



SEMPRE-BIO.

# Sempre Bio – ambitie naar meer biomethaan in Europa

Erik Meers, Universiteit Gent  
3 Oktober, 2023 - Drongen, BE

## 5 Research lines & Teams

- ∞ Nutrient Recycling in Agro-industry
- ∞ New Biomass from Waste(water)streams
- ∞ Phytoremediation
- ∞ Nature Based Solutions in Water Treatment
- ∞ Biogas Biorefineries

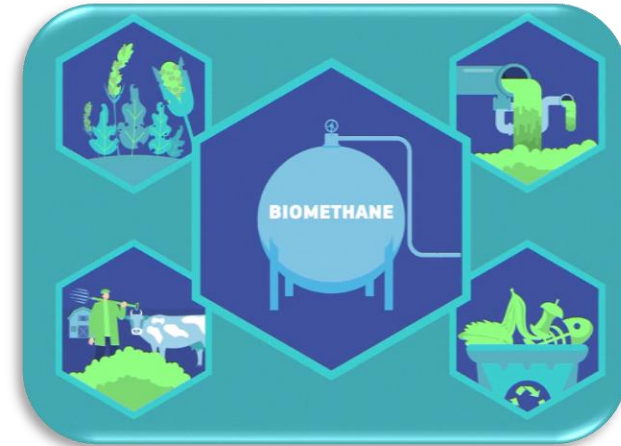




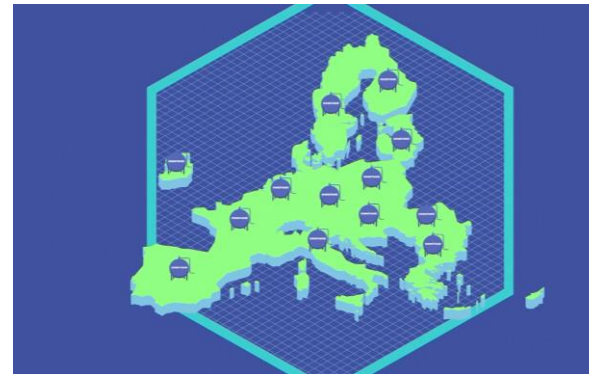
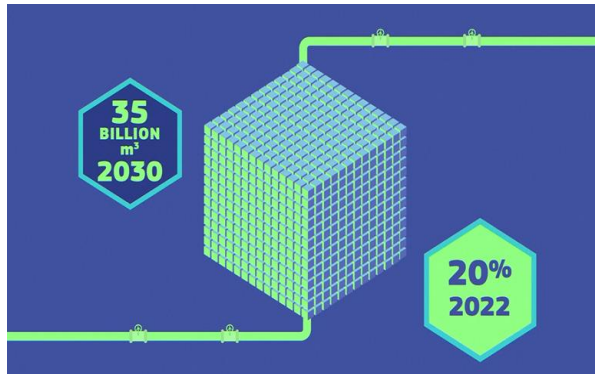
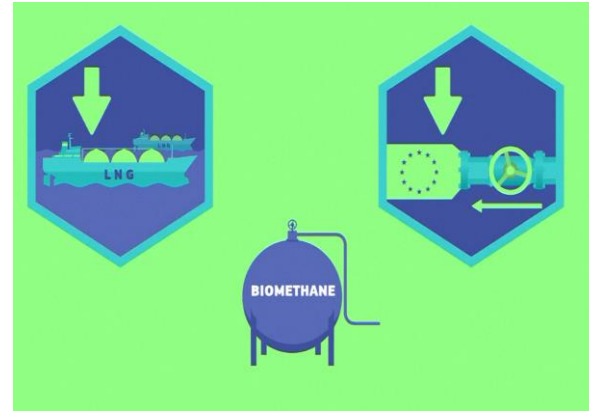
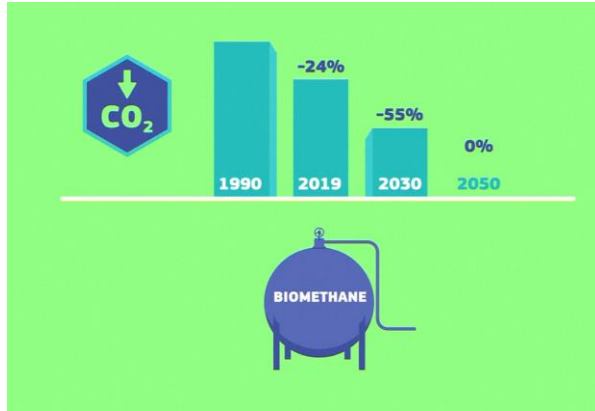
[https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomethane\\_en](https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomethane_en)



