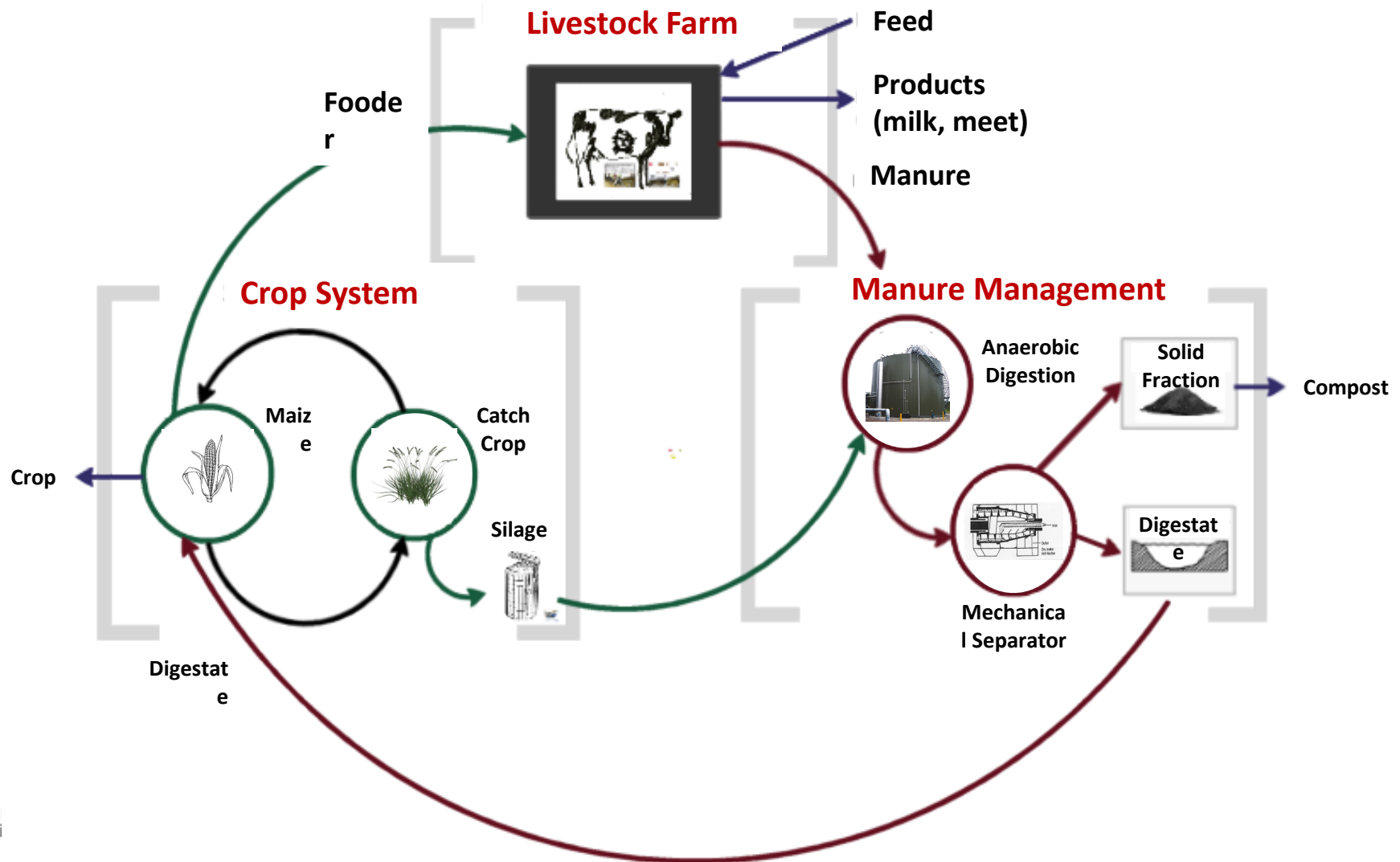
Closing nutrient loops. Catch crops to reduce nutrient losses and increase biogas production by anaerobic co-digestion

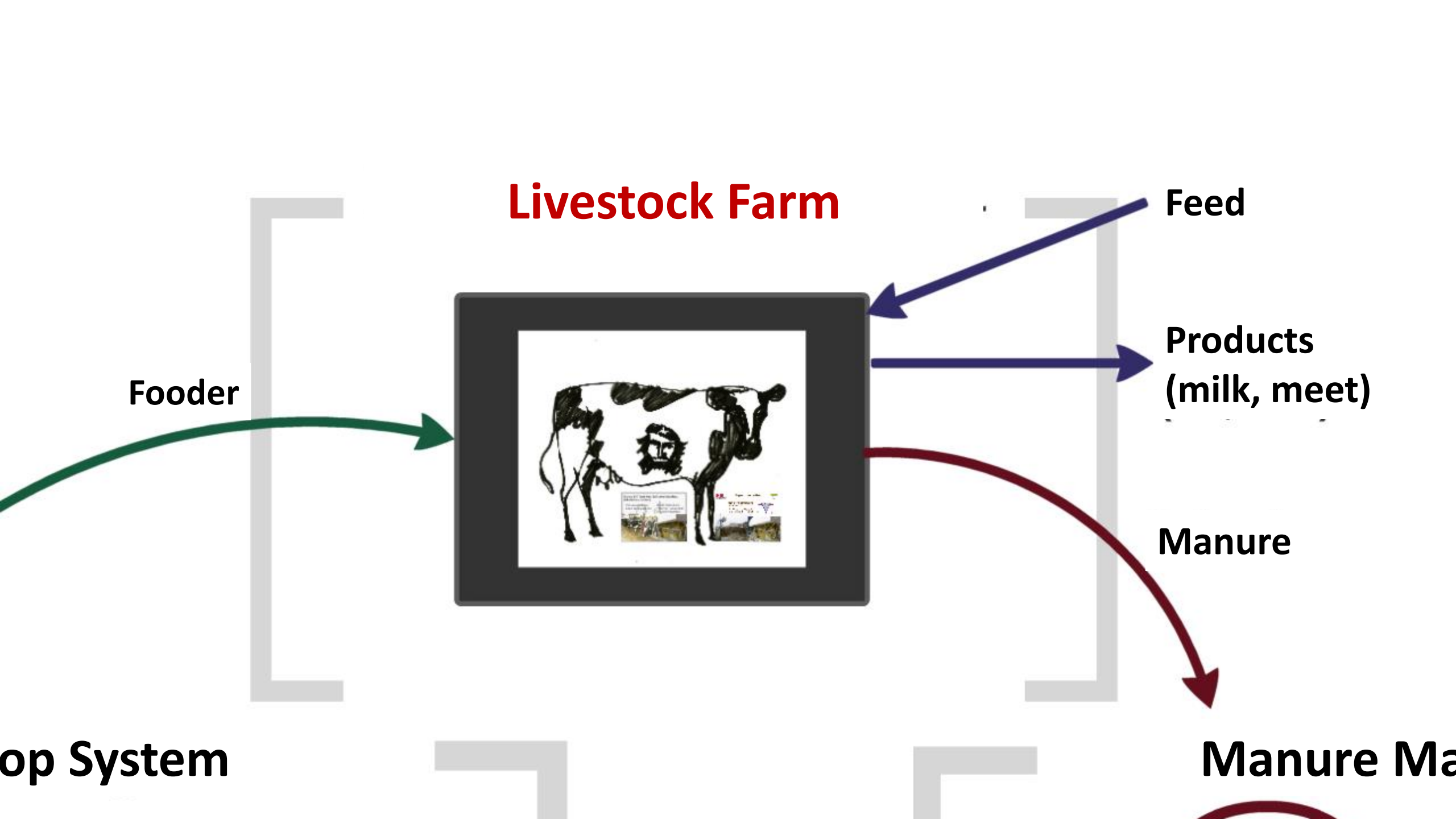
August Bonmatí, F. Camps, F. Domingo, A. Antón, V. Riau, L. Burgos

Objectives

- **Anaerobic digestion optimization using catch crops as co-substrates.**
- **Reduction of nitrogen leaching introducing catch crops in the crop rotation.**

Concept



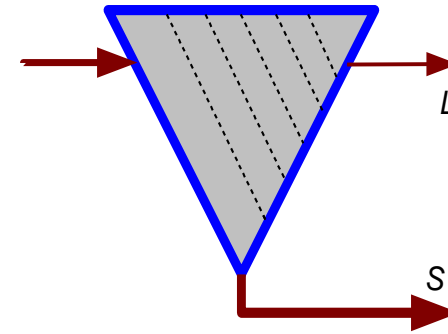


➤ Dairy cow farm:

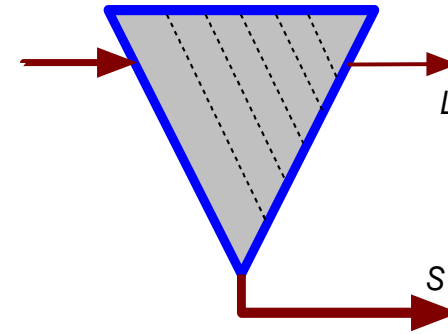
- 700 cows
- 6.614.106 kg/year of milk



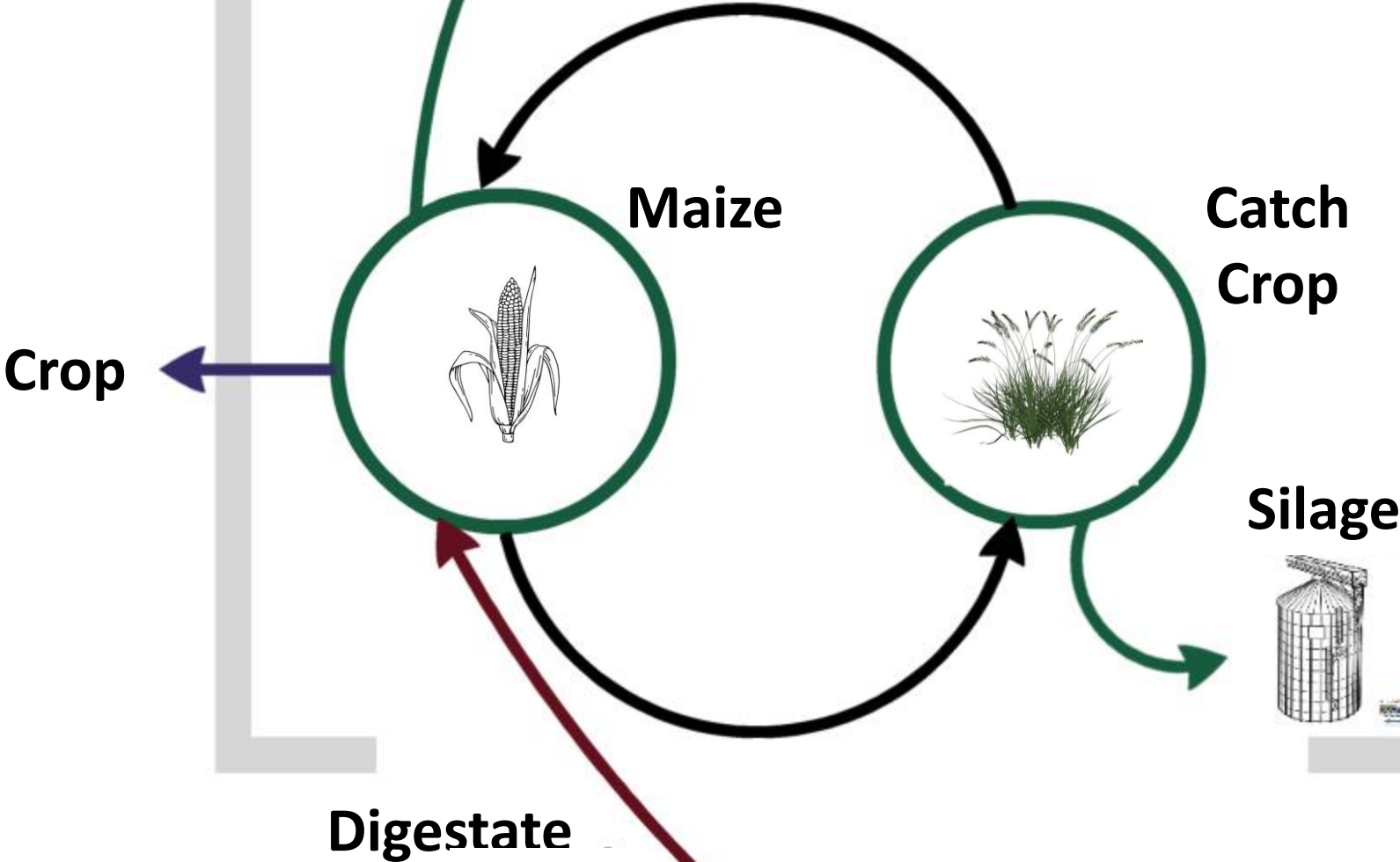
- **Manure Management:**
 - Mechanical Separator
 - Crop land fertilization (400 ha)



- **Manure Management:**
 - Mechanical Separator
 - Crop land fertilization (400 ha)



