

Biomethane Pilot Project

14th South East Europe Energy Dialogue

26th May 2023
Thessaloniki

Dr. Dareioti Margarita

H₂ & Biomethane Deputy Project Manager

m.darioti@depa.gr



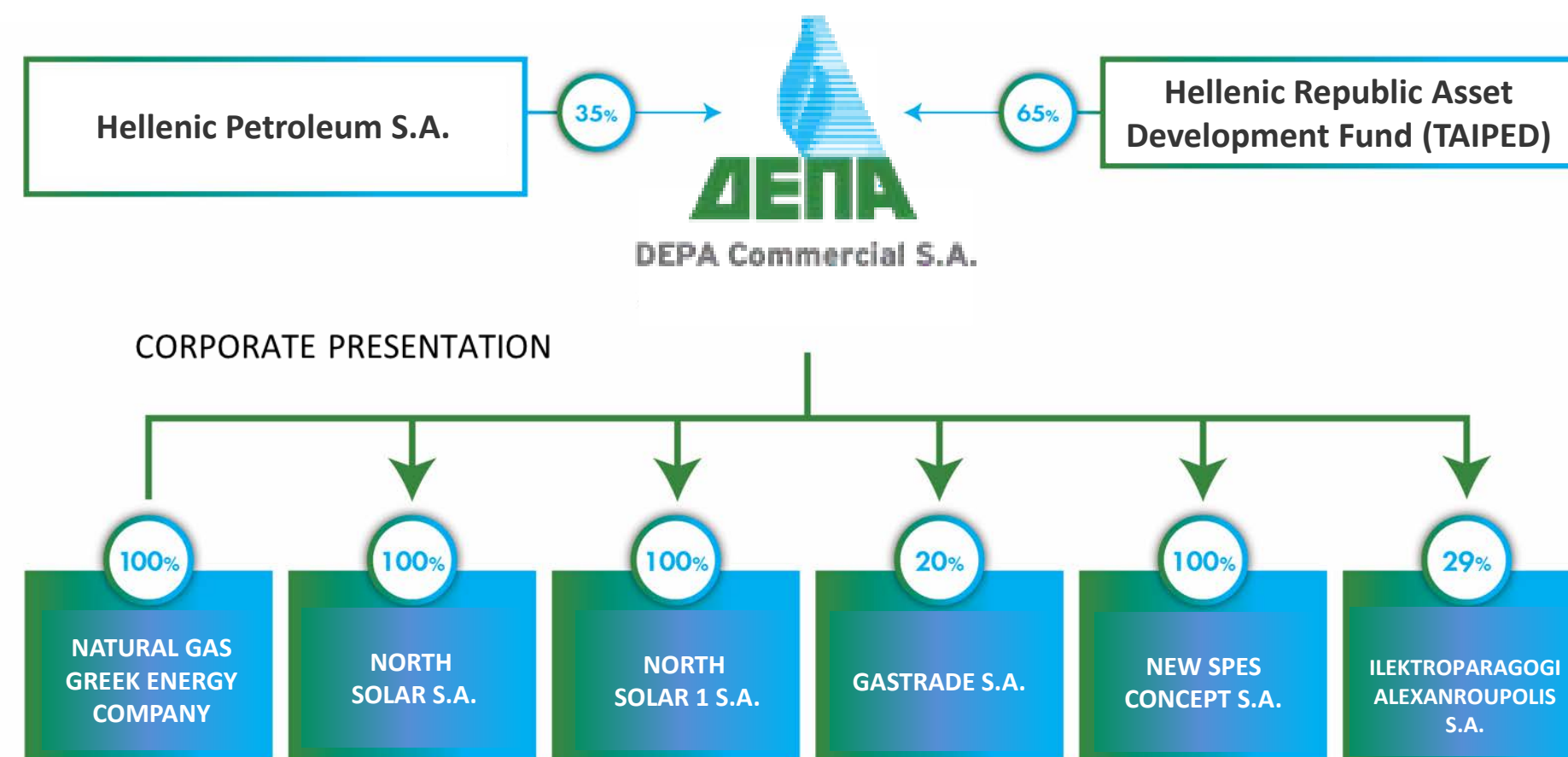
Project H₂ & BM

CORPORATE PRESENTATION

DEPA COMMERCIAL S.A. at a glance

DEPA Commercial is a modern and competitive company with substantial contribution to the development of the Greek economy. DEPA's business plan target is the constant expansion of activities, using different energy sources beyond natural gas, with the development of RES, H₂ and Biomethane and high vertical integration, with «green» entrepreneurship terms.

To achieve all its objectives DEPA's basic line is the absolute respect to the environment and the society, the support of green entrepreneurship and the invention, evaluation and exploitation of innovative practices that could contribute to the environmental protection and at the same time to the development of Greek economy.



Corporate development projects –Project Management Office

DEPA Commercial utilizing its many years of experience in the gas market and its qualified personnel, systematically invests in the development of innovative technologies and independent projects for the use of alternative and cleaner fuels. **These projects concern the fields of marine and road transportation, energy production and industry.**

PROJECT

SUB-PROJECT

**SMALL SCALE LNG
(SSLNG)**

1. LNG as a marine fuel
2. LNG for off – grid customers
3. LNG for on-road transportation

**HYDROGEN AND
BIOMETHANE (H₂ & BIO-CH₄)**

1. Hydrogen Re-fueling Station
2. Biomethane

**RENEWABLE ENERGY
SOURCES (RES)**

1. North Solar SA
2. NEW SPES CONCEPT SA
3. North Solar 1 SA

**ENERGY EFFICIENCY AND
KAI ELECTROMOBILITY**

1. Provision of energy saving services to large corporate customers
2. Energy saving to household consumers from the subsidiary company Natural Gas – Greek Energy Company (EPA Attikis)