<https://bip-europe.eu/>



<https://audiovisual.ec.europa.eu/en/video/I-246329>





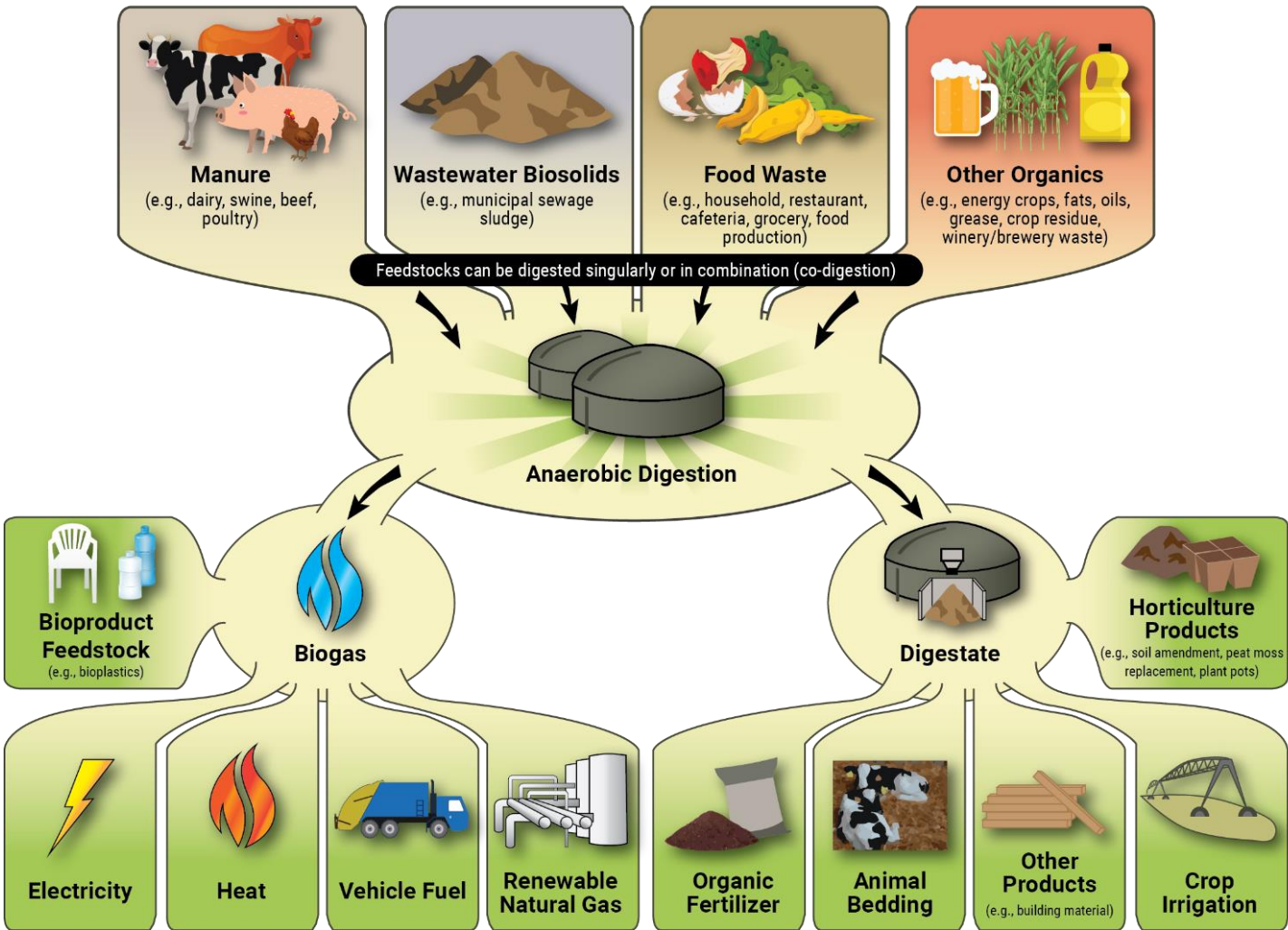
## BIOGAS / BIOMETHANE IN BELGIUM (DATA FROM 2021)

- Energy balances (Eurostat) record production of 0.3 bcm of biogases, without distinguishing the type.
- Biogases make 1.6% of gas supply.
- 0.3 bcm of biogases are used to produce electricity, either in electricity only or CHP plants (60%), whereas Final energy consumption (39%) had industry (16%), agriculture & forestry (12%) and commercial & public services (11%) as consumers.
- Biomethane in transport is not recorded in the Energy Balances.
- European Biogas Association (EBA) reports<sup>1</sup> 0.28 bcm of biogas produced in 2021 (95% in 189 biogas plants and 5% in 8 biomethane plants).
- Natural & bio Gas Vehicle Association (NGVA Europe) reports 174 CNG stations for Belgium in 2022. There were 3,769 CNG filling stations in the EU27 in 2022.



### Key messages for biomethane in Belgium:

- Belgium has ability to replace about 3.5% of current NG consumption (imports) with biomethane.
- Belgium has infrastructure to start supplying biomethane to transport in the existing 170 CNG filling stations.
- Full effect of biomethane in the green transition would be framing support schemes around livestock and meat and dairy industry to reduce carbon footprint of meat and dairy products as well as GHG emissions from agriculture.
- Combining manure based biomethane with sequential cropping and digestate use to store carbon in the soil and feedstock (like the BiogasDoneRight concept in Italy) and biogenic CO<sub>2</sub> use in agri-food production would add to simultaneous GHG emissions reductions in the top three highest GHG emitting sectors by air emissions in Belgium.
- Given the feedstock profile, a ripple effect would be created by pairing biomethane production with the industrial wastewater treatment facilities to achieve short supply chains with biogenic CO<sub>2</sub> and biomethane use in industry (ETS sector) or heavy-duty vehicles linked to the industry operation (transport sector).
- Well-developed natural gas grid gives an advantage to inject biomethane in the grid, with several small ADs clustered around one biomethane upgrading unit.