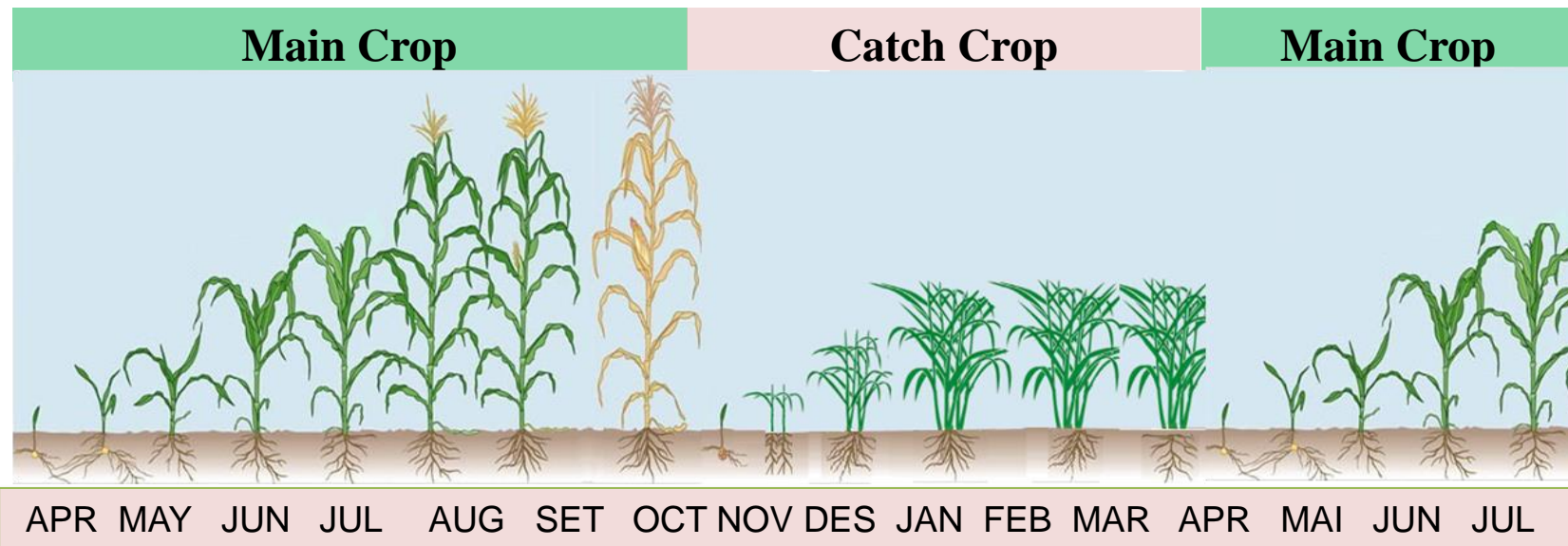
Crop Rotation



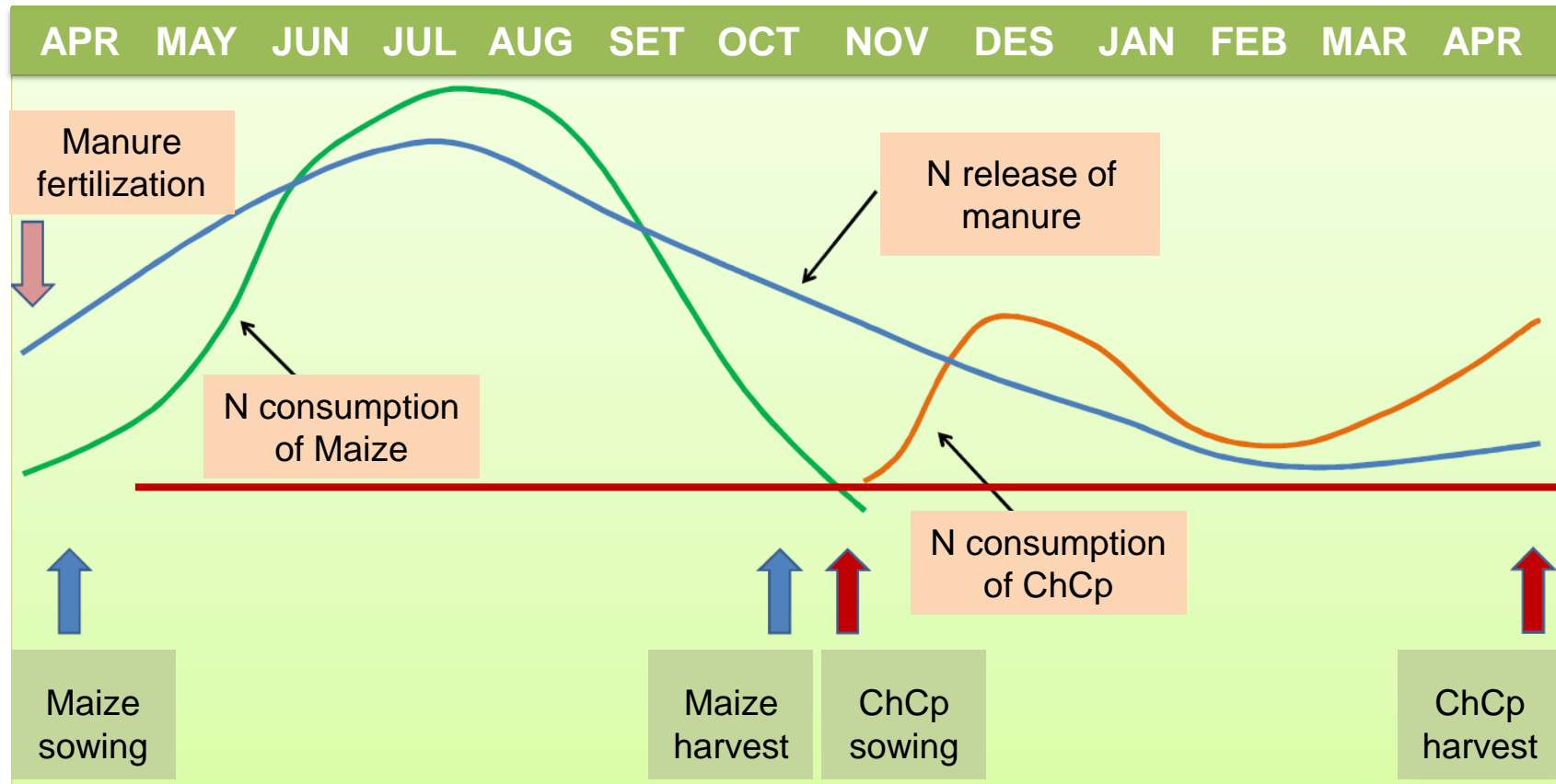
Catch Crops (ChCp)

Catch crops (ChCp) are grown between main crop with the primary purpose of binding nutrients and hinder their leachate to groundwater

- Rapid establishment of the crop
- High growth at low temperatures
- Tolerance to frost
- Not leguminous
- Low management cost



Main function of Catch Crops



Benefits of Catch Crops

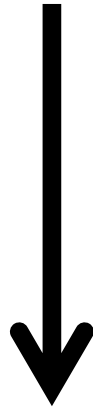
- Avoid nitrates leaching into groundwater.
- Protects soil from erosion.
- Limits the proliferation of weeds.
- Promotes the biological activity of the soil and its fertility.
- **Can be used as co-substrate of anaerobic digestion**



Crop Rotation

Experimental site (Mas Badia, NE Catalonia)

➤ Rotation (3 years):

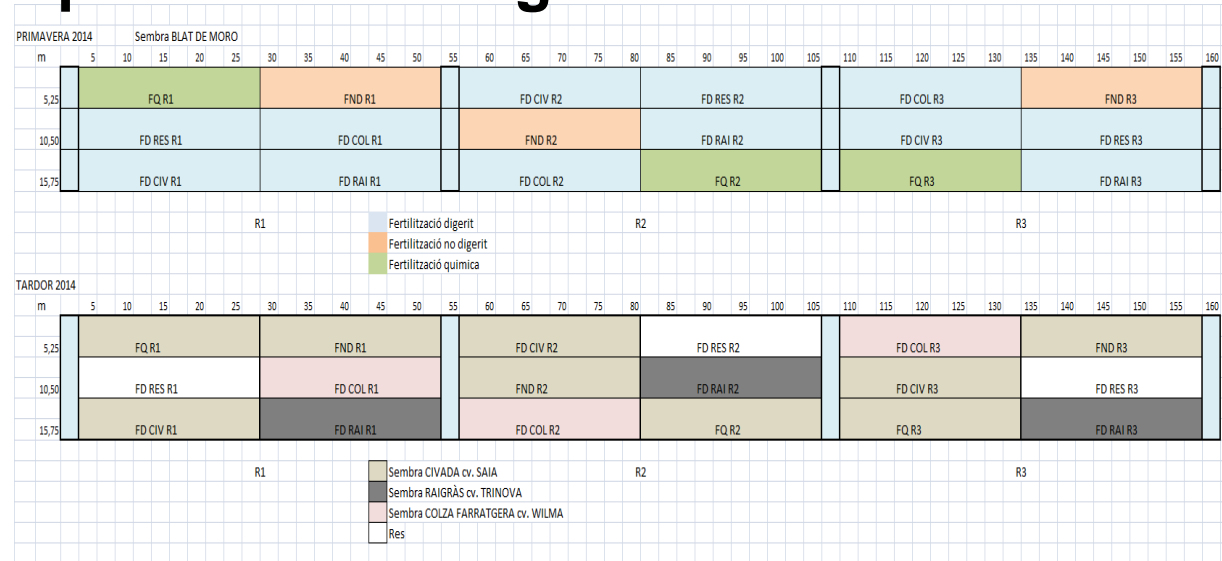


- Catch Crops: *Black Oat, Ryegrass, Forage rape.*
- Maize
- Catch Crops
- Maize
- ...



Crop Rotation

Experimental design



Treat.	Maize fertilization	Catch Crop
FDC	Digested manure	Black Oat
FDR	Digested manure	Ryegrass
FDF	Digested manure	Forage Rape
FDN	Digested manure	-

Crop Rotation

**ChCp
(DM/ha)** **production**

**Forage Rape
Brassica napus (7,1 Tn DM/ha)**



**Black Oat
Avena strigosa (5,5 Tn DM/ha)**



**Ryegrass
Lolium multiflorum (6,5 Tn DM/ha)**



Nutrient extraction of ChCp

Treat.	Maize fertilization	ChCp	N	P	Cu	Zn
			Kg N /ha	Kg P /ha	g Cu /ha	g Zn /ha
FDC	Digested manure	Oat	88,9	11,0	45,0	180
FDR	Digested manure	Ryegrass	115,5	13,8	34,0	150
FDF	Digested manure	Forage Rape	154,0	18,9	26,0	170
FDN	Digested manure	-	67,7	8,3	19	88



Manure Management

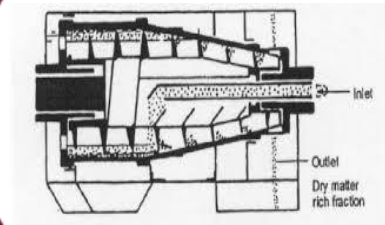
Anaerobic
Digestion



Solid
Fraction



Compo

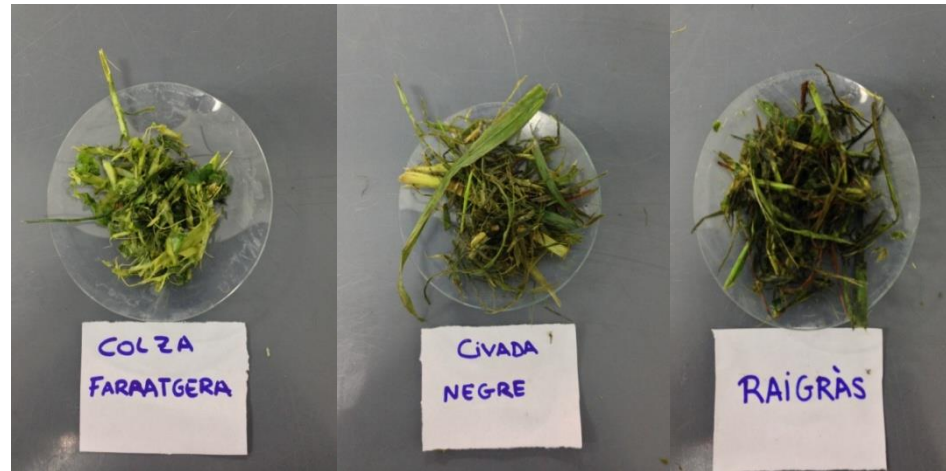


Mechanical
Separator

Digestate

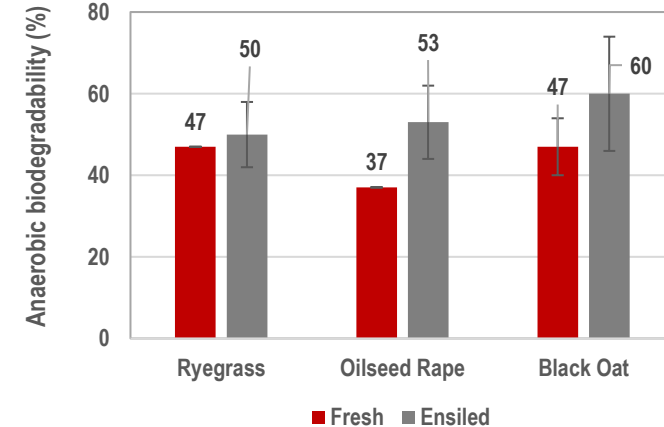
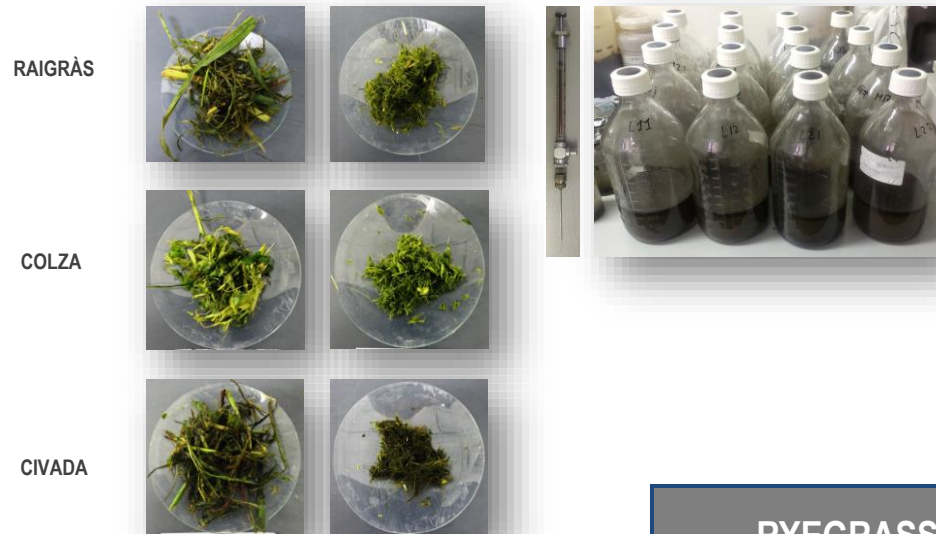