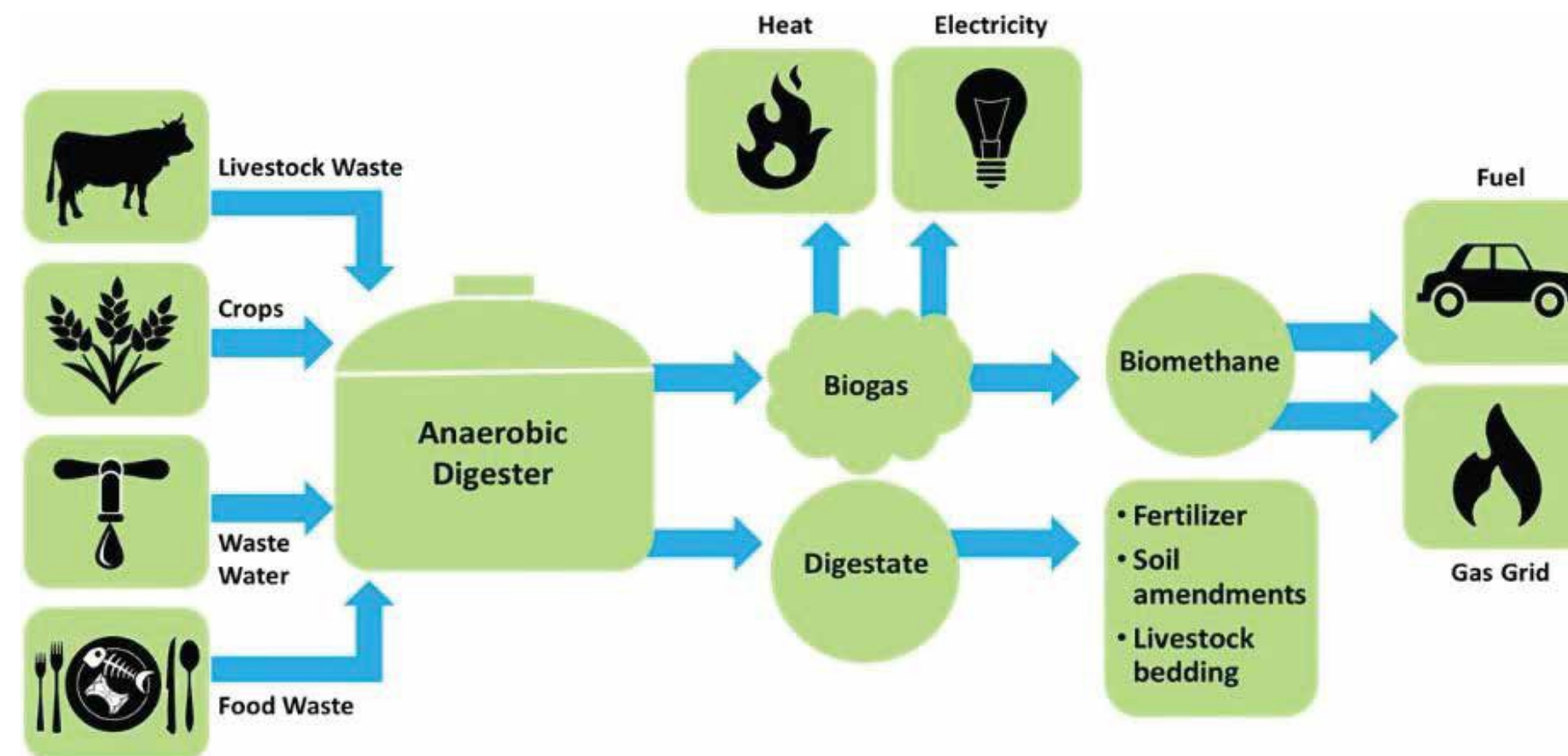
For the development, implementation and monitoring of its projects DEPA has established the Project Management Office (PMO) with the appropriate organizational structure for each project (Project Team).

DEPA's turn to Biomethane

Biomethane as a renewable fuel with zero carbon footprint contributes to the sustainable energy transition and to the reduction of Greece's energy dependence.

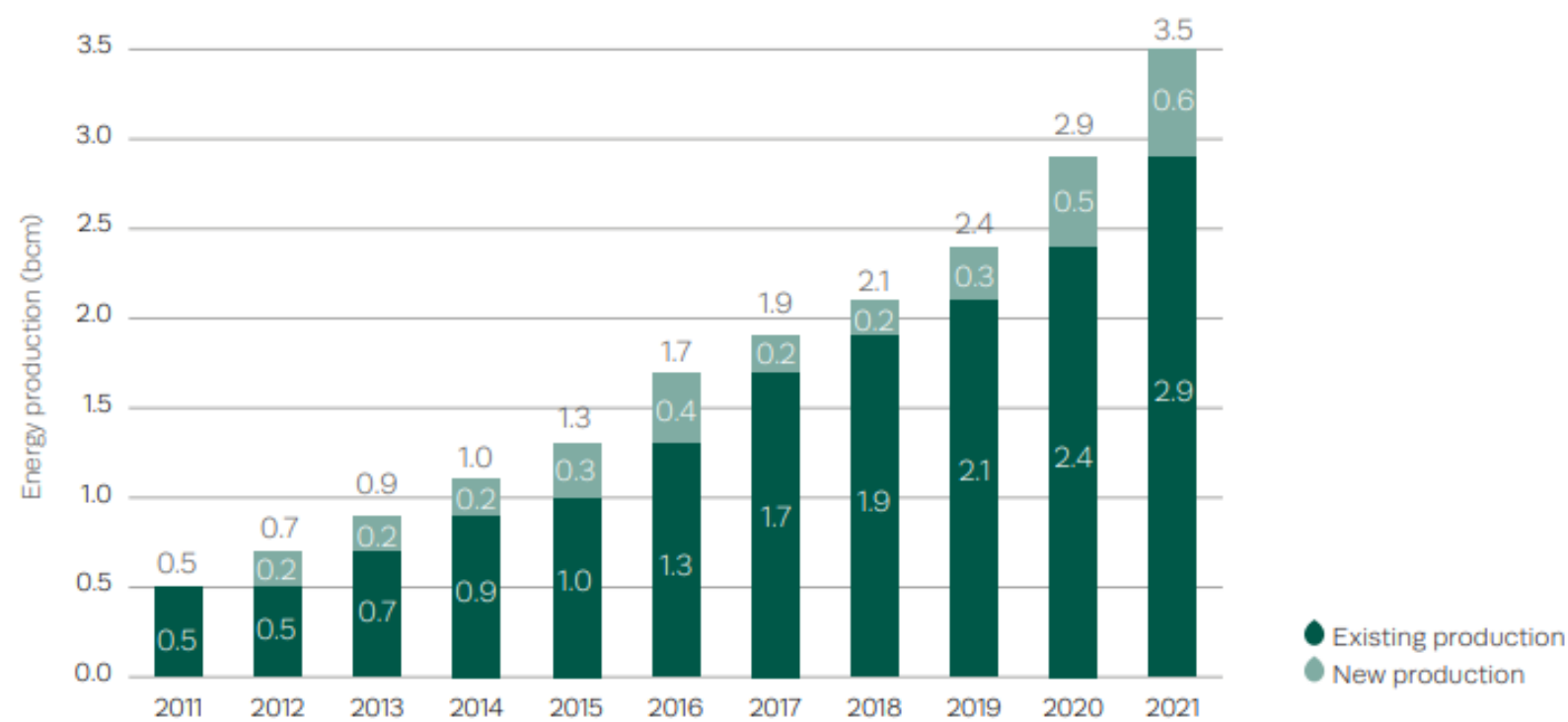
With biomethane project, DEPA Commercial inserts into the production and distribution of biomethane, which makes DEPA one of the most innovative companies in Greek market. Utilizing green technologies DEPA intends to:

- The upgrading of raw biogas excess quantities
- The conversion of biogas to high purity biomethane
- The injection of biomethane into the natural gas grid or its use as transport fuel