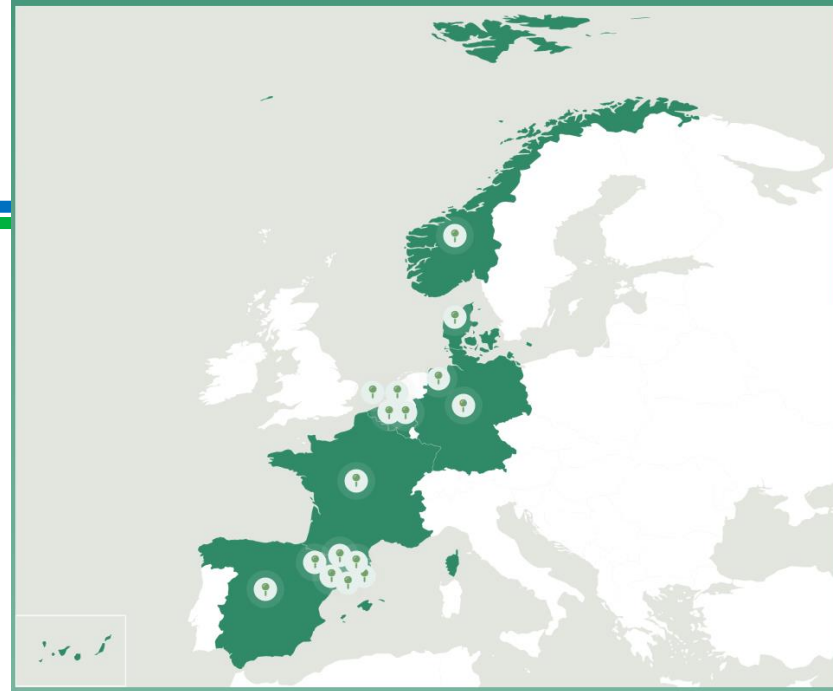


## ‘Securing domestic production of cost-effective biomethane’

- ✓ Start date: 01/11/2022
- ✓ End date: 30/04/2026
- ✓ 16 partners from 6 EU countries
- ✓ Coordinated by

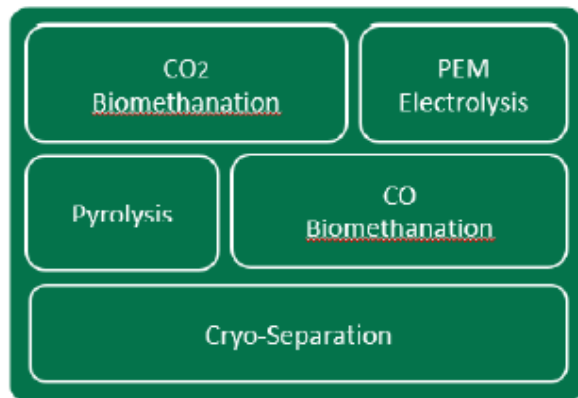
**CETAQUA**  
WATER TECHNOLOGY CENTRE

- ✓ Funded by





### Pillar 1: Innovative Biomethane Production Technologies



### Pillar 2: Case Studies



### Pillar 3: Techno-Economic Assessment



Diversify the conversion technology basis for biomethane production

Contribute to market up-take of biomethane related technologies in the gas market

Increase cost-effectiveness of the conversion in biomethane production

### Biomethane End-Users



Transport



Network Operators



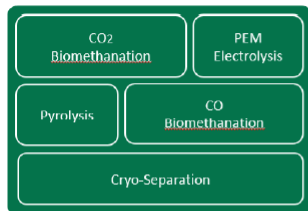
Industry



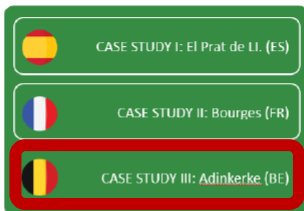
Traders

Contribute to the priorities of the SET Plan Action 8

## Pillar 1: Innovative Biomethane Production Technologies



## Pillar 2: Case Studies



## Pillar 3: Techno-Economic Assessment



Diversify the conversion technology basis for biomethane production

Contribute to market up-take of biomethane related technologies in the gas market

Increase cost-effective biomethane production

### Biomethane End-Users



Transport



Network Operators



Industry



End-Users

Contribute to the priorities of the SET Plan Action 8

## Case Study #3 (CS-III): Farm De Zwaenepoel, Adinkerke (BE)

**Leader:** UGENT

**Partners:** Zwaenepoel dairy Farm, INNOLAB

CRYOINOX, Biogas-E

**Country:** Belgium (BE)

**Feedstock:** cattle manure and organic biological waste as co-substrate

**Final use of biomethane:** Bio-LNG to be stored locally and collected by truck periodically



**Relevance:** CS-III represents a European Biomethane Innovation Ecosystem (EBIE) where current phased-out incentives on top of high maintenance and operation costs, make that smaller biogas producers cannot sustain operation anymore. In CS-III, SEMPRE-BIO will demonstrate retrofitting solutions that will bring back to profitability such small-scale plants.