Catch Crops Silage



Catch Crop	pH	TS (g kg ⁻¹)	VS (g kg ⁻¹)
Ryegrass	6,35	211	185
Ryegrass <small>SILAGE</small>	4,01	204	177
Forage Rape	5,72	131	110
Forage Rape <small>SILAGE</small>	3,98	127	108
Black Oat	6,29	173	153
Black Oat <small>SILAGE</small>	3,67	168	148

BMP essays



3% 16% 17%

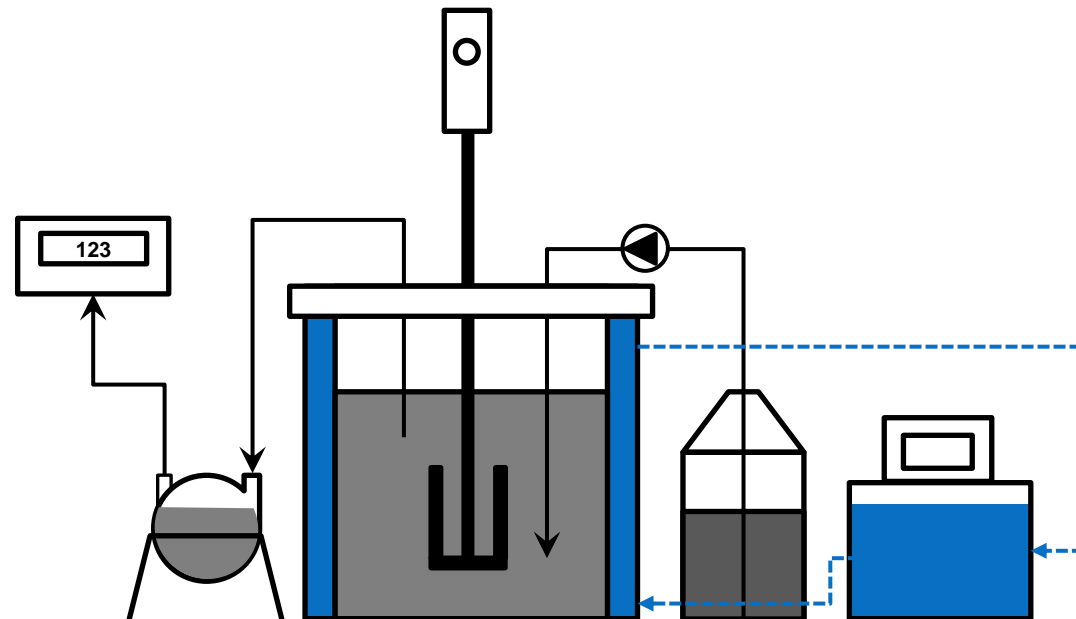
	RYEGRASS		FORAGE RAPE		BLACK OAT	
	Fresh	Ensiled	Fresh	Ensiled	Fresh	Ensiled
Methanogenic potential (LCH ₄ kgSV d ⁻¹)	195±2	255±15	301±8	424±27	271±12	391±17
Methanogenic potential (LCH ₄ kgDQO ⁻¹)	152±1	162±10	120±3	172±11	139±6	194±9
Methanogenic potential (m ³ CH ₄ t ⁻¹)	35±0	47±3	32±1	47±3	46±2	60±3
m³ CH₄ ha⁻¹	460	603	793	1117	726	1048

31% 41% 44%

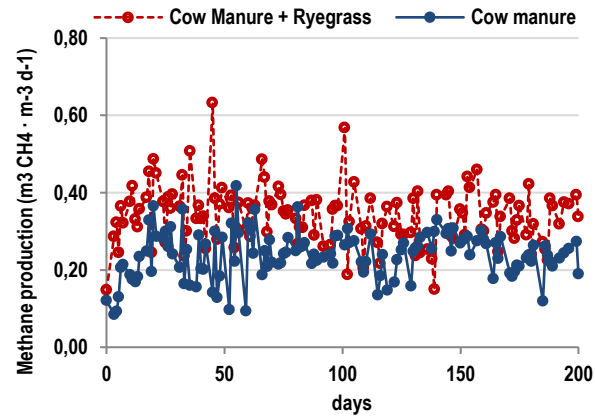
Continuous anaerobic essays



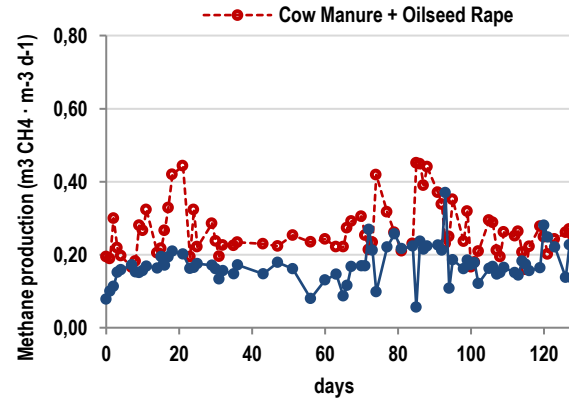
- CSTR Reactor
- Volume: 6 L
- HRT: 40 days
- Co-substrate (ChCp): 10% w/w
- T^a Range: mesophilic (37 °C)



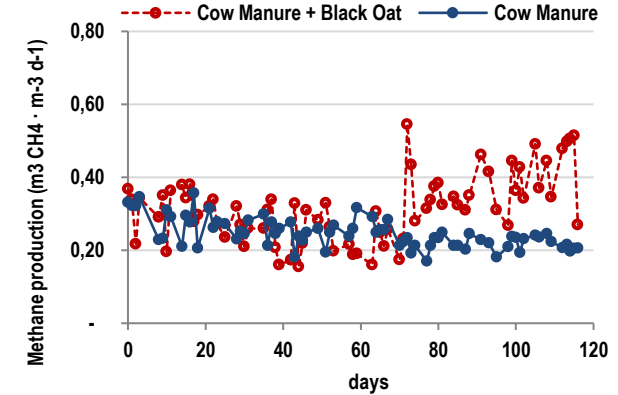
Continuous anaerobic essays



AD continuous essay: R1- Manure / R2 Manure + Ryegrass (10%)



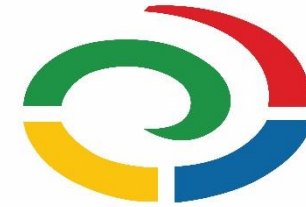
AD continuous essay: R1- Manure / R2 Manure + Rapeseed (10%)



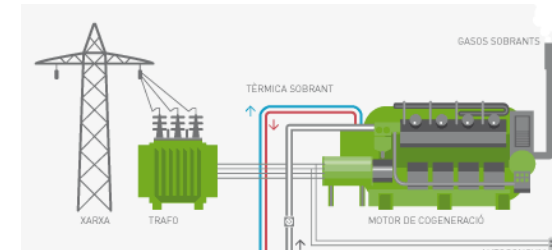
AD continuous essay: R1- Manure / R2 Manure + Oat (10%)

		Ryegrass	Forage Rape	Black Oat
Manure	$\text{m}^3 \text{CH}_4 / \text{t}_{\text{manure}}$	8,78	7,45	8,73
Manure + ChCp	$\text{m}^3 \text{CH}_4 / \text{t}_{\text{manure}}$	12,57	10,94	12,91
Increase	%	43	47	48