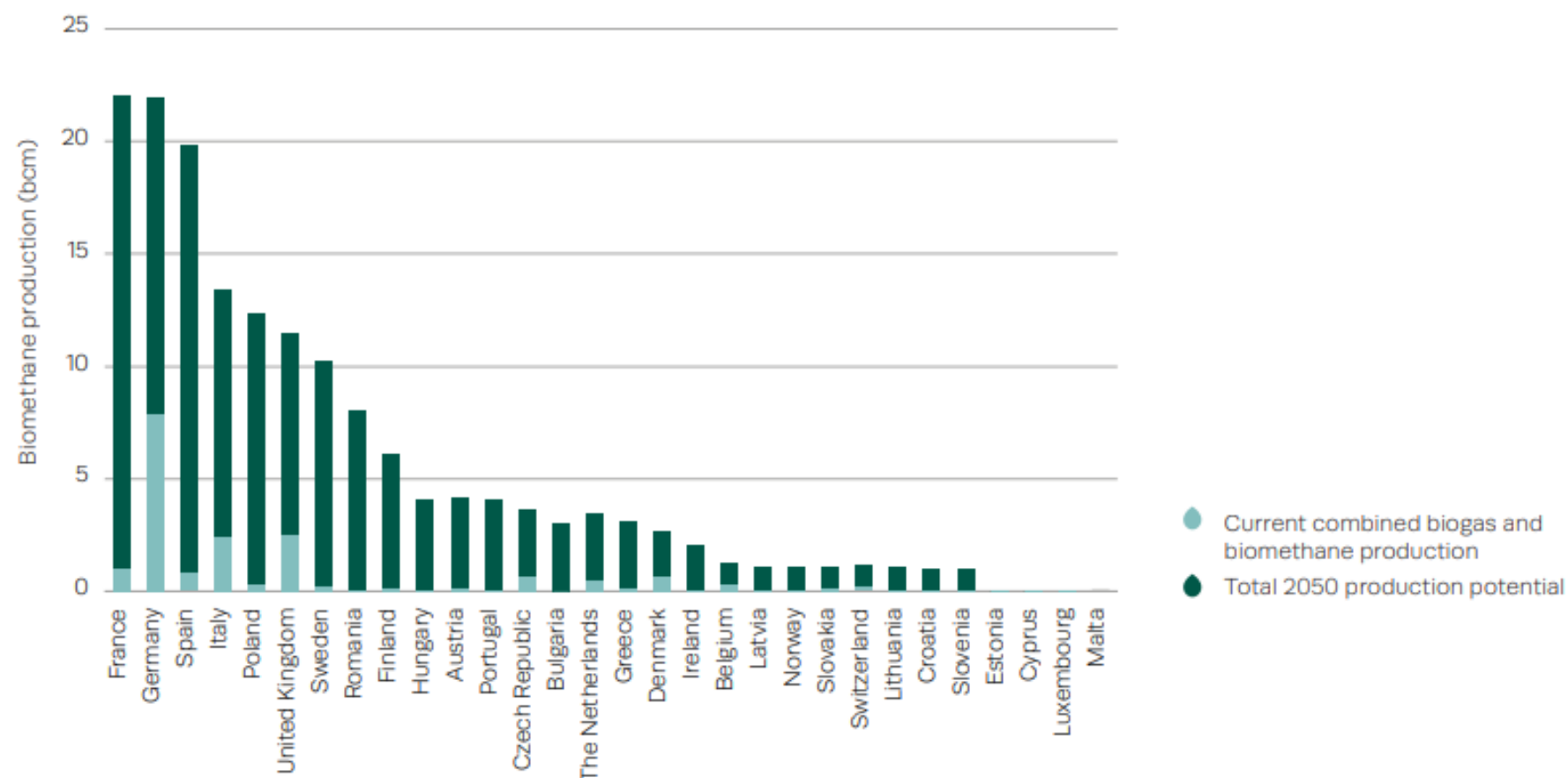
EUROPEAN TRENDS IN BIOMETHANE SECTOR

Biomethane production in Europe



Biomethane production has enjoyed remarkable growth in the last decade, and 2021 saw the biggest yearly increase so far, with an additional 6.1 TWh or 0.6 bcm of biomethane production compared to 2020. This represents a production increase rate of 20% in 2021.

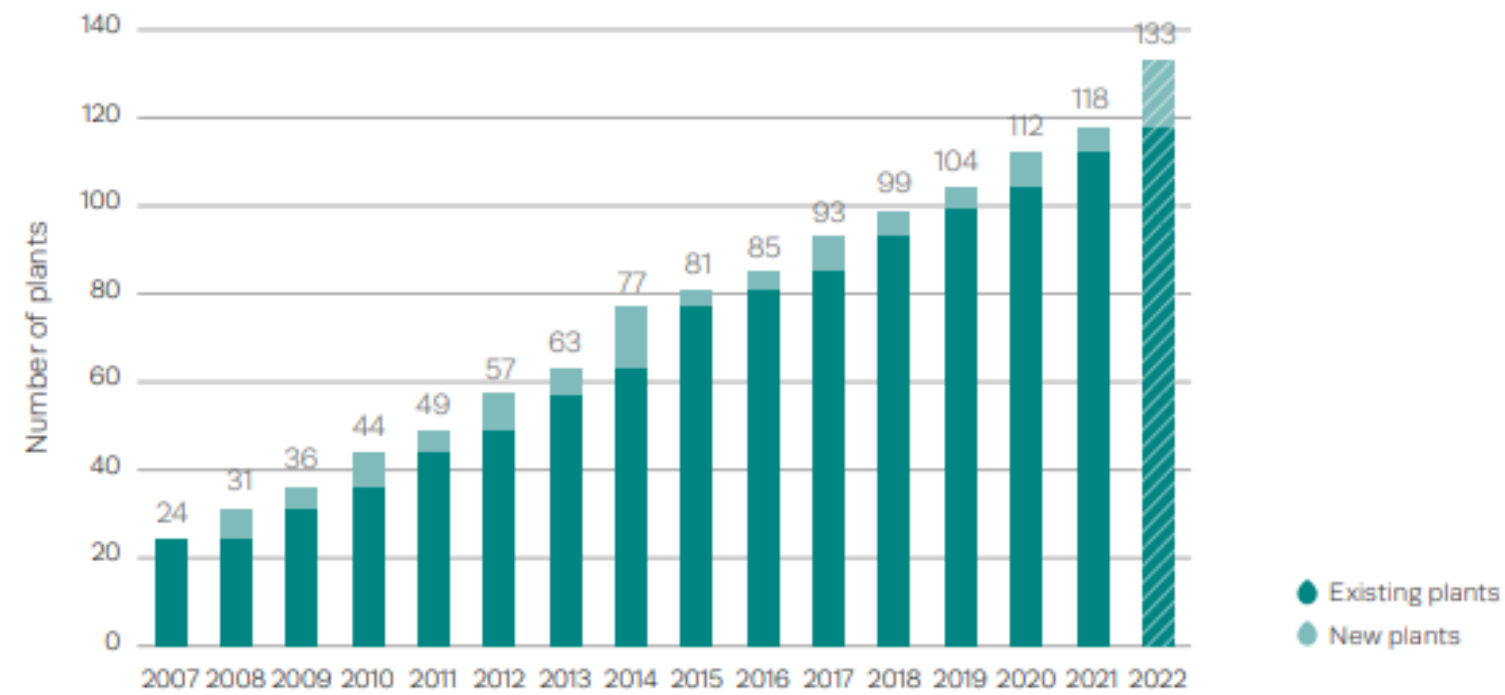
Biomethane production in Europe (bcm)