# Case Study

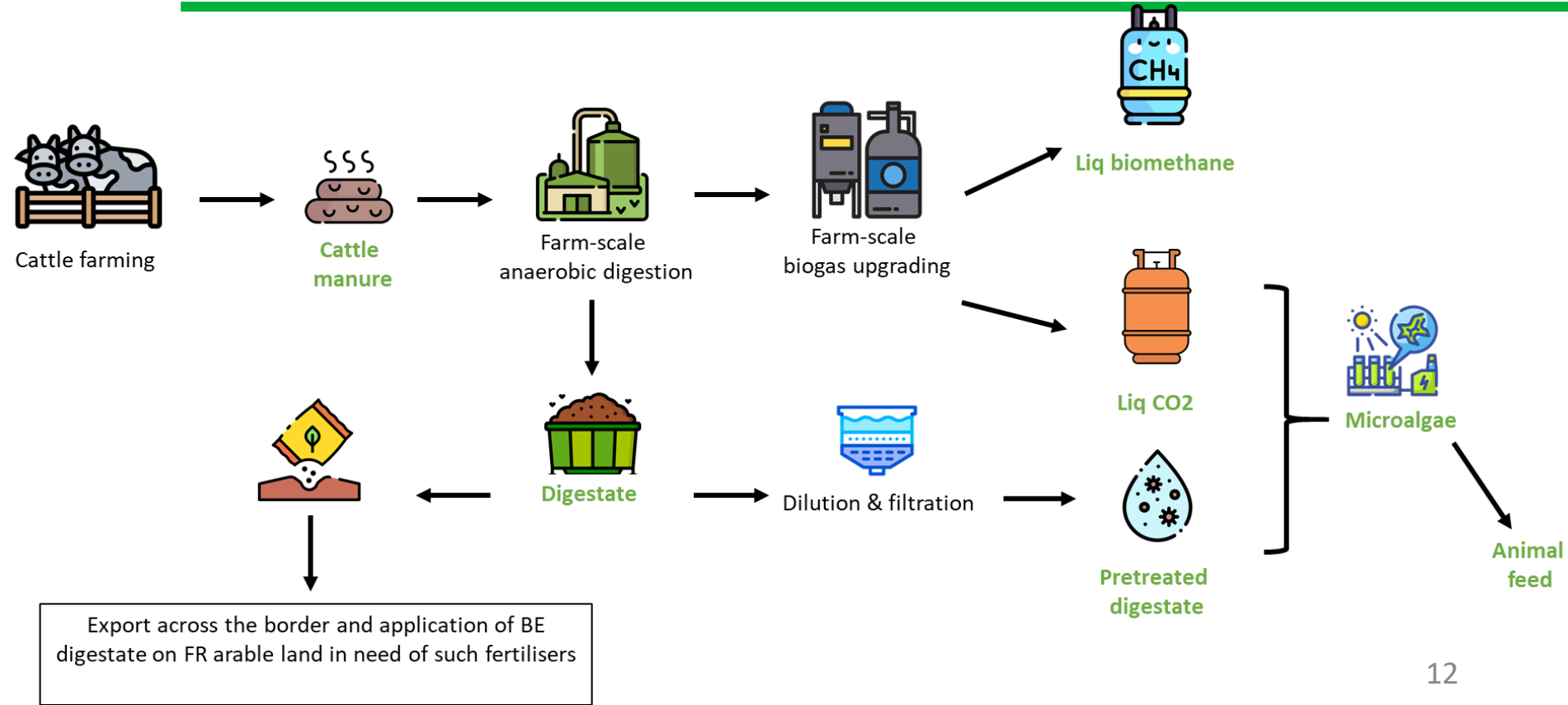


Case Study #3 (CS-III): Farm De Zwaenepoel, Adinkerke (BE)

CS-III represents a European Biomethane Innovation Ecosystem (EBIE) where current phased-out incentives on top of high maintenance and operation costs, make that smaller biogas producers cannot sustain operation anymore. In CS-III, SEMPRE-BIO will demonstrate retrofitting solutions that will bring back to profitability such small-scale plants.