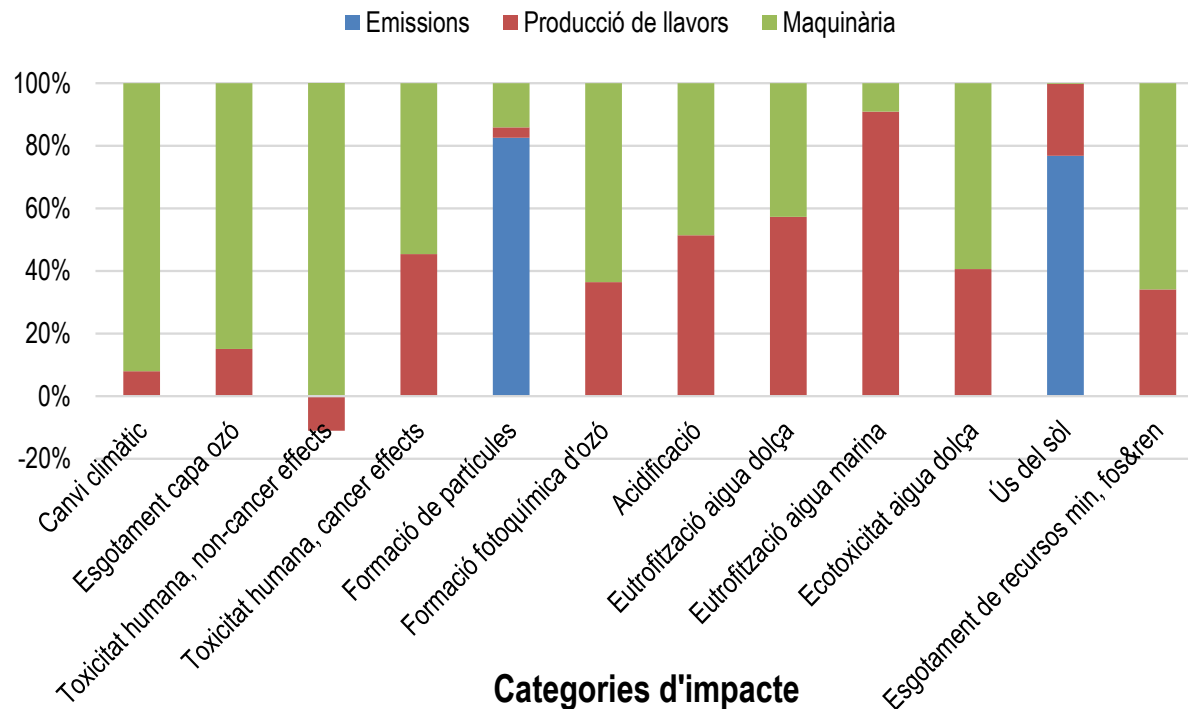
➤ Environmental assessment



➤ Energy assessment



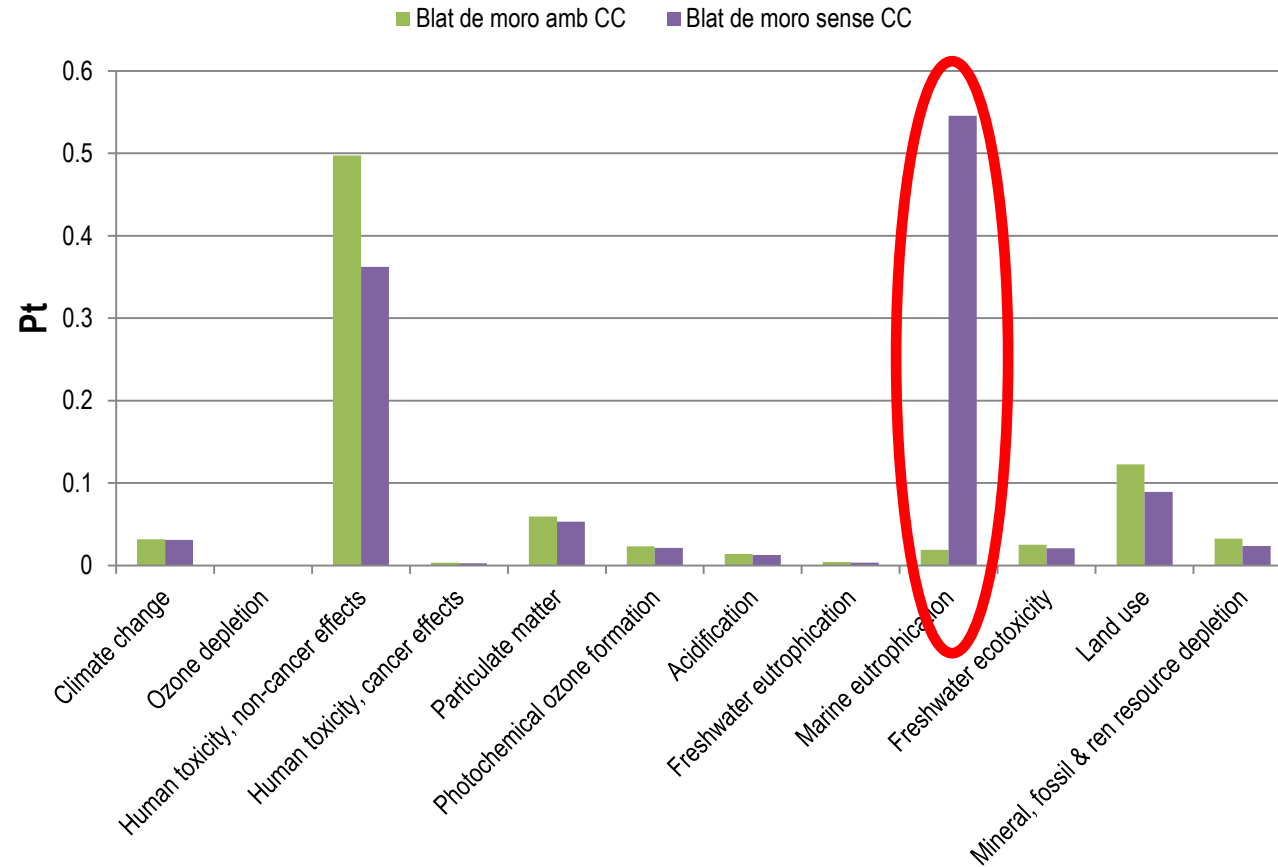
Catch Crop production - Impacts of 1 ha de Ryegrass



➤ **Machinery use has the greatest impacts**

Environmental assessment

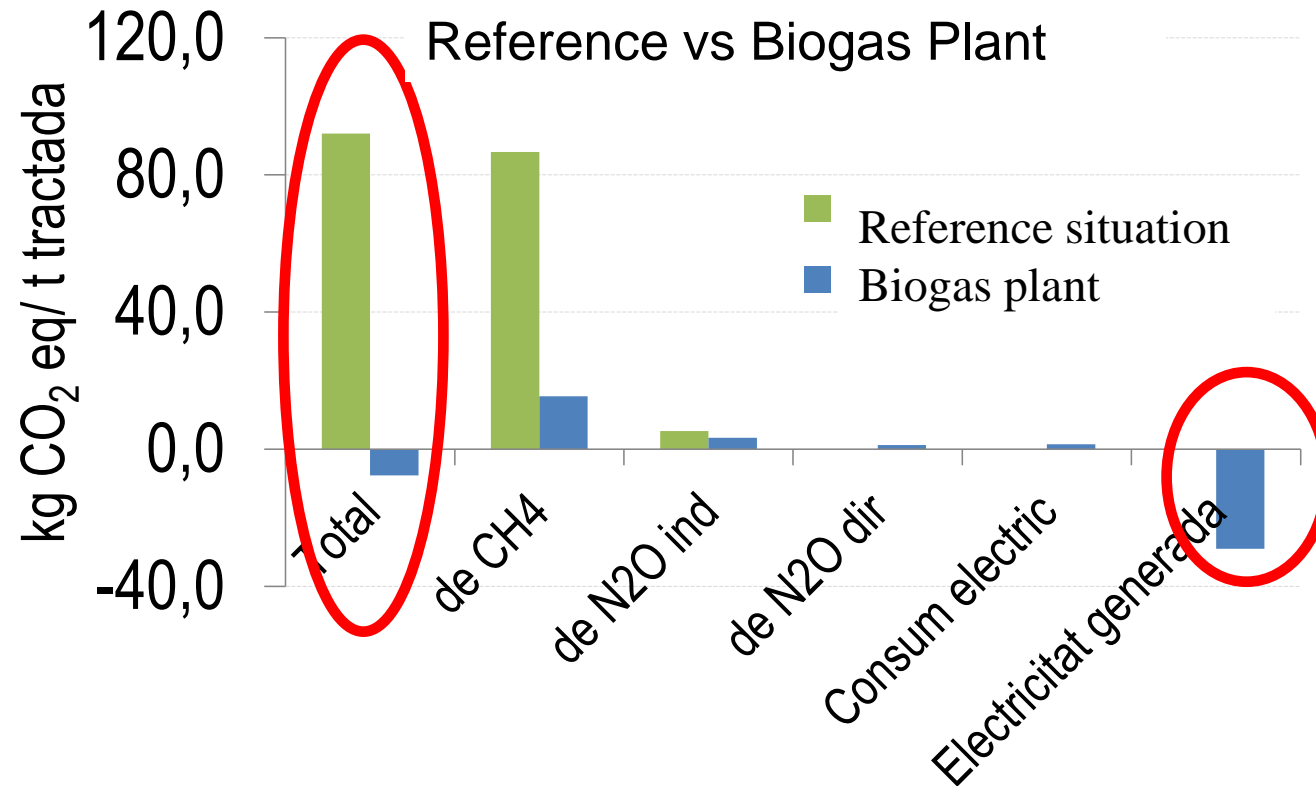
Maize + ChCp (1ha) vs Maize (1ha)



- **ChCp inclusion in the rotation reduces significantly eutrophication**

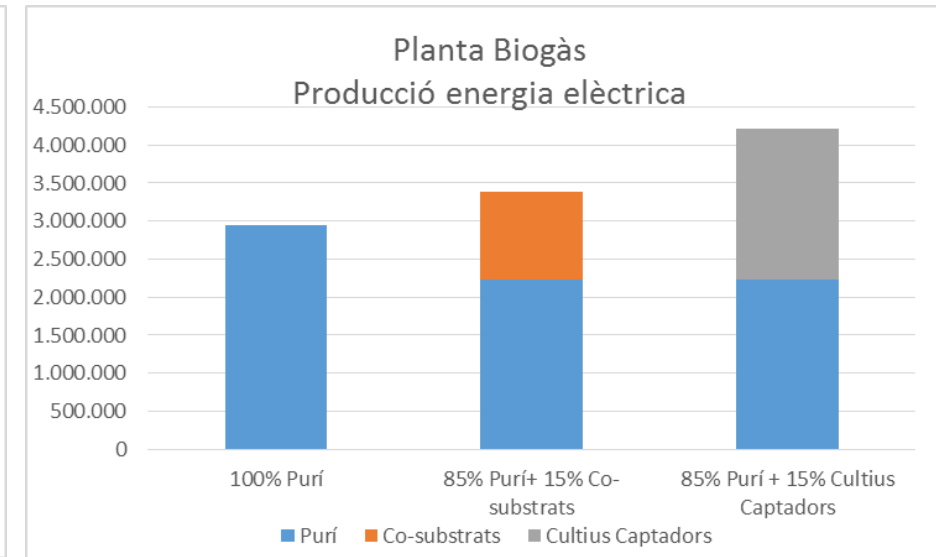
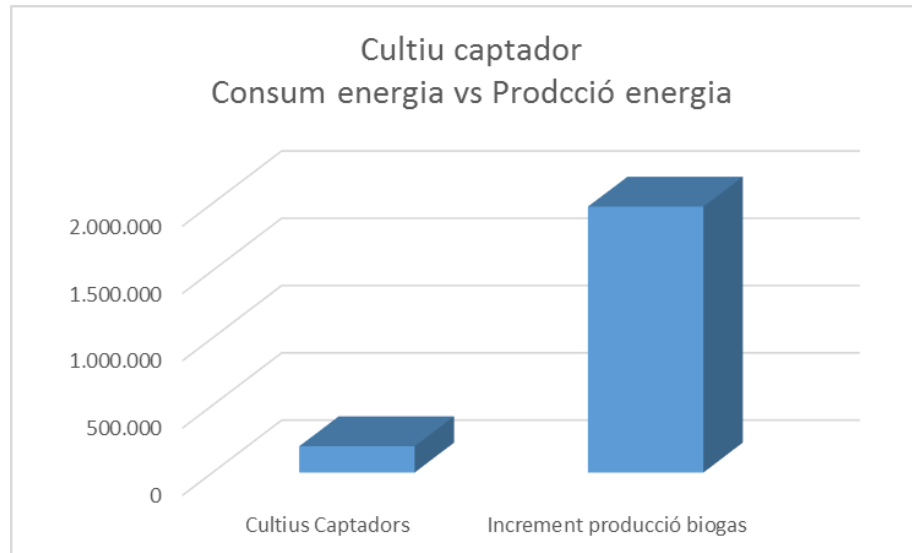
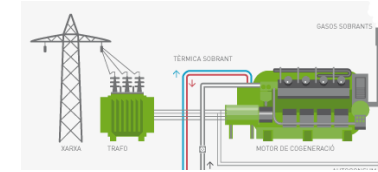


Biogas plant – CO₂ eq emissions



- Manure processing through the biogas plant reduces CO₂ emissions

Energy assessment



➤ **ChCp produce 10 times more energy than the energy invested in their production**

➤ **Replacement of current co-substrates by ChCp increases biogas production by 24%**

- ChCp in the climatic conditions tested produce 5,5 – 7,1 t_{DM}/ha and extracts 88 - 154 kgN/ha.
- The biogas production of the ChCp essayed is between 500 - 1200 m³ CH₄ / ha.
- Its use as a co-substrate in the anaerobic digestion of cow manure increases biogas production 40 - 50%.
- Energy production is 10 times higher than the energy invested in its production.
- **ChCp inclusion in crop rotation allows to close nutrient loop while producing renewable energy when using as co-substrates in the anaerobic digestion of manure.**

IRTA

RESEARCH & TECHNOLOGY
FOOD & AGRICULTURE



Thank you for your attention



EBA Conference – 27 October

*Digital cooperation for the exportation
of European biogas technologies*

ANN-KATHRIN VAN LAERE

Project Manager DiBiCoo EU Project, GIZ



26–27 October 2021, Brussels

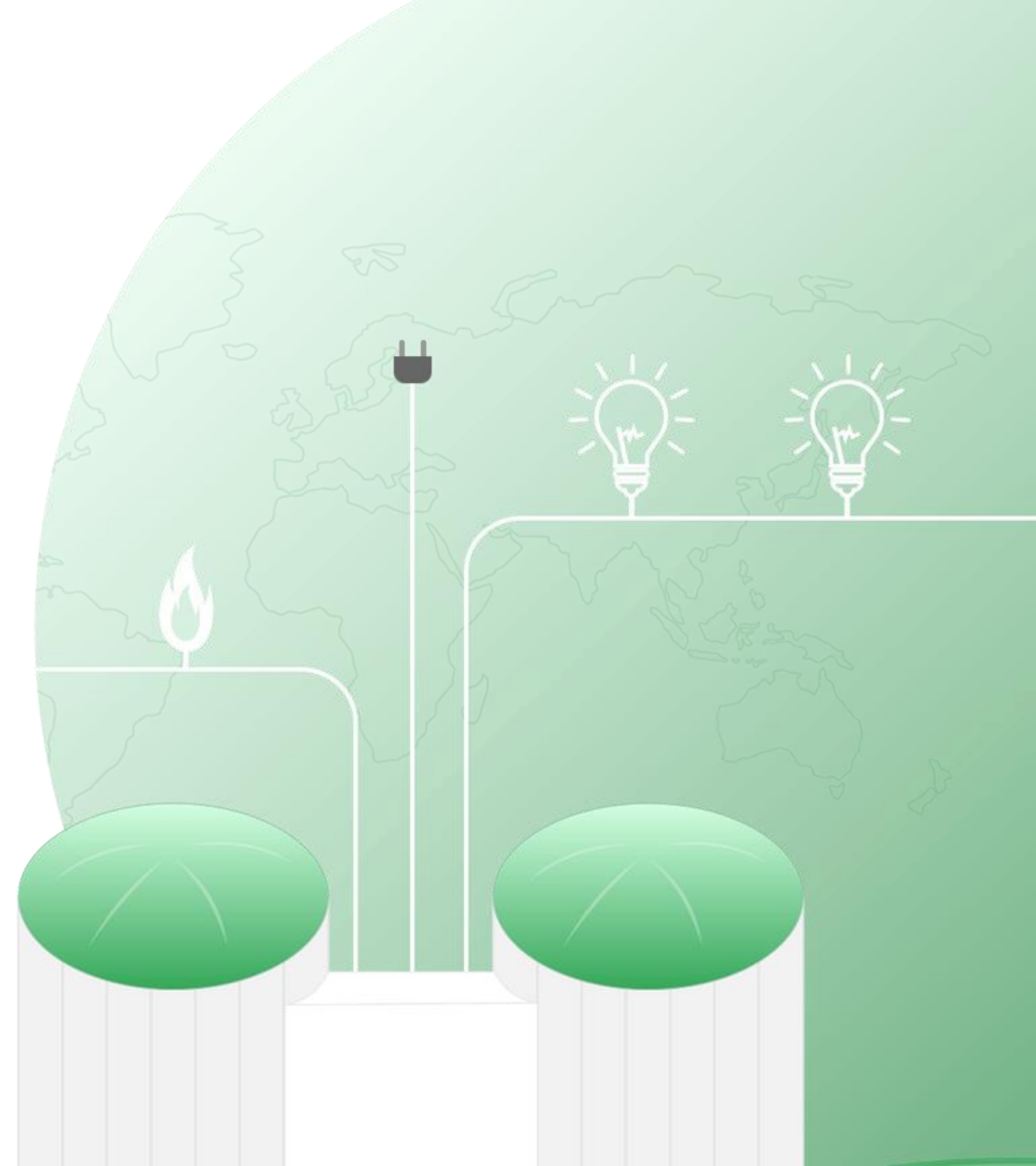
DiBiCoo

Digital global Biogas Cooperation

European Biogas Conference 2021

Ann-Kathrin van Laere

Gesellschaft für Internationale Zusammenarbeit (GIZ)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 857804. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.