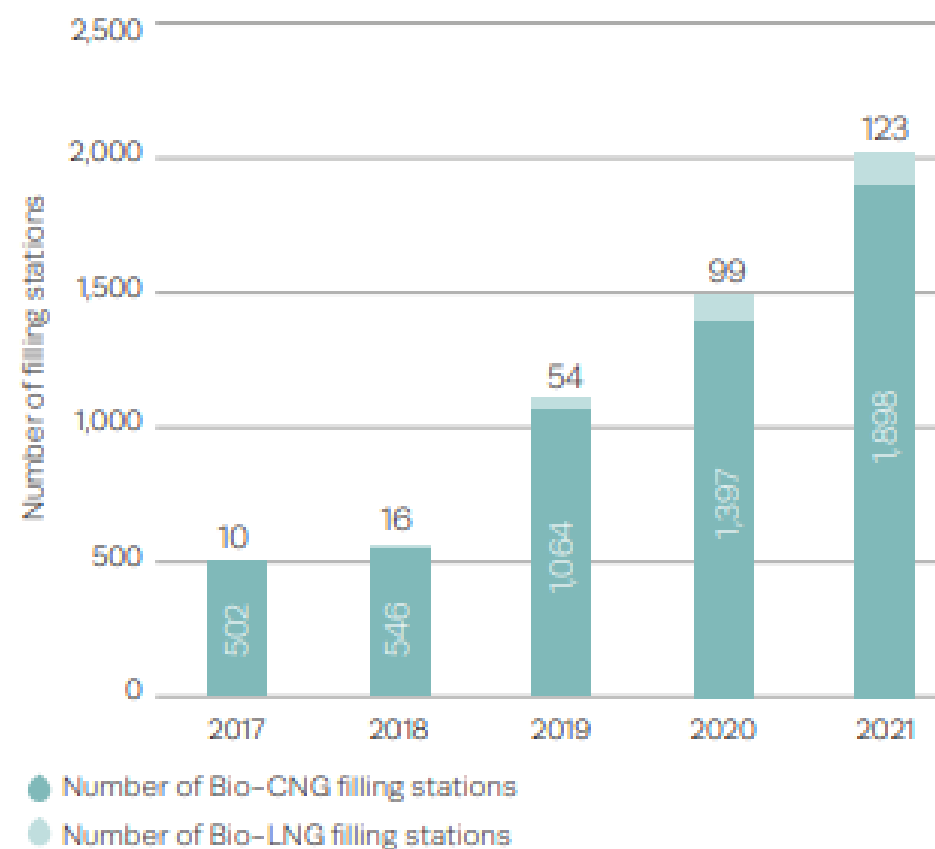
The countries with the highest 2050 production potentials are France (22 bcm/year), Germany (22 bcm/year), Spain (20 bcm/year), and Italy (14 bcm/year).

EUROPEAN TRENDS IN BIOMETHANE SECTOR

Bio-CNG production in Europe



Development of on-site Bio-CNG production at biomethane plant in Europe



Number of Bio-CNG and Bio-LNG filling stations in Europe



Number of on-site Bio-CNG production plants by mid-2022 in Europe

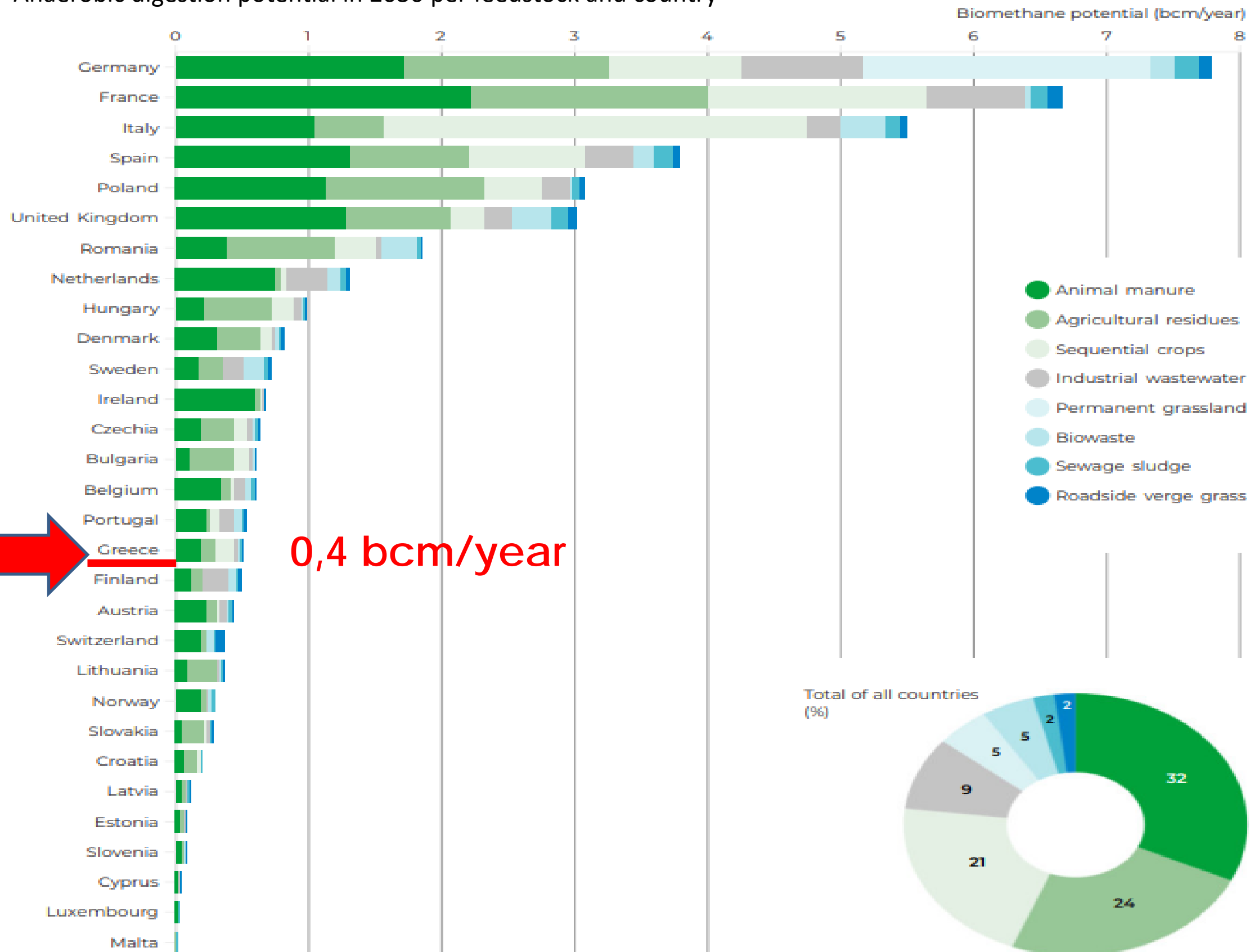
The Bio-CNG production in Europe continues to increase at a constant and healthy rate. Out of the 1,222 biomethane plants active in Europe by the end of August 2022, 133 plants are known to compress biomethane on-site to produce Bio-CNG.