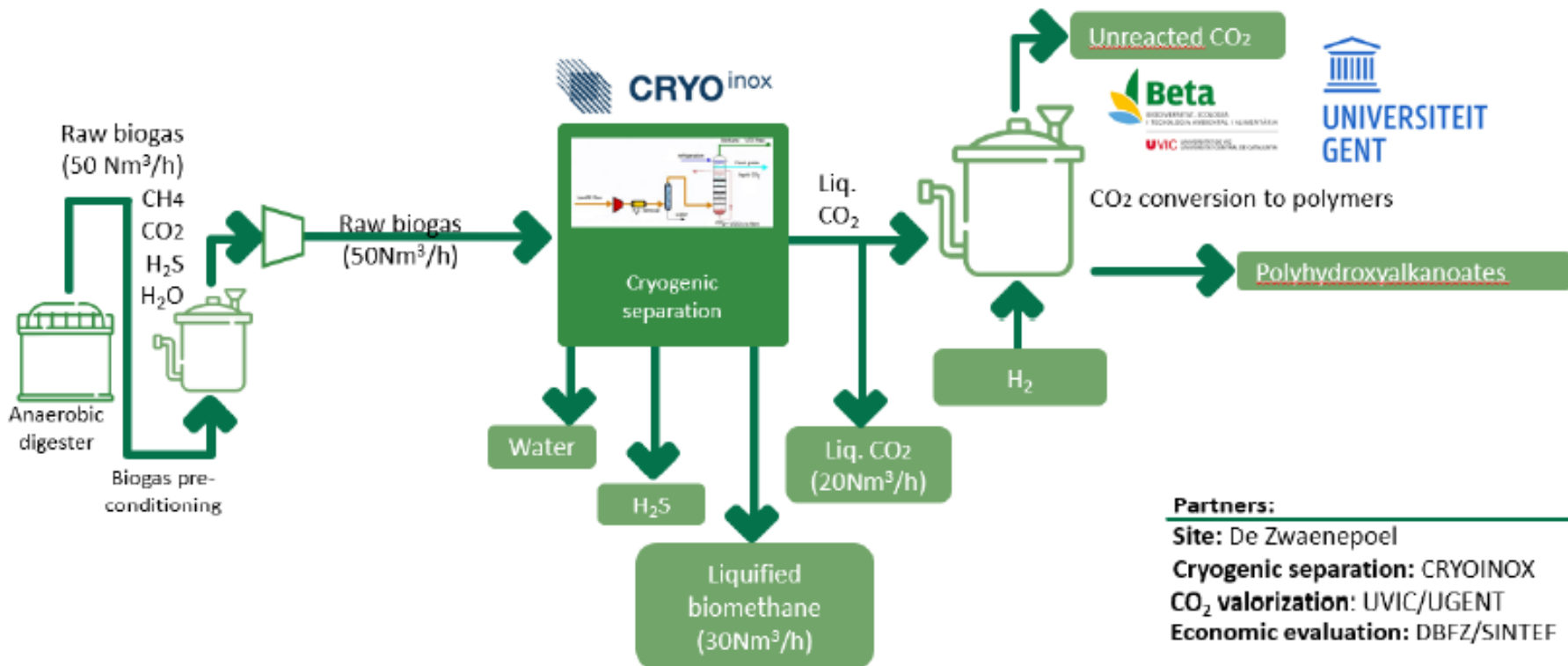
# Pilot



Export across the border and application of BE digestate on FR arable land in need of such fertilisers



# Pilot



**Partners:**

**Site:** De Zwaenepoel

**Cryogenic separation:** CRYOINOX

**CO<sub>2</sub> valorization:** UVIC/UGENT

**Economic evaluation:** DBFZ/SINTEF



# Purpose

To develop and demonstrate innovative biogas upgrading technologies that enable the retrofitting of biogas and biomethane plants even at low capacities at risk of going out of operation due to phased-out incentives or increasing feedstock costs



# Core Team



**Innolab** is a laboratory and a research platform offering services in connection with biogas production and biomass valorization. **Biogas-E** is the biogas association in Flanders

Will support the pre-project study phase, the substrates characterization, the validation of project feasibility.



**Cryoinox** is technological company specialized in production of systems for liquefaction and micro-liquefaction of natural gas and biomethane.

Will design, produce, install and operate the pilot unit of cryogenic separation of H<sub>2</sub>O, H<sub>2</sub>S and CO<sub>2</sub>.



**Ghent University** is an internationally well known, pluralistic and socially engaged university in Belgium.

Will study further business case optimization by addressing biogas & biomethane based sub-product costs and valorization





# WP3 Roadmap

## Task 3.1



*Energy profile &  
renewable energy  
integration scenarios*

**Leader: Innolab**

## Task 3.2



*Cryogenic upgrading  
demo site operation and  
data analysis*

**Leader: Cryoinox**

## Task 3.3



*Study towards further  
business case  
optimization*

**Leader: Ghent University**



# Task 3.1

Leader: INNOLAB

## In short:

- Identify the energy profile of the farm
- Set the optimal integration of renewable energy technology at the farm scale
- Focusing on the potential of decentralized biomethane production at the farm level



# Task 3.1 - Energy profile & renewable energy integration scenarios

## (i) Energy profile (Farm & AD plant)

- Conduct a full audit of the actual energy consumption on the farm (gas, electricity, heat, diesel)
- Make an overview of the future AD plant with the energy consumption of the site

## (ii) Optimization scenarios

- Characterize the AD plant substrates (BMP)
- Carry out pilot tests (if necessary)
- Make a firm energy balance with the AD plant (net production)

## (iii) Renewable energy integration scenarios

- Make an overview of the gas valorization technologies suitable for this scale
- Financial study (feasibility) for a gas injection station or LNG station