**Digital global
Biogas
Cooperation**

Key Project Facts

Programme, Coordination, Funding

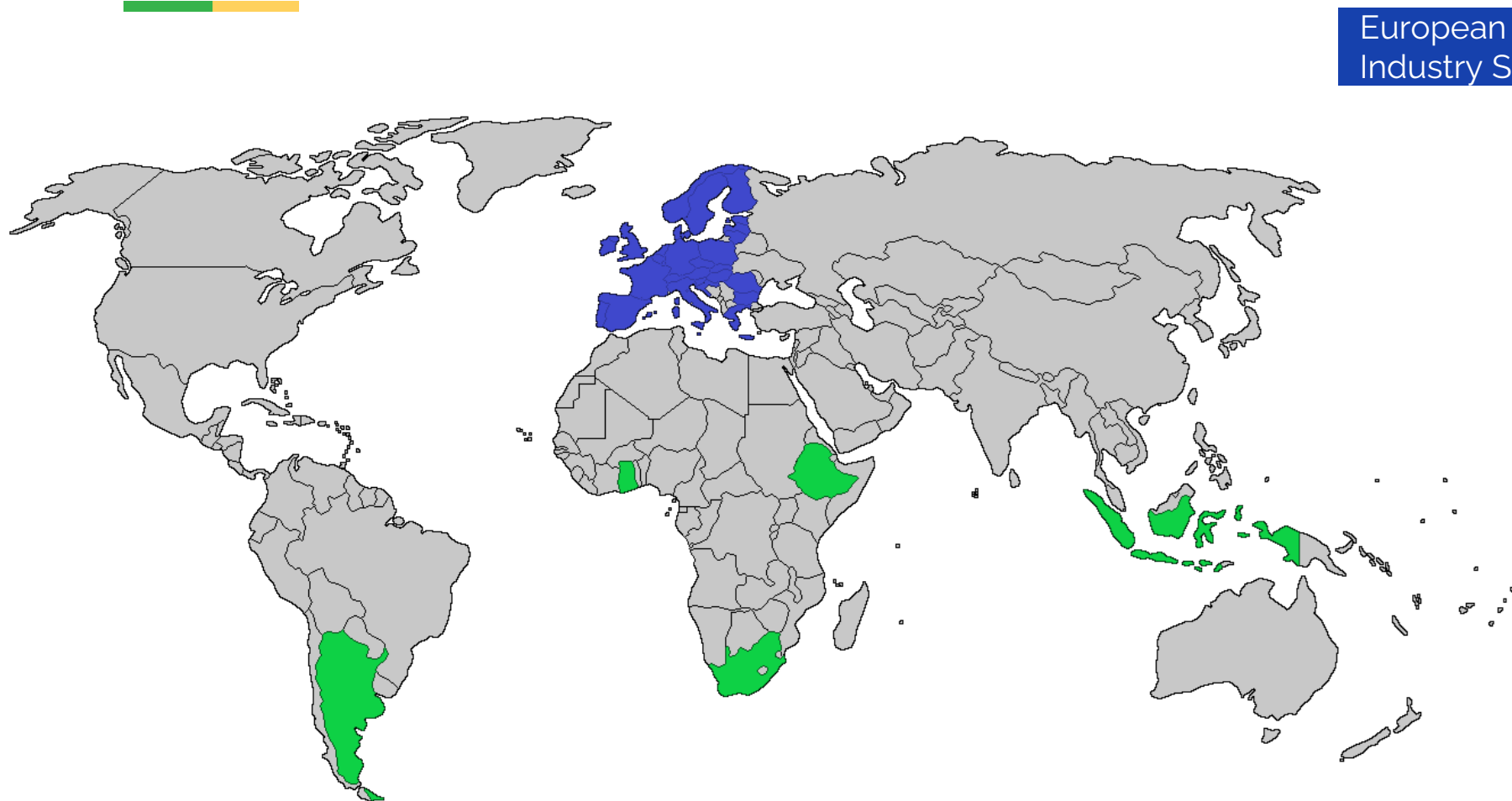


01	Programme	Horizon 2020 Programme – Societal Challenge – Secure, Clean & Efficient Energy; Support tools to facilitate export markets.
02	Duration	October 2019 – June 2022
03	Consortium	13 members from 5 target countries and Europe: biogas associations and think tanks on renewable energy
04	Coordination	DiBiCoo is coordinated by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).
05	Funding	The project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 857804.



Key Project Facts

Technology Importing and Exporting Countries



European Biogas Industry Scope

DiBiCoo target countries



Indonesia



Argentina



Ethiopia



Ghana



South Africa



Digital global Biogas Cooperation

Key Project Facts

Consortium



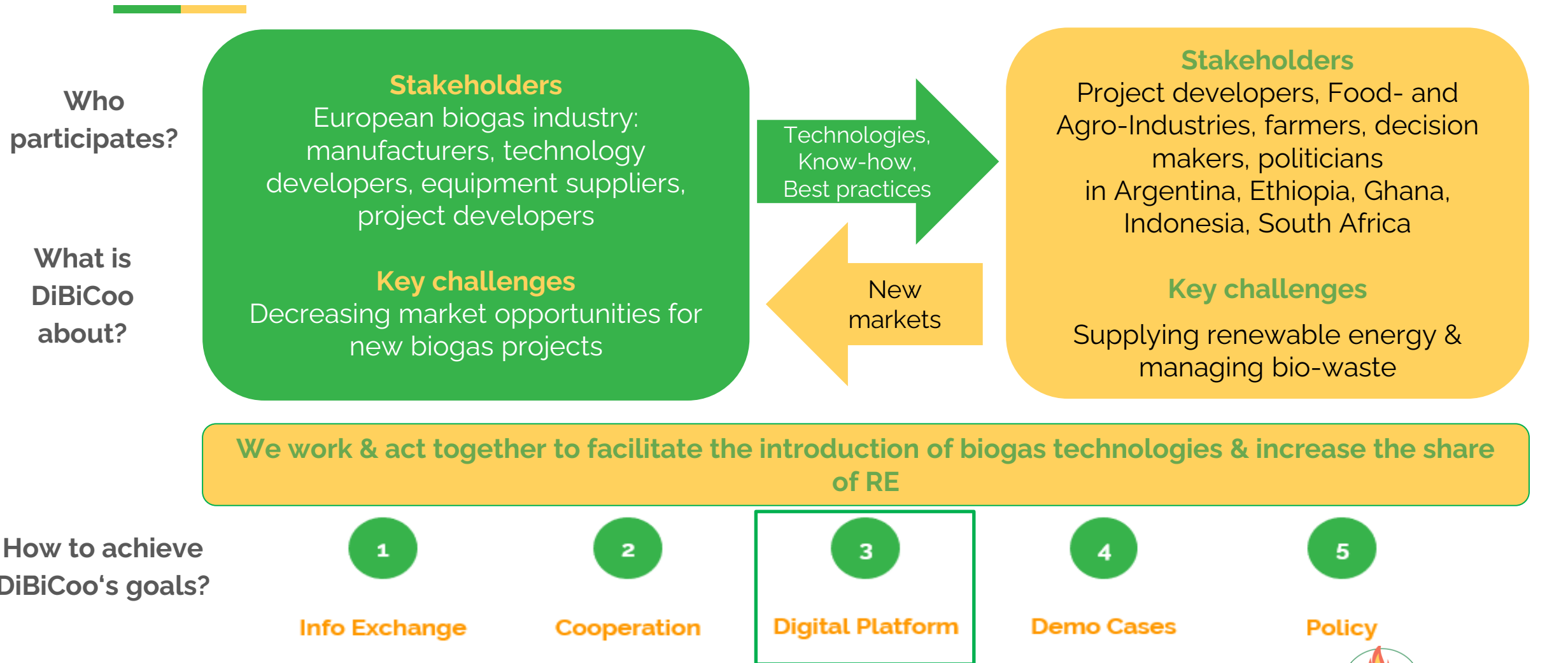


DiBiCoo Project Objective

DiBiCoo is a cooperation project between biogas technology exporting and importing countries, with the overall objective to prepare markets in developing and emerging countries for the uptake of sustainable biogas/biomethane technologies from Europe.



DiBiCoo: a two-way collaboration project





Biogas and Gasification Matchmaking Plattform





Why do we need such a platform?

Especially the COVID-pandemic showed us: no conferences, no trade fairs or conventions were possible.

- **HOW** can companies and organizations
 - still interact and connect with each other?
 - find new and suitable business partners?
 - promote and market their services and products?
 - advertise their own business ideas and find partners to bring them to life?



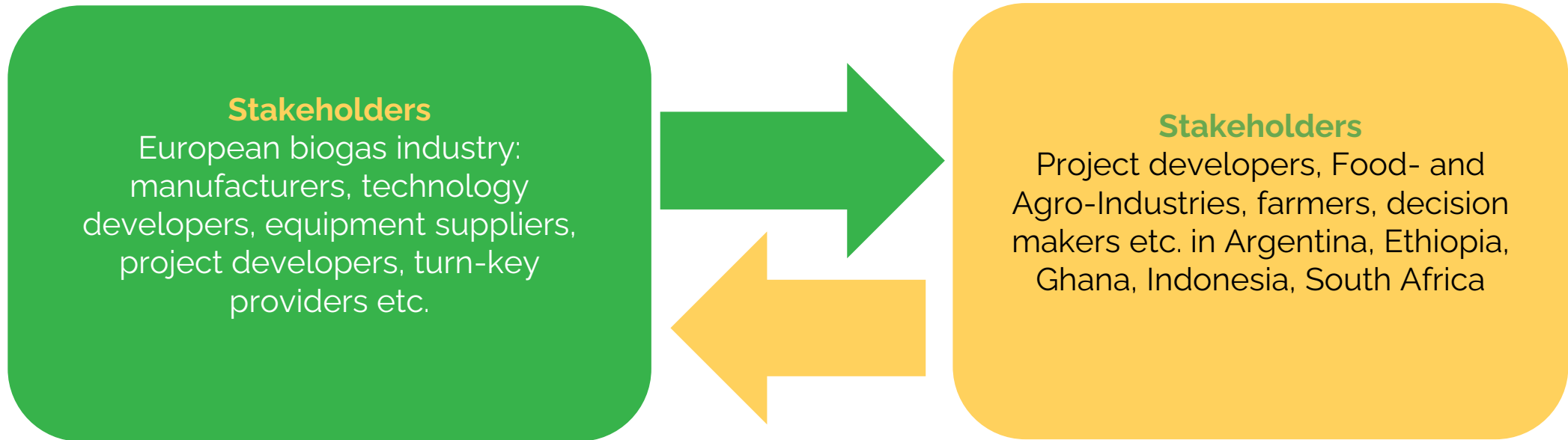
Biogas & Gasification Matchmaking Platform

= online and **free** platform which facilitates **worldwide networking** and is considered as an **additional marketing option** for EU companies and for stakeholders in countries of the global south to get in contact and connect with each other

- **Database** of biogas and gasification related stakeholders from EU and non-EU companies
- **B2B Matchmaking** feature
- **Marketplace** to promote business opportunities
- **Information hub** on available biogas and gasification technologies and services



Biogas & Gasification Matchmaking Platform





Biogas and Gasification Matchmaking Platform

The only matchmaking platform for biogas and gasification you ever need.

[Join platform for free!](#)

Company profiles

Leading stakeholders in the biogas and gasification sectors



Explore profiles of the world leading companies and entrepreneurs in the biogas and gasification sector. Browse companies by categories or view them on the global map. Find an appropriate partner to bring your ideas to life!

Business opportunities

Counterparties presenting their needs and looking for business cooperation



Become a participant of a dynamic and evolving marketplace for making business deals. Build collaboration with various experienced biogas solution providers by selecting one of the existing or posting your own request for a biogas solution, service or project idea.

Knowledge base

Biogas and gasification related information sources and factsheets



Are you new to a biogas sector? Get insight into the biogas sector by reading our selected list of relevant literature sources. Developed factsheets are created to summarise basic elements of the biogas plants and present this information in an easy to understand way.



Biogas and Gasification Matchmaking Platform

The only matchmaking platform for biogas and gasification you ever need.

Join platform for free!