An extensive biomethane-ready network of CNG and LNG filling stations is already in place in Europe with 1,898 Bio-CNG filling stations and 123 Bio-LNG operational filling stations (according to EBA data).

EUROPEAN TRENDS IN BIOMETHANE SECTOR

Biomethane Feedstocks Potential in Europe

Anaerobic digestion potential in 2030 per feedstock and country



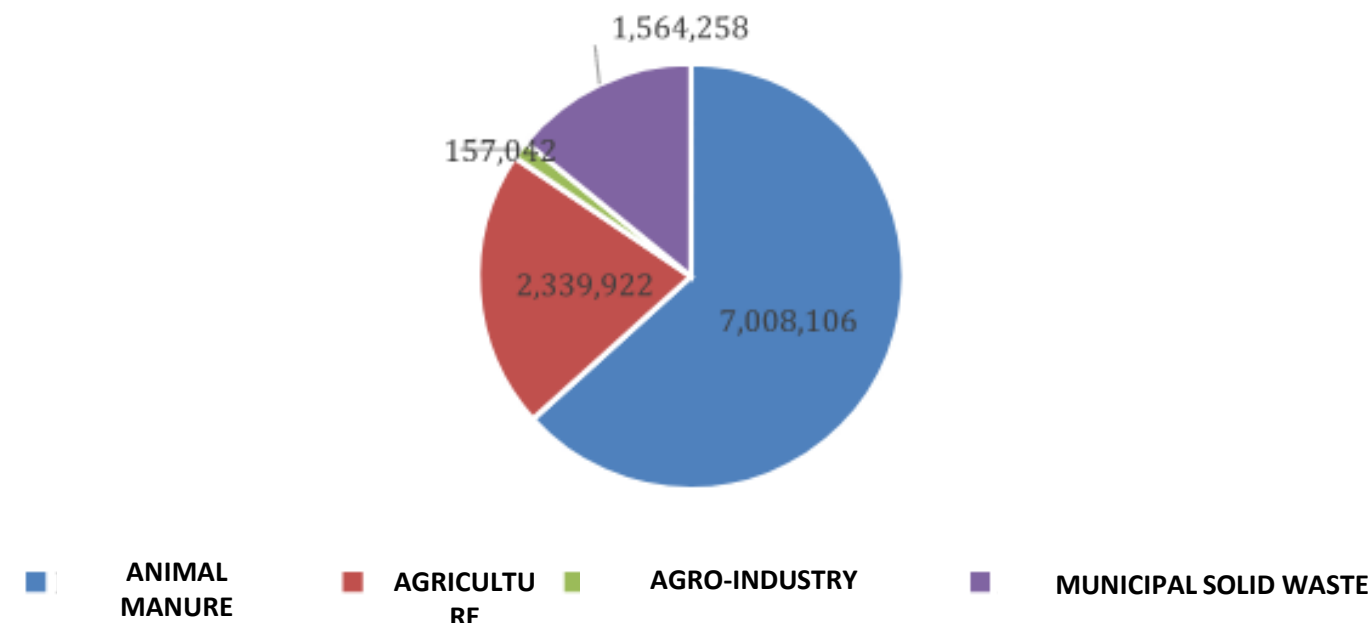
- A potential of 41.8 bcm is estimated for anaerobic digestion in 2030 (which increases to 98 bcm in 2050). The top 5 countries (in both 2030 and 2050) consistently include France, Germany, Italy, Spain and Poland.
- Key feedstocks in 2030 are animal manure (32%), agricultural residues (24%) and sequential cropping (21%). This contrasts with 2050 in which sequential cropping dominates (47%), with again a significant contribution from manure (19%), and agricultural residues (17%).

EUROPEAN TRENDS IN BIOMETHANE SECTOR

Biomethane Potential in Greece

Research by Center for Renewable Energy Sources and Saving

Biomethane's energy content (MWh/year)



Total biomethane production per feedstock

Theoretical biomass capacity and biomethane's energy content

BIOMASS TYPE	BIOMASS	BIOMETHANE	
	tons/year	m ³ /year	MWh/year
ANIMAL MANURE	23.969.935	726.846.217	7.008.106
AGRICULTURE	1.002.930	242.685.210	2.339.922
AGRO-INDUSTRY	1.150.815	16.287.673	157.042
MUNICIPAL SOLID WASTE	2.086.089	162.237.088	1.564.258
TOTAL	28.209.769	1.148.056.188	11.069.328

- ❖ The theoretical biomass capacity amounts to 28.209.768 tons/year, with biomethane capacity 1,14 bcm and biomethane energy content 11 TWh/year.
- ❖ Animal manure is at the first place, with capacity 23.969.935 tons/year and biomethane energy content 7.008.106 MWh/year

Integration of Biomethane in Greek legal framework

- **Addition of biomethane in the definition of «alternative fuels»:** fuels or energy sources that could be used, at least partially, as a substitute of mineral oil in the energy supply of transport sector and are capable to contribute in the elimination of carbon emissions in transports enhancing the environmental performance of this sector. Such fuels among others include: natural gas, **biomethane included**, in gas form, (compressed natural gas – CNG) and liquid form (liquified natural gas – LNG) (Law No 4439/2016, article 2)
- **Permission of using biomethane in natural gas distribution network:** The use of natural gas systems and distribution networks is also allowed for the distribution of renewable gases, **biomethane included**, as well as other gases, since this is technically possible and meets safety requirements, after having taken into consideration the quality requirements and the physicochemical characteristics of those gases (Law No 5073/2023, article 105)

Brief description of the Biomethane Project

- ❑ Operation of a pilot installation for upgrading biogas to high purity biomethane at an existing biogas production facility.
- ❑ The pilot project has been designed in order to compress the produced biomethane and provide it to FISIKON filling stations, for sale as a transport fuel and with potential injection into the gas grid in the future.
- ❑ Estimated initial production of biomethane is 1.000.000 m³/year
- ❑ The commercial operation of the project is estimated to begin in 2024.

DEPA's target is:

- To become both the commercial operator and the producer of biomethane.
- To obtain the appropriate technical knowledge and collect the necessary information in order to evaluate the development of large-scale projects.