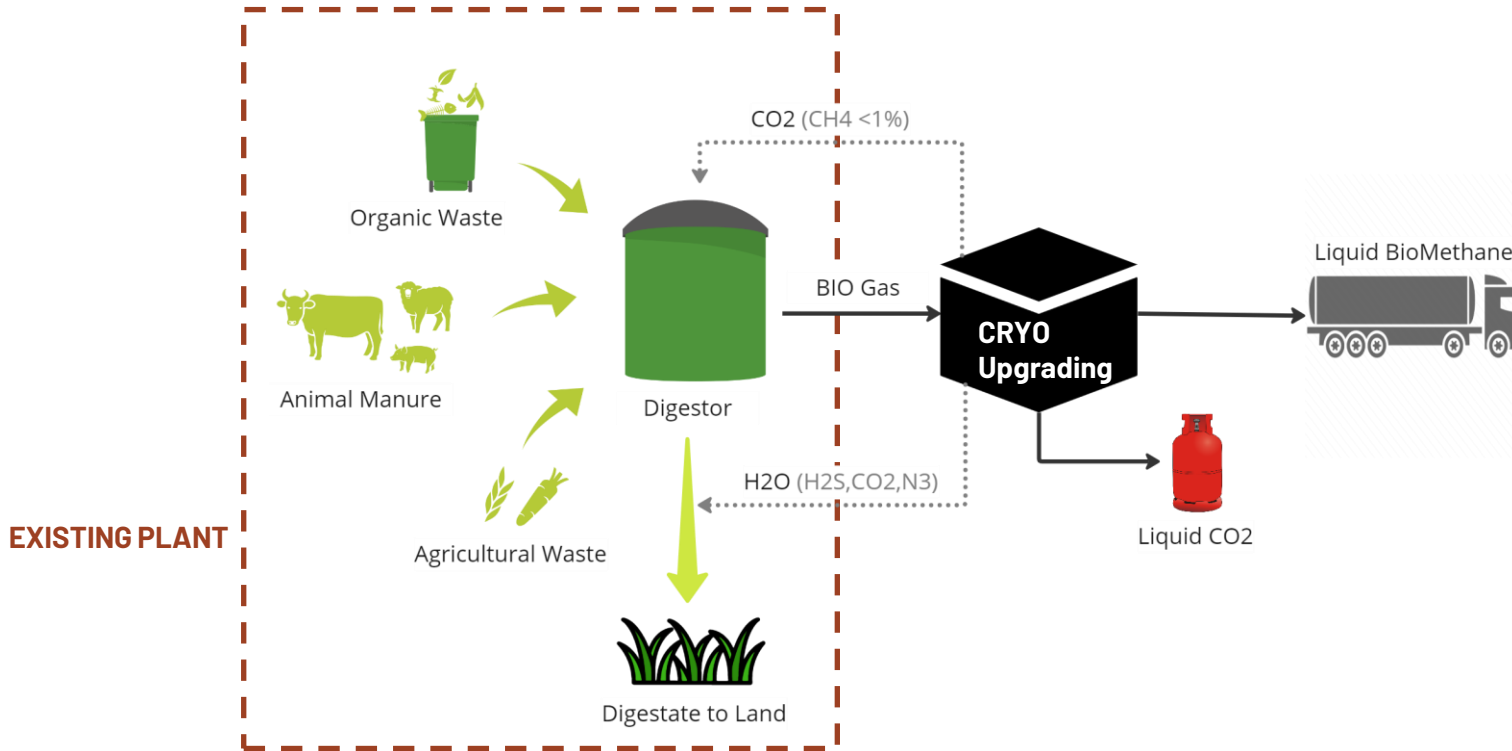
# Task 3.2

Leader: CRYOinox

## In short:

- Design, produce and installed a Cryogenic Treatment of Biogas system
- Separate and eliminated CO<sub>2</sub>, H<sub>2</sub>O, H<sub>2</sub>S and NH<sub>3</sub> from the methane; to obtain the desired Liquid Bio methane.
- Collect and analyze the experimental data for its use in other WPs

# Task 3.2 - Cryogenic upgrading demo site operation & data analysis



# Task 3.3

Leader: Ghent University

## In short:

- Study further business case optimization by addressing biogas & biomethane sub-product costs
- Study further business case optimization by addressing biogas & biomethane sub-product valorization
- To address the possible upcycling and up-valuation of nutrients from AD-processed manure



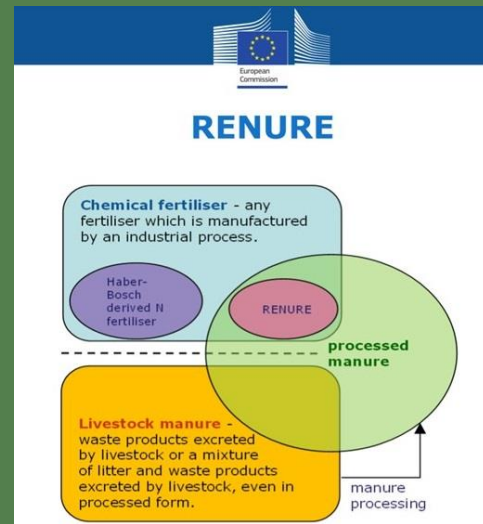
# Task 3.3 – Study towards further business case optimization