1

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1 Company Profiles

→ **create a company profile** and present the technologies and services you offer

Company profile wizard

Progress bar: General information (active), Contact information, Field of business, Reference projects, Attachments, Publishing

General information

Name of the company *

Company profile *

Brief description of company profile 0/2000

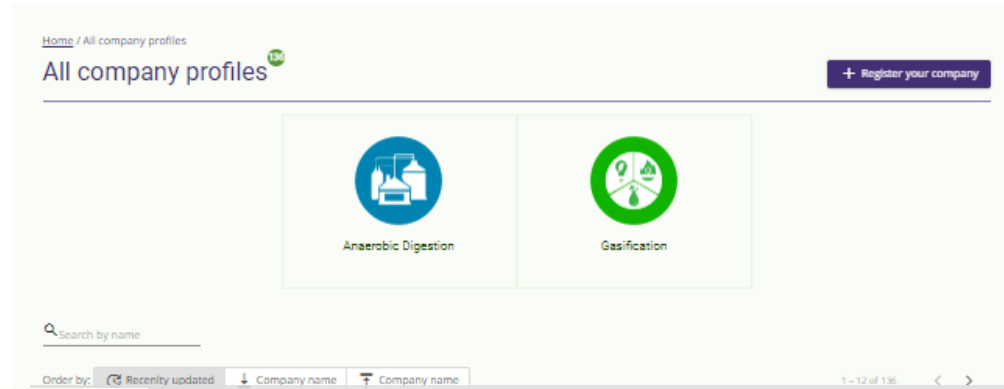
Select Company Logo

Exit wizard Continue >

1 Company Profiles

→ Company database

→ Already **136** companies are registered!



Home / Company profiles / ...

German Biogas Association - Fachverband Biogas e.V. (FvB)

Updated: Sep 27, 2021
 Address: Deutschland, Freising, Angerbrunnenstraße 12, 85356
 Web page: https://www.biogas.org/edcom/webfwb.nsf/id/en_Homepage

The German Biogas Association brings together operators, manufacturers and planners of biogas plants as well as representatives from science and research, and interested parties from all over Germany. Since it was founded in 1992, the Association, with over 4.700 members, has become Europe's strongest organization in the area of biogas. In addition to its headquarters in Freising, it has an office in the capital, Berlin, as well as five regional offices throughout Germany. The German Biogas Association employs about 40 permanent staff members. With intensive political advocacy at EU, federal and state levels, the Association campaigns for the increased use of biogas technology. Furthermore, it encourages the exchange of biogas-related information and knowledge. For example through collecting, evaluating and spreading knowledge of scientific findings and practical experience, or by means of conferences, exhibitions and other events. The Association is hosting the annual BIOGAS Convention. With more than 7.000 visitors it has become the most important meeting place for biogas industry stakeholders from Germany and across the globe. As a consequence of both participation in EU projects and membership of the European Biogas Association (EBA), the German Biogas Association actively promotes the international exchange of experience.

info@biogas.org
0049 8161 / 984660

- ISO 20675:2018 Biogas — Biogas production, conditioning, upgrading, and utilization — Terms, definitions, and classification scheme
- ISO/AWI 23590 Household Biogas System Requirements
- ISO 24252 Biogas systems — Non-household and non-gasification (close to be published)

Company categories

- Anaerobic Digestion
- Services / Technical experts
- Consultant
- Biogas expert
- Environment
- Safety
- Other services

- BioG GmbH** (Oct 18, 2021)
- Gastechnik Himmel GmbH** (Oct 18, 2021)
- TerraX Srl/GmbH** (Oct 15, 2021)
- TerraX H2 Holding Srl** (Oct 15, 2021)
- Austrian Compost & Biogas Association** (Oct 15, 2021)
- European Biogas Association** (Oct 15, 2021)
- giz** (Oct 14, 2021) - *Highlighted with a green arrow*
- Neditel** (Oct 12, 2021)
- German Biogas Association - Fachverband Biogas e.V. (FvB)** (Sep 27, 2021)
- IG Energy AG** (Sep 22, 2021)
- Waste2EnergyLab** (Aug 4, 2021)
- ArieeGreen Renewables** (Jul 5, 2021)



1 Company Profiles

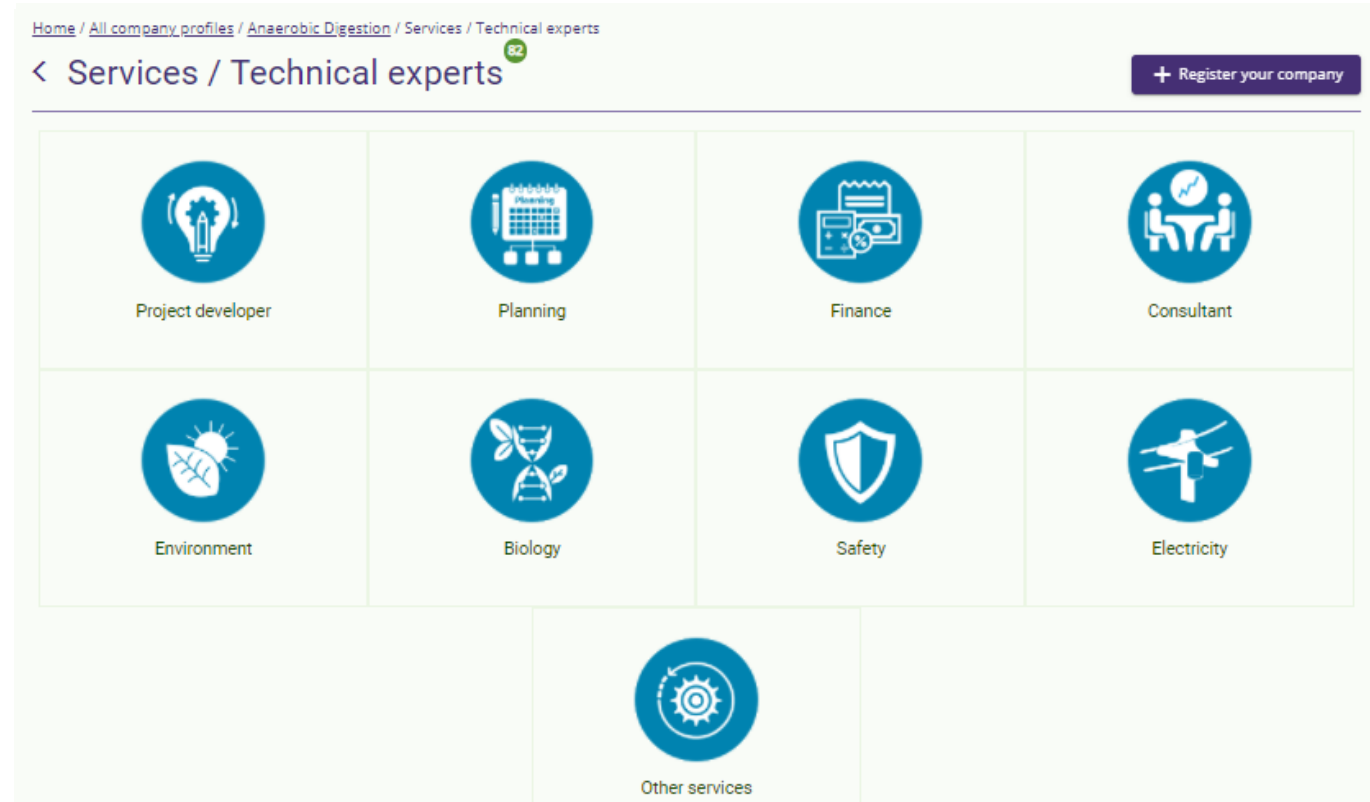
→ Browse through the company database and find companies that best suit your needs

→ by categories

- Anaerobic Digestion
- Gasification

→ by filters

→ by the global map





1 Company Profiles

- **Browse through the company database** and find companies that best suit your needs
 - by categories
 - **by filters**
 - by the global map

[Home](#) / Companies matchmaking

Companies matchmaking

Matchmaking filters
Find companies profiles by...

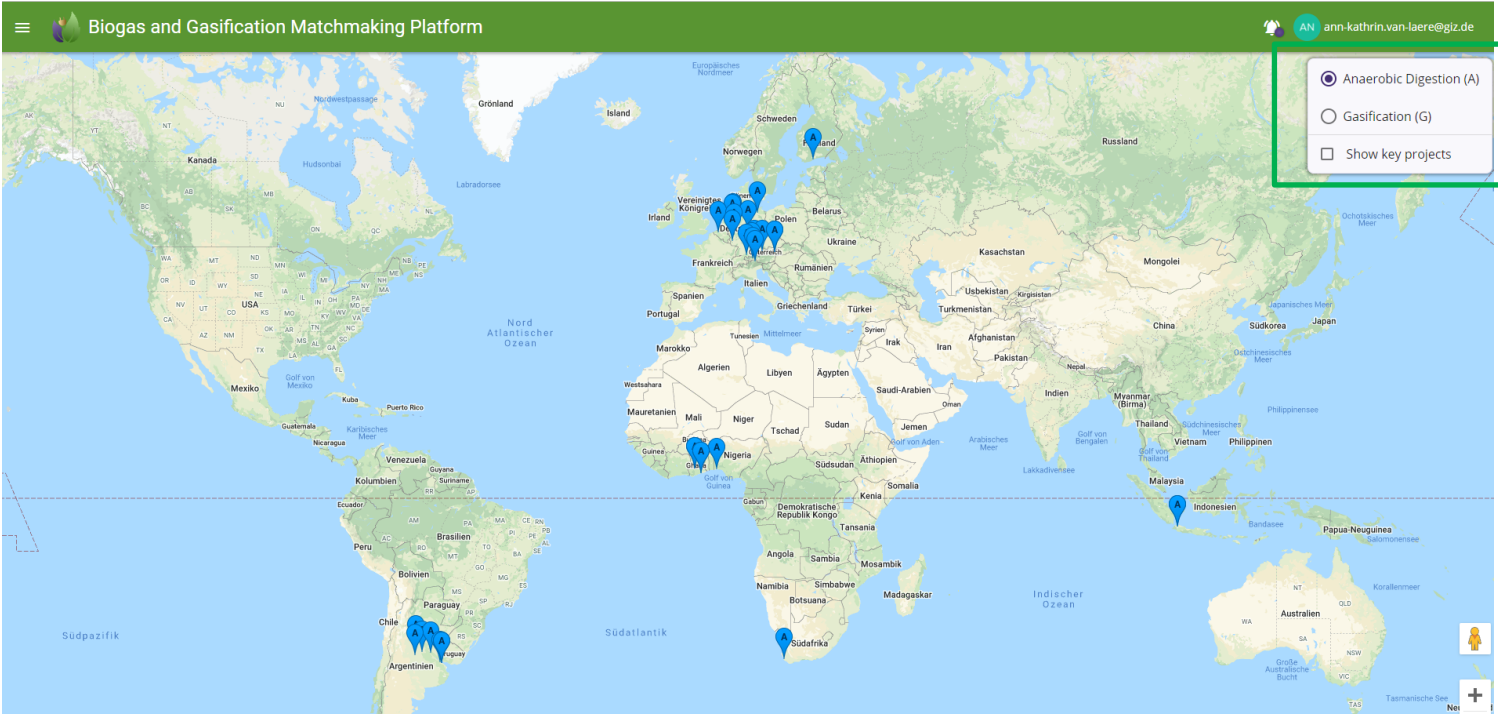
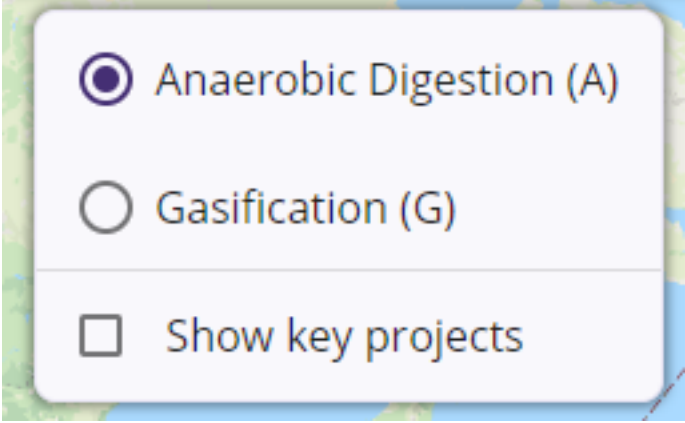
Business fields Select company business field	Company region Company region of origin	Company country Company country of origin
Profile updates Select when company profile updated	Project region Reference project region	Project country Country of reference project



1 Company Profiles

→ Browse through the company database and find companies that best suit your needs

- by categories
- by filters
- by the global map





1 Company Profiles – Matchmaking Feature

→ Find companies that **match your needs** and offer the services/ products you are looking for

[Home](#) / Companies matchmaking

Companies matchmaking



Matchmaking filters

Find companies profiles by...

Business fields

Select company business field



Company region

Company region of origin



Company country

Company country of origin



Profile updates

Select when company profile updated



Project region

Reference project region



Project country

Country of reference project





1 Company Profiles – Matchmaking Feature

→ **Save filters** to get internal platform notifications when new company matches the saved filters

The screenshot shows the 'Companies matchmaking' interface. At the top, there is a search icon and the text 'Matchmaking filters' with the subtitle 'Find companies profiles by...'. Below this, there are two sections: 'Business fields' with the instruction 'Select company business field' and 'Profile updates' with the instruction 'Select when company profile updated'. The 'Business fields' section has a button labeled 'Eastern Africa' and a 'Clear' button. The 'Profile updates' section has a 'Save' button. At the bottom, there is a message: 'No companies found match... Please, refine matchmaking...'. A dialog box titled 'Save matchmaking filters' is overlaid in the center. It contains the text: 'For easear overview you can label the selected matchmaking filters, e.g. "Pump producers from Germany"'. Below this text is a 'Label' input field with the text 'My matchmaking'. At the bottom of the dialog box are 'Ok' and 'Cancel' buttons.