BIOMETHANE PILOT PROJECT

Biogas Facility

Co-operation between DEPA COMMERCIAL S.A. & FARMA CHITAS S.A.



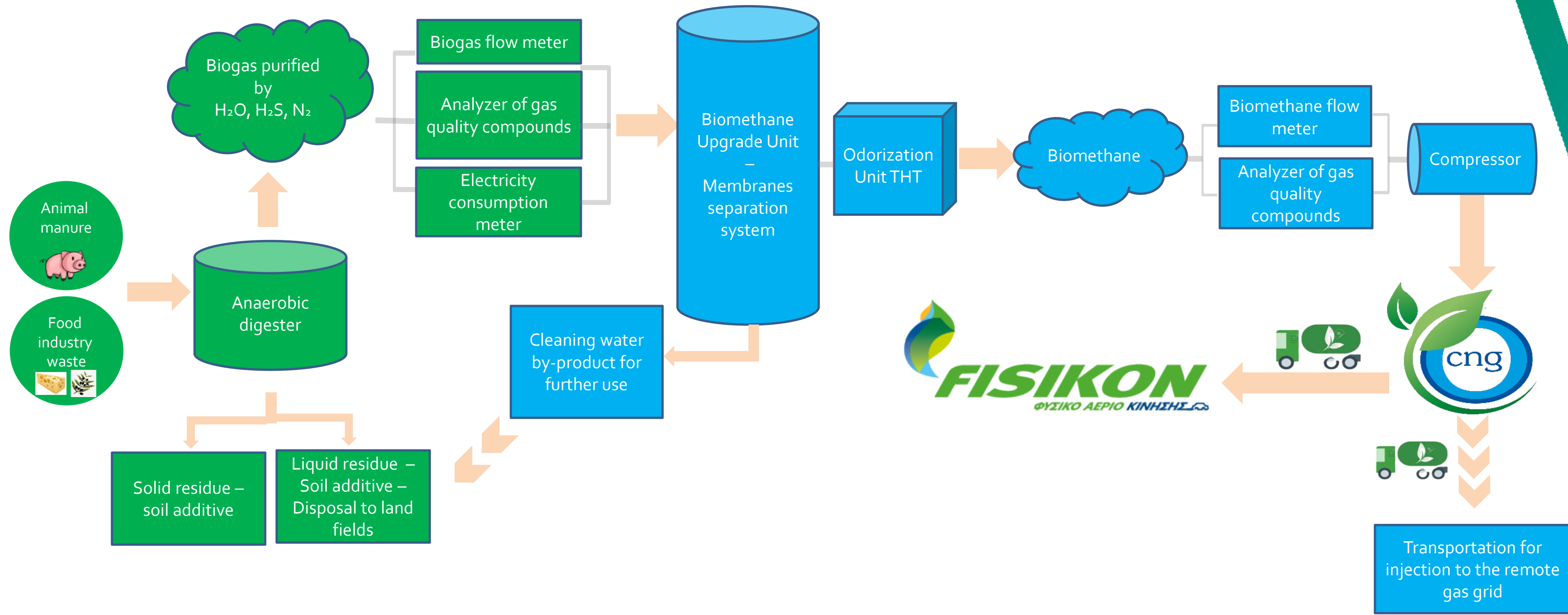
- ❖ FARMA CHITAS S.A. is a family business operating in the production and trade of pork meat since 1969.
- ❖ Operates a pig farm located in a large area at Romia Philippiadas (Western Greece).
- ❖ The produced biogas is been used for the co-production of electrical and thermal energy.

- ✓ *FARMA CHITAS S.A. can provide DEPA Commercial S.A. with the indented biogas quantity for further upgrading to biomethane.*
- ✓ *The facility has a stable and qualitative production of biogas.*
- ✓ *The location of the facility is close to FISIKON filling stations that are not connected with the natural gas grid.*