In frame of the current pilot in Belgium, we will;

**(i)** assess the feasibility to allow export across the border and application of BE digestate (local surplus) on FR arable land in need of such fertilisers (meeting hygienisation requirements of the EC by-product regulation)

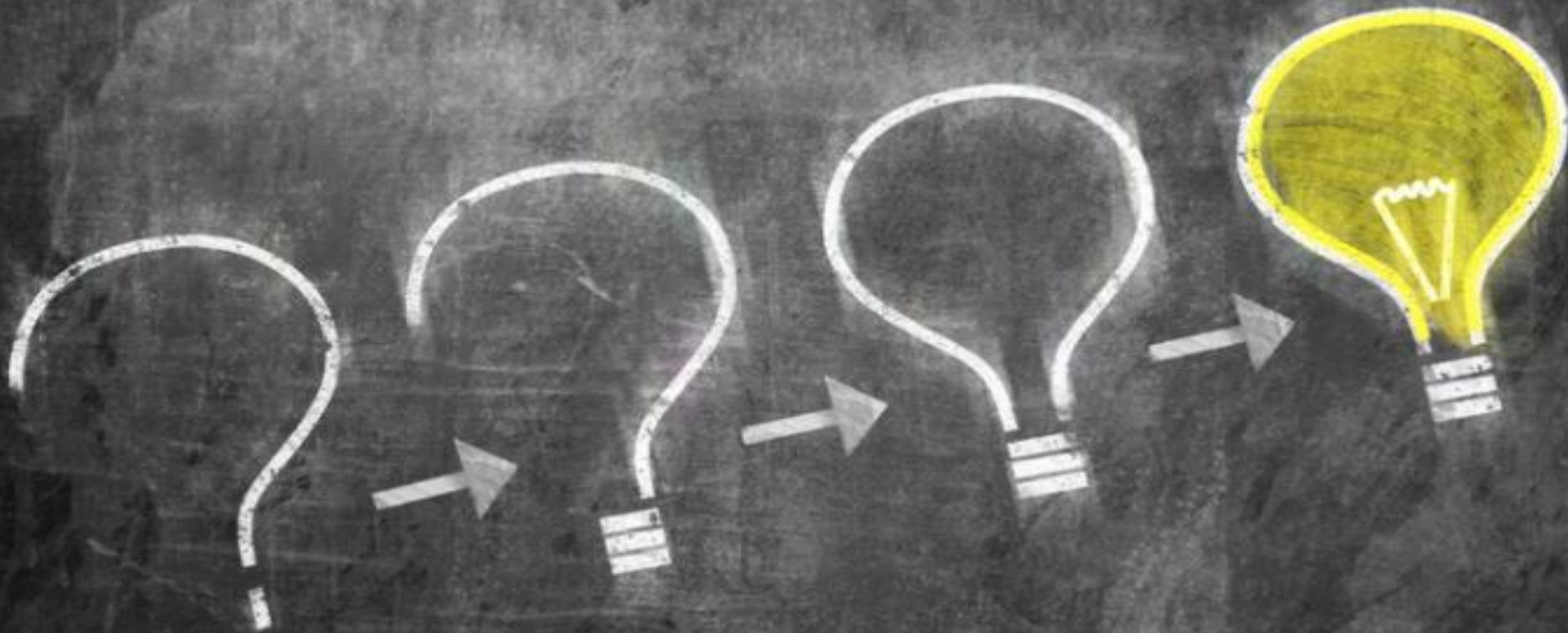
**(ii)** evaluate the possibilities of the EC-JRC\* study on SAFEMANURE and end-of-manure status (also annotated by the EC as RENURE) by applying digestate treatment processes,

**(iii)** investigate which products under the EC fertilising product regulation (FPR) can be produced from the digestate from agro-AD.



\*Joint Research Centre | European Commission

# Vragen ?



@Bioref\_Cluster



erik.meers@ugent.be

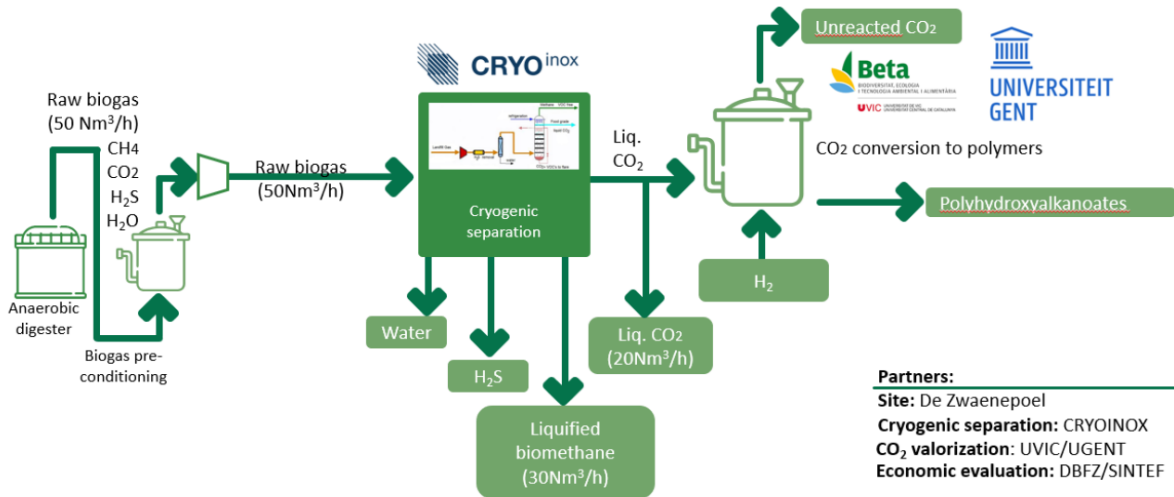


[www.biorefine.eu/newsletter](http://www.biorefine.eu/newsletter)