1 Company Profiles – Matchmaking Feature

→ Mark companies with a star to feature them on your individual **watchlist**

My watchlist of companies

Order by:

1 - 5 of 5 < >

<p>★  kompost & biogas verband</p> <p>Austrian Compost & Biogas Association</p> <p>📍 Austria, Vienna</p> <p>📅 Oct 15, 2021</p>	<p>★  EBA European Biogas Association</p> <p>European Biogas Association</p> <p>📍 Belgium, Brussels</p> <p>📅 Oct 15, 2021</p>	<p>★  giz</p> <p>Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH</p> <p>📍 Germany, Bonn</p> <p>📅 Oct 14, 2021</p>
<p>★  Fachverband BIOGAS</p> <p>German Biogas Association Associação Alemã de Biogás Asociación Alemana de Biogás www.biogas.org</p> <p>German Biogas Association - Fachverband Biogas e.V. (FvB)</p> <p>📍 Deutschland, Freising</p> <p>📅 Sep 27, 2021</p>	<p>★  GreenCape</p> <p>GreenCape</p> <p>📍 South Africa, Cape Town</p> <p>📅 Jun 10, 2021</p>	



Biogas and Gasification Matchmaking Platform

The only matchmaking platform for biogas and gasification you ever need.

Join for free

2

Company profiles

Leading stakeholders in the biogas and gasification sectors



Explore profiles of the world leading companies and entrepreneurs in the biogas and gasification sector. Browse companies by categories or view them on the global map. Find an appropriate partner to bring your ideas to life!

Business opportunities

Counterparties presenting their needs and looking for business cooperation.



Become a participant of a dynamic and evolving marketplace for making business deals. Build collaboration with various experienced biogas solution providers by selecting one of the existing or posting your own request for a biogas solution, service or project idea.

Knowledge base

Biogas and gasification related information sources and factsheets



Are you new to a biogas sector? Get insight into the biogas sector by reading our selected list of relevant literature sources. Developed factsheets are created to summarise basic elements of the biogas plants and present this information in an easy to understand way.



2 Business Opportunities

→ **Online marketplace** where users can post requests or business opportunities/ideas for collaboration on a service or project idea

The screenshot displays the 'Biogas and Gasification Matchmaking Platform' interface. The top navigation bar is green and contains a hamburger menu icon, the platform name, a notification bell icon, and a user profile icon for 'ann-kathrin.van-laere@giz.de'. A left sidebar lists navigation options: 'Company profiles', 'Companies explorer', 'Companies matchmaking', 'Saved filters', 'Companies on global map', 'My watchlist', and 'My companies', with an 'Add company profile' button at the bottom. The main content area shows the breadcrumb 'Home / All business opportunities' and a title 'Business opportunities' with a '3' notification badge. A '+ Add business opportunity' button is in the top right. Below is a descriptive paragraph: 'This section is intended to create cooperative connections and realize business opportunities. Stakeholders can post their business needs, project ideas and requests looking for various services to build a successful business cooperation.' Two business opportunity cards are visible. The first card, titled 'Turnkey project provider / Wet digestion', includes a date of 'Oct 25, 2021', a location in 'België, Roeselare, IEPERSEWEG 87, 8800', and a description: 'Through this way, Inagro VZW announces that it is issuing a public tender: "The preliminary study and implementation of the refurbishment and further development of the existing small-scale digester on the site of Inagro VZW".' The second card, also titled 'Turnkey project provider / Wet digestion', includes a date of 'Oct 21, 2021', a location in 'Ethiopia, Bahir Dar, Pedaline, 1817', and a description: 'The water hyacinth (Eichhornia crassipes) is a free floating perennial herb found at the surface of rivers, lakes, canals and ponds and may root in the mud of shallow waters. It is a rhizomatous and stoloniferous plant with long adventitious roots that can'.



2 Business Opportunities

- Describe your **request or project idea** and specify what you are looking for

- **Upload your business opportunity** to the marketplace where suitable stakeholders can get in contact with you

Business opportunity wizard

Looking for General description Attachments Contact information Publishing

Looking for

Anaerobic Digestion	Gasification
Turnkey project provider	Turnkey system provider
Component producer	Component producer
Services / Technical experts	Services / Technical experts
Maintenance provider	Facilitators

[Exit wizard](#) [Continue >](#)



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Join platform for free!

Company profiles

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Explore profiles of the world leading companies and entrepreneurs in the biogas and gasification sector. Browse companies by categories or view them on the global map. Find an appropriate partner to bring your ideas to life!

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3

Knowledge base

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Are you new to a biogas sector? Get insight into the biogas sector by reading our selected list of relevant literature sources. Developed factsheets are created to summarise basic elements of the biogas plants and present this information in an easy to understand way.

3 Knowledge Base

→ In-depth **studies, reports, factsheets and videos** on the biogas sector from the biological basics to biogas plant construction and operation are found in this section.

I. Biogas. Books, booklets and studies


Guide to biogas
Agency for Renewable resources, FNR, 2012



A book that covers nearly all relevant aspects of biogas topics, from general biological basics, feedstock, technology, biogas use until biogas plant construction and operation.

[View PDF](#)

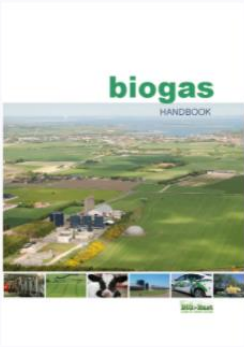
Biogas an introduction
Agency for Renewable resources, FNR, 2013



A shorter version of a book that covers nearly all relevant aspects of biogas topics.

[View PDF](#)

Big East – Biogas Handbook
2008




This handbook was elaborated through the joint efforts of a group of biogas experts from Denmark, Germany, Austria and Greece, as part of the BIG-East project, (EIE/07/214/SI2.467620), running during the period 09.2007-02.2010, with the overall aim of promoting the development of biogas from anaerobic digestion in Eastern Europe

[View PDF](#)


Factsheets

Feedstocks
Receipt, storage, pretreatment and handling




[View PDF](#)

Digester
Biological process, process conditions, hydraulic flow



[View PDF](#)

Pumps, Pipes, Valves
Transportation of liquids and digestate



[View PDF](#)



Additional features

Notifications

- Platform notifications will inform users about matchmaking results.
- E-mail notifications will guarantee that potential collaborations will not be missed

The screenshot displays the user interface of the Biogas and Gasification Matchmaking Platform. At the top, a green header bar contains the platform name, a user profile for 'ann-kathrin.van-laere@giz.de', and a notification bell icon. A left sidebar lists navigation options: Company profiles, Companies explorer, Companies matchmaking, Saved filters, Companies on global map, and My watchlist. The main content area shows the 'Notifications' page with a breadcrumb 'Home / Notifications'. A notification card titled 'New matchmaking entry' (18 minutes ago) states: 'We would like to inform you, that company BioG GmbH has matched your pre-defined matchmaking filter labeled as My matchmaking'. The card includes links for 'View company profile' and 'List saved options', and a 'Mark as read' button. A 'Settings' button and a 'Mark all as read' button are also visible in the top right of the notification area.



Additional features



Surveys

- Stakeholders can engage with the platform developers through surveys and direct emails.

Statistics

- Company profile managers can view statistics
- Soon also available for Business Opportunity Section

→ More features to come...!

[Home](#) / [My companies](#) / [Deutsche Gesellschaft für Internationale Zusammenarbeit \(GIZ\) GmbH](#) / ...

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH statistics

The table below shows the statistics about the company profile page visits. Statistics are updated approximately every 12 hours.

Country	Users (week)	↓ Views (week)	Users (month)	Views (month)
Latvia	1	1	1	15
Germany0		0	1	1
Total	1	1	2	16

← Back



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Biogas
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Support to get started

ITF © 2021 | [About](#) | [User manual](#)  | [FGP](#) | [FAQ](#) | [Feedback](#)  | [Imprint](#) | [Privacy statement](#) | [Contact us](#) | [Cookie settings](#) |

→ **User Manual**

→ **Fair Guiding Principles (FGP)**

→ **FAQ**

→ **Guided Tour for each section**



The Biogas and Gasification Matchmaking Platform in a nutshell:



- register for free as a user
- create a profile for your company
- explore the company database and find suitable business partners around the world
- upload a business opportunity / business idea





Frank Hofmann, Fachverband Biogas e.V.

“The German Biogas Association is expecting that the biogas platform helps to bring biogas stakeholders worldwide together. It allows interested persons to identify qualified biogas technology providers and contact them. Additionally the platform will help to bring individuals together, some knowing about interesting locations with high biogas potential and others that offer best solutions for that location.”





Wondwossen Bogale, Iceaddis Ethiopia

“The Biogas and Gasification Matchmaking Platform is a great opportunity to access leading stakeholders in the biogas and gasification sector in Europe. The platform makes it easy to find the right choice in implementing biogas and gasification technology and brings business opportunities for importing and exporting countries.”



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 857804. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.



Visit our platform and register as user!

Biogas and Gasification Matchmaking Platform

(www.biogasplatform.eu)

The screenshot shows the login interface for the Biogas and Gasification Matchmaking Platform. At the top, there is a logo consisting of a green leaf and a yellow flame. Below the logo, the text reads "Biogas and Gasification Matchmaking Platform". There are two buttons: "Log In" and "Sign Up". Below these buttons, there is a "Sign in with Google" button with the Google logo. Underneath, the word "or" is centered. There are two input fields: one for an email address (placeholder: "yours@example.com") and one for a password (placeholder: "your password"). Below the password field, there is a link that says "Don't remember your password?". At the bottom, there is a large purple button with the text "LOG IN >".





Other DiBiCoo activities



DiBiCoo Demo Cases



<p>Biogas Utilization Gas upgrading</p> <p>Feedstock Wastewater Organic municipal waste</p> <p>Electricity production (est.) 1.1 mio. m³ bio-methane per year</p> <p>Operation Local micro gas grid injection</p>	
--	--

Demo Case in South Africa

- More information on the demo cases on the DiBiCoo website
- Find request for collaboration on **the Biogas and Gasification Matchmaking Platform!**



Biogas Utilization

Combined Heat-Power

Feedstock

Thin stillage

Organic fraction of municipal solid waste

Electricity production (est.)

17 GWh per year

Operation

Public grid injection



Demo Case in Argentina

Biogas Utilization

Combined Heat-Power

Feedstock

Water hyacinth

Manure

Electricity production (est.)

13 GWh per year

Operation

Grid injection



Photo taken by Nega Tassie

Demo Case in Ethiopia





Biogas Utilization

Combined Heat-Power

Feedstock

Palm oil mill residues

2Electricity production (est.)

24 GWh per year

Operation

Self Consumption



Demo Case in Indonesia

Biogas Utilization

Combined Heat-Power

Feedstock

Organic household waste
Faecal sludge and septage

2Electricity production (est.)