BIOMETHANE PILOT PROJECT

Production & Utilization of Biomethane

Project's flow chart

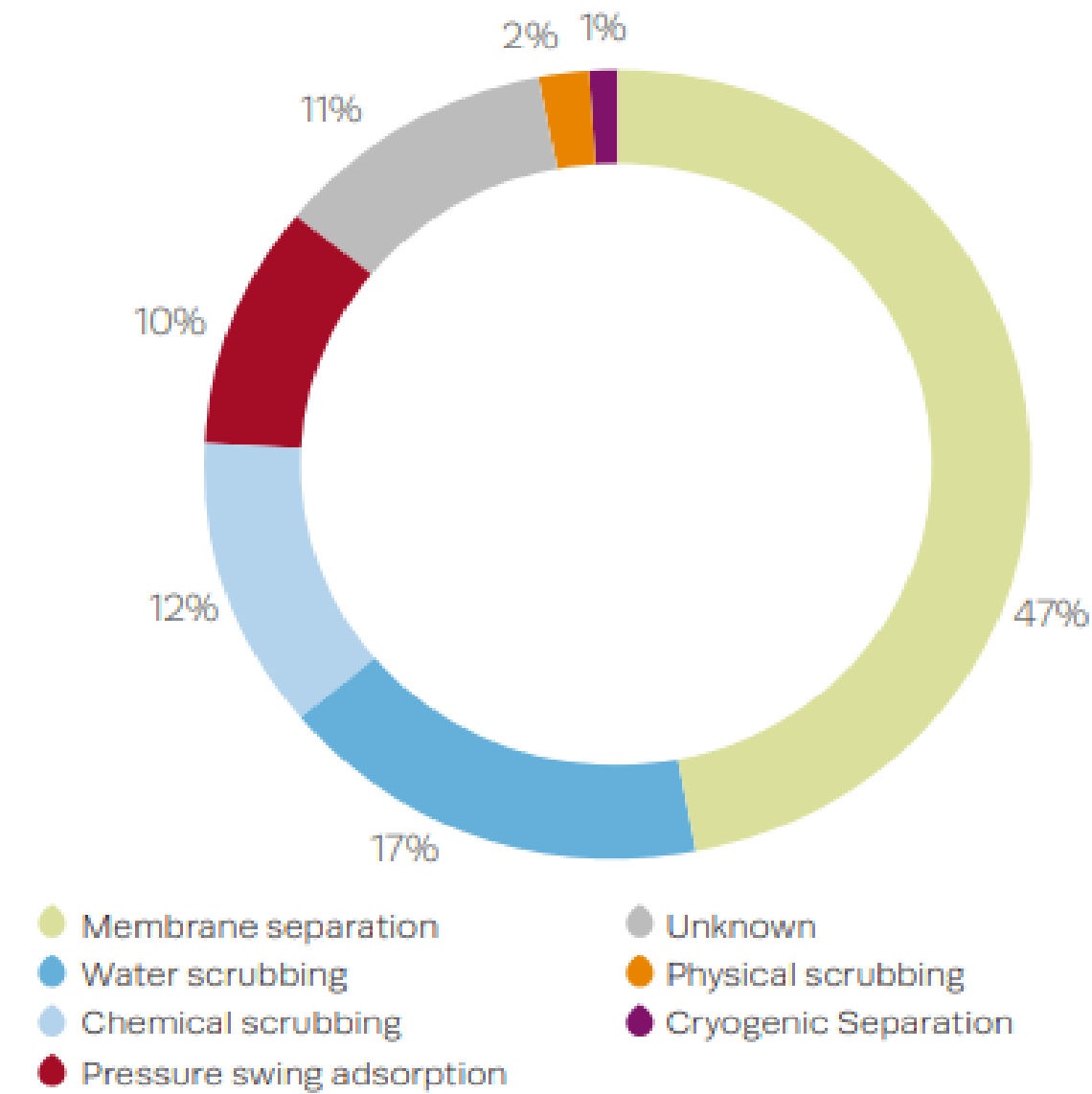
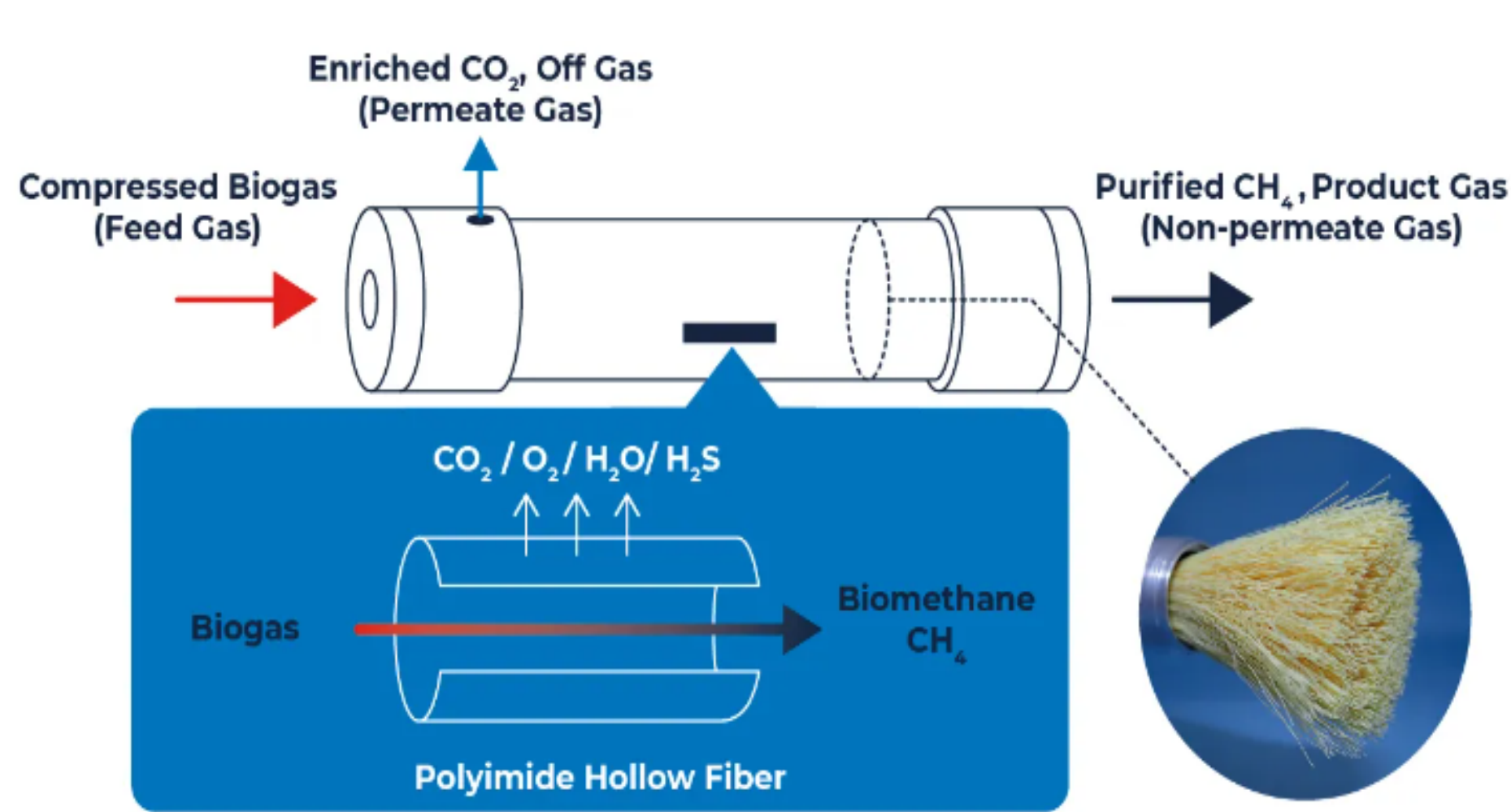


- Property of FARMA CHITAS S.A.
- Property of DEPA COMMERCIAL S.A.