# Sempre-Bio: the case studies

## Case Study III



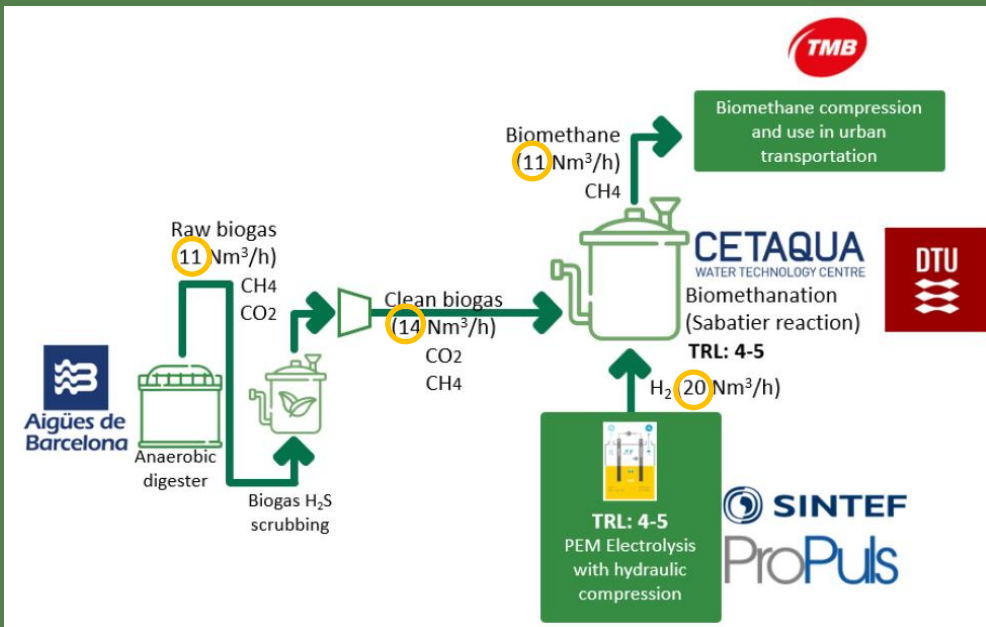
- Profit?
- LNG trading
- Cryogenic separation
- Potential bottleneck: permitting?
- Digestate valorisation
- CO<sub>2</sub> valorisation: proteins, biopolymers, microalgae, purple bacteria
- Liquified CO<sub>2</sub> trading?





# Sempre-Bio: the case studies

## Case Study I



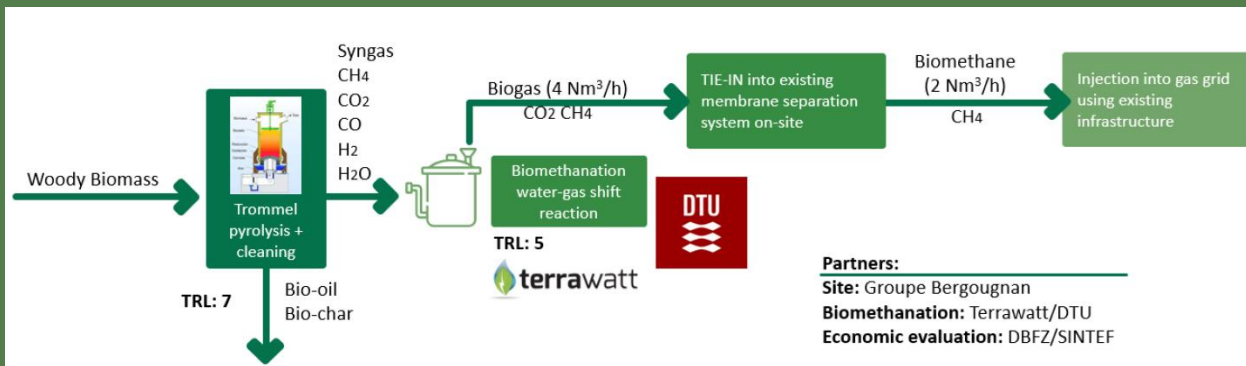
- No profit = no problem
- 2 buses
- Biogas/CO<sub>2</sub> methanation (P2G)
- Potential bottleneck: bench scale experimentation





# Sempre-Bio: the case studies

## Case Study II



- Profit?
- Injection to grid
- CO methanation
- Potential bottleneck: bench scale experimentation
- Biochar valorization