24 GWh per year

Operation

Public grid injection



Rev Nana Kofi Ahenkorah
Managing Director



Ing. Kwasi Ahenkorah
Chairman, Board of Directors



Dr. Richard Arthur
Technical Director



Rev Mrs. Naami Ahenkorah
Administrator

Demo Case in Ghana





Capacity Building and Networking

- **Matchmaking Events** to bring exporters and importers together
- **Study Tours** (to Europe and partner countries) for business delegations
- Capacity Building **Training Courses** on biogas project development
- **Business Design Trainings**
- **Web Seminar Series**





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Cooperation

Web Seminar 006 

BIO METHANE (CNG & LNG) AND WASTE TREATMENT



Alexey Mozgovoy
Fachverband Biogas
e.V. (FVB)



Ing. Nicolas Marinelli
Tecnored Energia



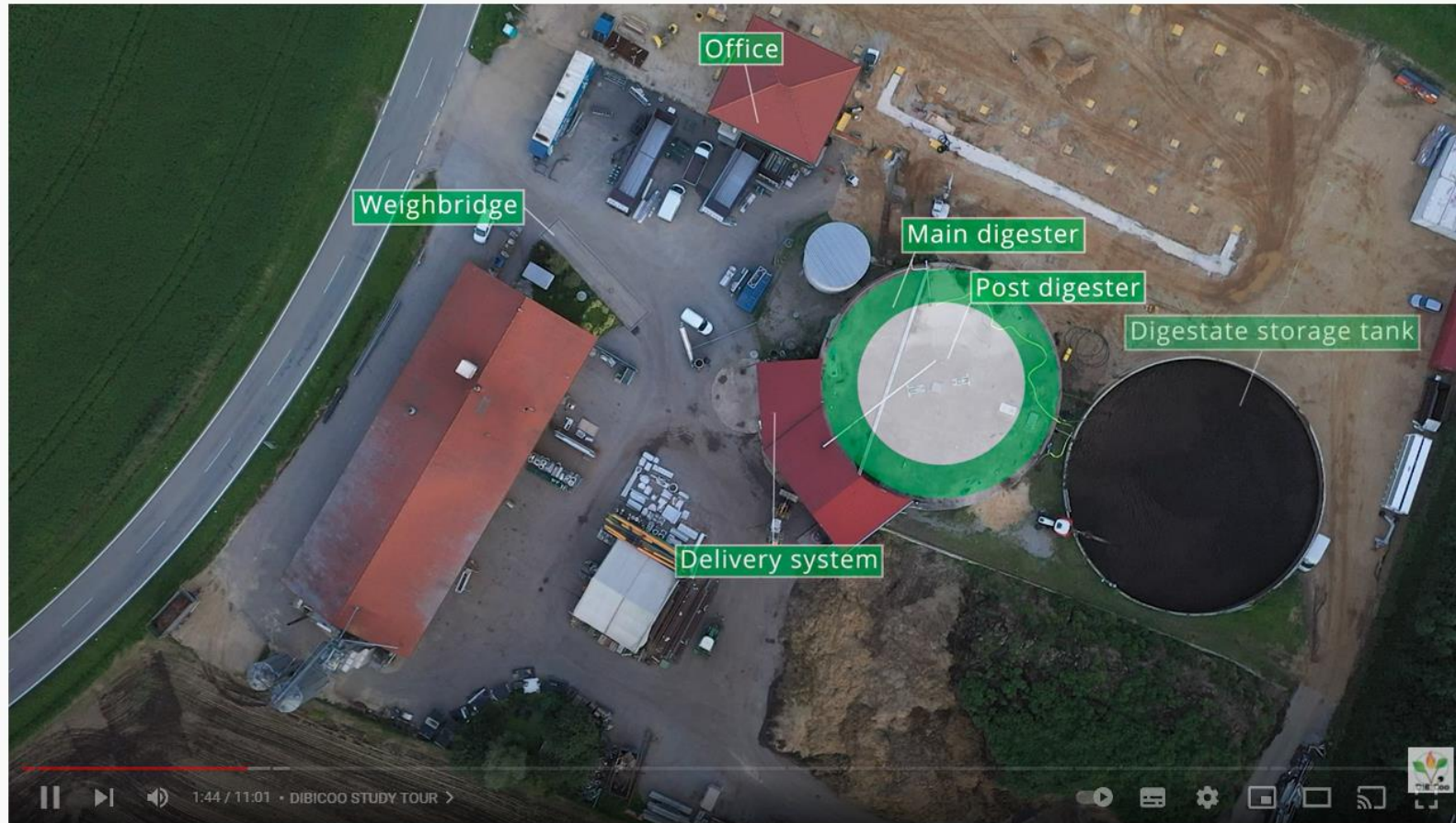
Marion Melix
Chargée de Mission Digestats
at ATEE Club Biogaz

Our 6th Web Seminar Series focuses on two important aspects: Biomethane & Waste treatment. We will start with an introduction on biomethane and its use as CNG or LNG from a European perspective. This will be followed by practical lessons presentation of bio methane production and use in Argentina. The second section discusses 'biowaste to biogas' technologies. Register to hear from our global intellectuals and partners of DIBiCoo.

 www.dibicoo.org <https://bit.ly/3nfPcMP> January 14, 2021 1:00 PM – 2:45 PM, CET



DiBiCoo Virtual Study Tour



DiBiCoo virtual study tour biogas plant Utzenaich EN

76 Aufrufe • 01.10.2021

6 0 TEILEN SPEICHERN ...

 DiBiCoo
84 Abonnenten

ABONNIEREN



oo virtual study tour biogas plant Bruck an der Leitha DE

14 Aufrufe • 23.09.2021

5 0 TEILEN SPEICHERN ...

 DiBiCoo
84 Abonnenten

ABONNIEREN



DiBiCoo virtual study tour biogas plant Augsburg EN 1

114 Aufrufe • 01.10.2021

3 0 TEILEN SPEICHERN ...


 DiBiCoo
84 Abonnenten

ABONNIEREN



Digital global
Biogas
Cooperation

Analysis of Biogas Markets

Biogas Financing Options in Argentina, Ethiopia, Ghana, Indonesia, and South Africa


Author(s): Elisabeth Rianawati (RDI), Ihsan Hafiz Loekmanto (RDI), Jorge Hilbert (INTA), Sinshaw Alemmu (Icoaddis), Mandisa Mkhize (GreenCape), Mutala Mohammed (ISEES), Wondwossen Bogale Eremed (Icoaddis), Yaseen Saleh (Greencape)

Review: AEA, EBA, FVB, GIZ, WIP, INTA, Icoaddis, Selectra, ISEES, Greencape

Date: 08.05.2020

Deliverable N°: D3.4

DiBiCoo – Digital Global Biogas Cooperation
Grant Agreement N°857804



Biogas Markets and Frameworks in Argentina, Ethiopia, Ghana, Indonesia, and South Africa

Author(s): Avila Rahmatzafan (RDI), Dwight Rosslee (Selectra), Elisabeth Rianawati (RDI), Ihsan Hafiz Loekmanto (RDI), Jorge Hilbert (INTA), Sinshaw Alemmu (Icoaddis), Mutala Mohammed (ISEES), Wondwossen Bogale Eremed (Icoaddis), Yaseen Saleh (Greencape)

Review: AEA, EBA, FVB, GIZ, WIP, INTA, Icoaddis, Selectra, ISEES, Greencape

Date: 02.07.2020

Deliverable N°: D3.3

DiBiCoo – Digital Global Biogas Cooperation
Grant Agreement N°857804

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 857804. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.



Global diffusion of biogas technology

Research needs to fast track the renewable transition of developing economies

Author(s): Oscar Gue (WIP/Aalborg University Copenhagen)

Review: Dominik Rutz (WIP), Felix Colmorgen (WIP), Rainer Janssen (WIP)

Date: 15.07.2020

Deliverable N°: D3.5

DiBiCoo – Digital Global Biogas Cooperation
Grant Agreement N°857804



FEEDSTOCKS

Receipt, storage, pretreatment and handling

Biogas plants usually receive feedstock from different suppliers in the surrounding area. As each supplier may deliver different qualities and quantities of feedstock the following measures need to be taken:

- Registration of the charge
- Quantitative and qualitative detection
- Taking retain samples
- Pre-treatment
- Optional technical pre-treatment processes, such as sanitation and hydrolysis
- Storage

Figure 1: Batch test determining the methane yield of specific substrates @Kirchmeyr


Figure 2: Air-tight clamp-on silage compression is done with heavy machinery like tractors or even snow groomers @ Kirchmeyr

Typical feedstock

- Agricultural residues** which accrue in huge amounts during the harvesting season are usually seasonally stored and fed into the digester by following means:
 - dry and not sensitive to self-decomposition, it can be first stacked in halls, then transported with a wheel loader.
 - wet and sensitive for decomposition, it is most common to store the feedstock in vertical or horizontal upright silos, transported automatically via auger, conveyor belt, press piston, or with wheel loaders.
 - liquid and not sensitive to self-decomposition, it can be stored in tanks and fed into digester with a pump.
- Animal by-products**, like manure, dung or urine are usually fed daily into the digester.
 - If wet, like liquid manure, it can be pumped.
 - If dry, like a mixture of dung and straw, it can be transported by wheel loader or other technologies.
- Organic waste**
Besides organic waste from food, feed and beverage industries, all other organic waste materials may contain several impurities which need to be removed and then, if containing animal by-products, the material needs to be sanitized in order to prevent hygienic problems. The additional handling and pre-treatment depend on its origin and characteristics.
Organic wastes from households are usually collected source-separated (with a dedicated bin for organic waste) and are constantly delivered.
Organic wastes from supermarkets (expired food) needs to be unpacked. Unpacking, removal of impurities and crushing is usually done in one step.
Organic wastes from catering services needs a removal step of impurities and a crushing step.
Organic wastes from food, feed and beverage processing industries (e.g. from sugar mills, palm oil mills, breweries, dairies, slaughterhouses) can have very different characteristics and the feedstock handling needs to be adjusted to its characteristics.

More details www.dibicoo.org

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 857804. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.



Overview and Categorization of European Biogas Technologies

- Introduction: Anaerobic Digestion -

Author(s): Franz Kirchmeyr (AKBOE) & Bernhard Stürmer (AKBOE)

Review: AEA, EBA, FVB, GIZ and WIP

Date: 15.04.2020

Deliverable N°: D2.2

DiBiCoo – Digital Global Biogas Cooperation
Grant Agreement N°857804

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How can you take part?

- **Register** on the **Biogas and Gasification Matchmaking Platform**
 - **advertise your biogas project opportunity** on the platform or find project opportunities to create new business collaborations
 - **get to know relevant business partners** and stakeholders from around the world
 - **get information and advisory** on European technologies as well as on market conditions in the target countries
- Stay tuned for updates on **future training courses, web seminars, the demo case program** and many more activities
- Become **part of our network** and help us to enable knowledge exchange



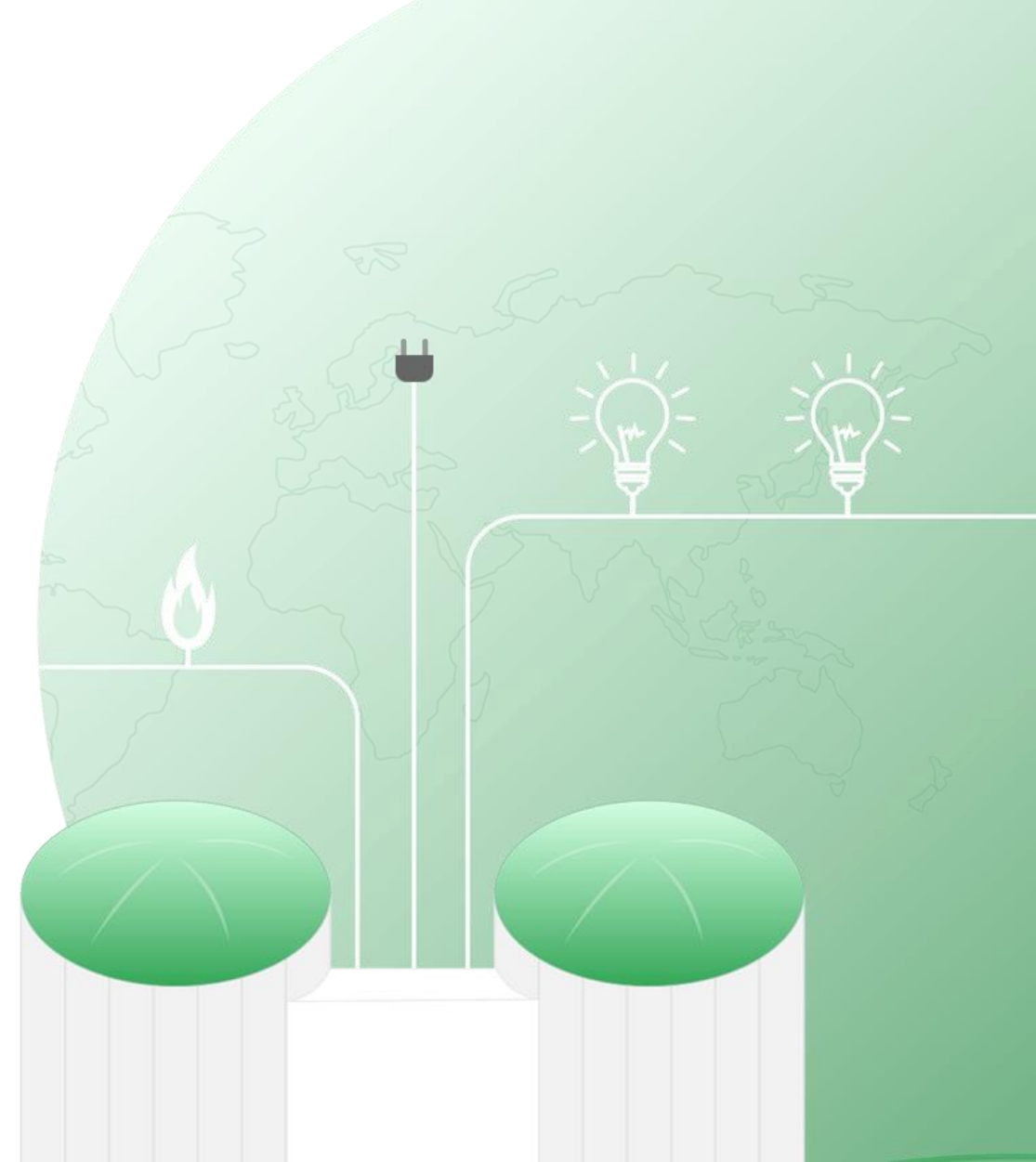
If you are interested to join, please contact us!

 www.dibicoo.org

 facebook.com/dibicoo

 [@dibicoo_eu](https://twitter.com/dibicoo_eu)

 Ann-kathrin.van-laere@giz.de or
Johannes.Anhorn@giz.de



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**Digital global
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Cooperation**

BREAKOUT SESSION: DRIVING INNOVATION

Question & Answer Session



Marieke Verbeke, Systemic EU project

Francesca Magnolo, Gent University

August Bonmati Blasi, IRTA

Ann-Kathrin van Laere, DiBiCoo EU Project