BIOMETHANE PILOT PROJECT

Upgrading Technology

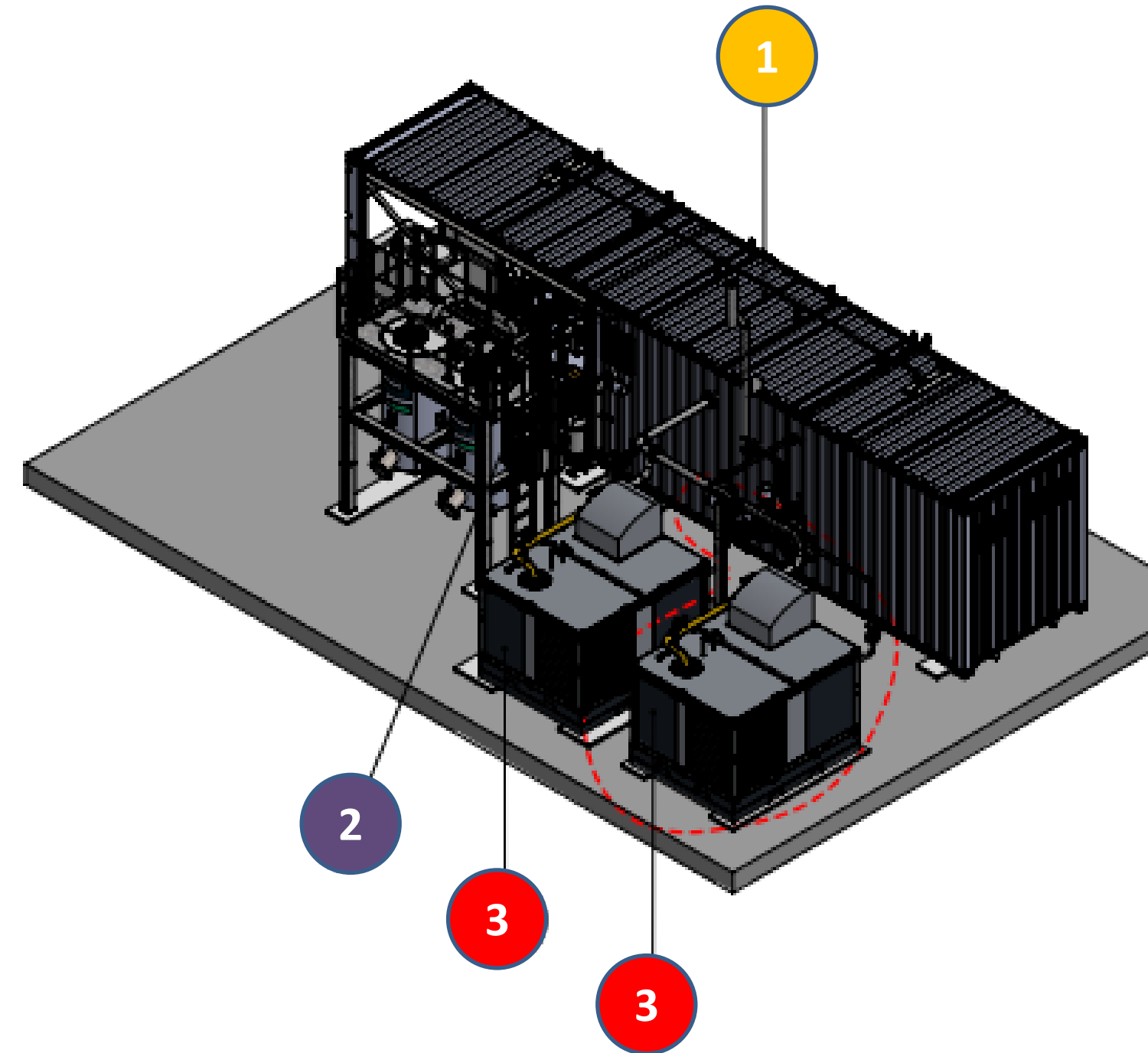
Membrane Separation



Relative use of different upgrading technologies in Europe in 2021
 Source: EBA statistical report 2022

- Membrane upgrading technology is the most popular and quick developing separation technology used for biogas upgrade to biomethane
- The 47% of biomethane plants currently active in EU use membrane separation as their upgrading technology.

Biogas Upgrading Unit

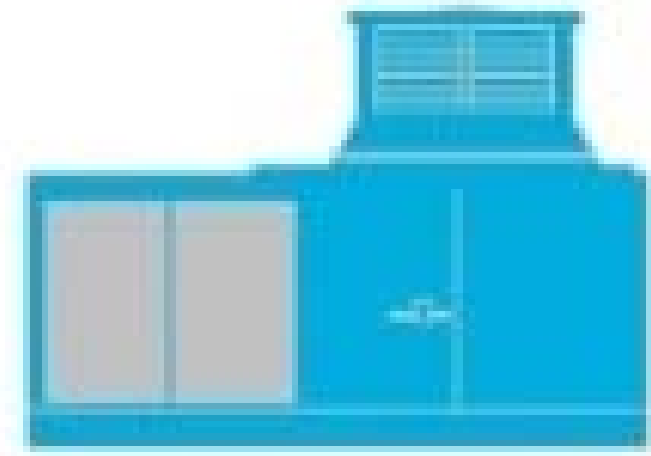
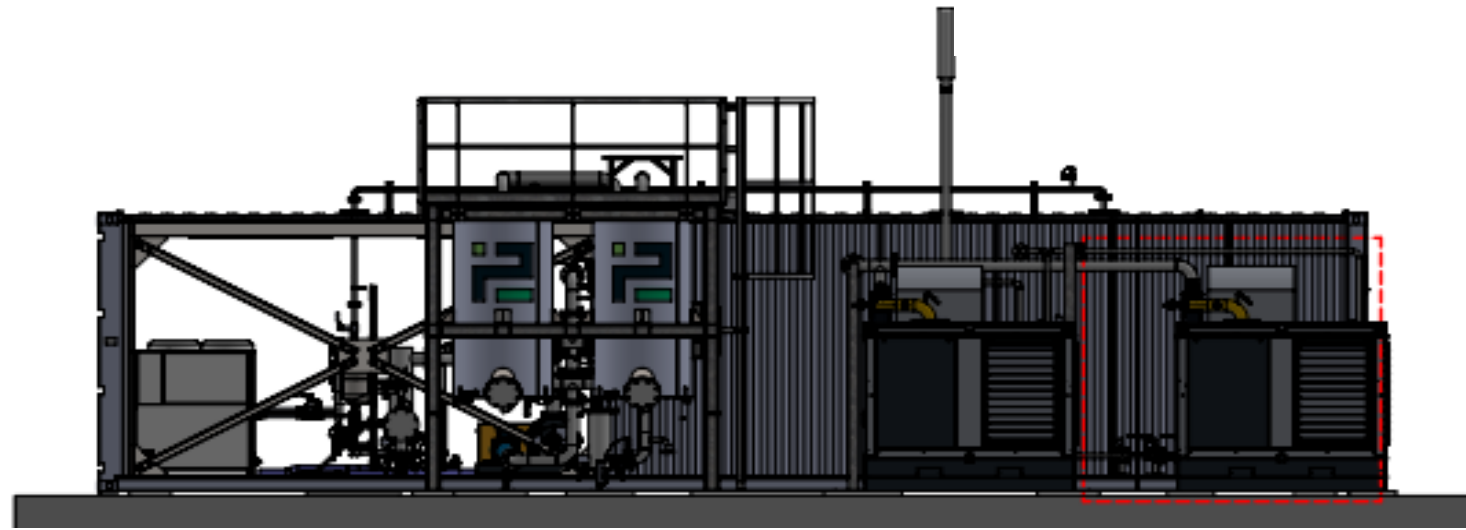


1. **Biogas upgrading unit (membranes cleaning unit for extraction of CO₂, PLC control system, gas analyzer)**
2. **Activated carbon filters for pollutants extraction (H₂S – Hydrogen Sulphur, siloxanes and VOCs - Volatile Organic Compounds)**
3. **Biogas compressor (compresses biogas at the membranes' optimal operating pressure)**

Biomethane Compression to bio-CNG & transportation

Biomethane Compression to bio-CNG

Biomethane will be compressed to high pressure Bio-CNG



COMPRESSOR SYSTEM

Bio-CNG Transportation to Filling Stations

Bio-CNG will be stored in tube skids to be transported to FISIKON filling stations (potential future injection into the gas grid)



Future project extensions



DEPA Commercial continually investigate new technologies in line with Sustainable Development and its contribution to society. Therefore since the designing of biomethane pilot project DEPA had predicted possibilities for future extensions as below:

- Injection of Bio-CNG into the remote natural gas grid
- Capturing CO₂ from the “off-gas” stream (during biomethane production process) for industrial use

THANK YOU



DEPA Commercial S.A.

Project H₂ & BM