SYSADVANCE

SHAPING THE FUTURE OF TECHNOLOGY

Aumentando a rentabilidade das unidades de digestão anaeróbia através da captura e purificação do CO_2

Patrick da Silva Bárcia
R&D Manager SYSADVANCE

Paris

Madrid

London

São Paulo


CLIMATE ACTION

- FOUNDED IN **2002**
- **HIGH SPECIALIZATION** IN GAS SEPARATION PROCESSES
- **EXTENSIVE EXPERIENCE** IN SEVERAL INDUSTRY SECTORS

- COMPLETE SOLUTIONS (**TURNKEY**)
- WORLD LEADER IN **PSA TECHNOLOGY**
- MORE THAN **3000 PSA SYSTEMS** WORLDWIDE

GLOBAL PRESENCE

sysadvance®

SYSADVANCE
is present in more than
40 countries.


GERRESHEIMER
GRUPO CABELTE
ETMA METAL PARTS
SCHAEFFLER
NASA
ReFood
pure bioenergy
Greener. Safer. Cheaper.
POLIOLES
GENTHERM
gold energy
CIN
DON SIMÓN
TORRE DO TOMBO
trustenergy
navarra
TAYLOR'S PORT
CR&R
INCORPORATED
environmental services
REFER
Sonangol
GRUPO VALOURO
Orgaworld
Part of Shanks Group
GAS PETRONAS
PEPSICO
efacec
Arnarlax
BIO-NATURALSALMON
GREENLANE BIOGAS
Valeo
nemak
BRITISH AEROSPACE
YAZAKI
LATAM AIRLINES
Semardel
ENVIRONNEMENT SERVICE
DUPONT
SOLVAY
KEPAR
ELECTRONICS
ZEISS
RAMOS PINTO
REPSOL
prio energy
TEXAS INSTRUMENTS
RESPOL
RESINAS, S.A.
UNITED STATES ARMY HERITAGE AND EDUCATION CENTER
sapa:
TAAG
Johnson Controls
Pernod Ricard
LACTOGAL
SOGRAPE VINHOS
BASF
We create chemistry
EURO YSER
HERDADE DO ESPORÃO
1267
TOTAL
VIGOR
GREENSHORE
SALVAT
alubium
premium aluminium
sovena
Amkor Technology

BUSINESS AREAS

sysadvance®

INDUSTRIAL

MEDICAL

ENERGY

N_2 O_2

INTEGRATED
SOLUTIONS

He

PSA
VSA

O2 MED

AIR

VACUUM


ENERGY

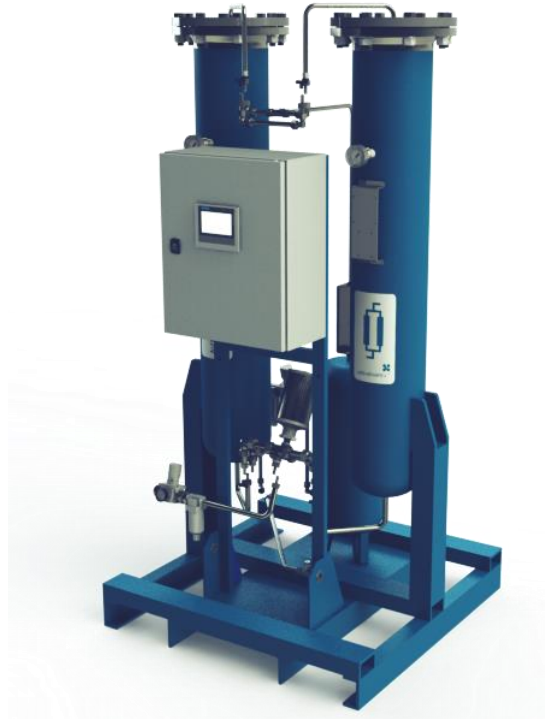
CH_4

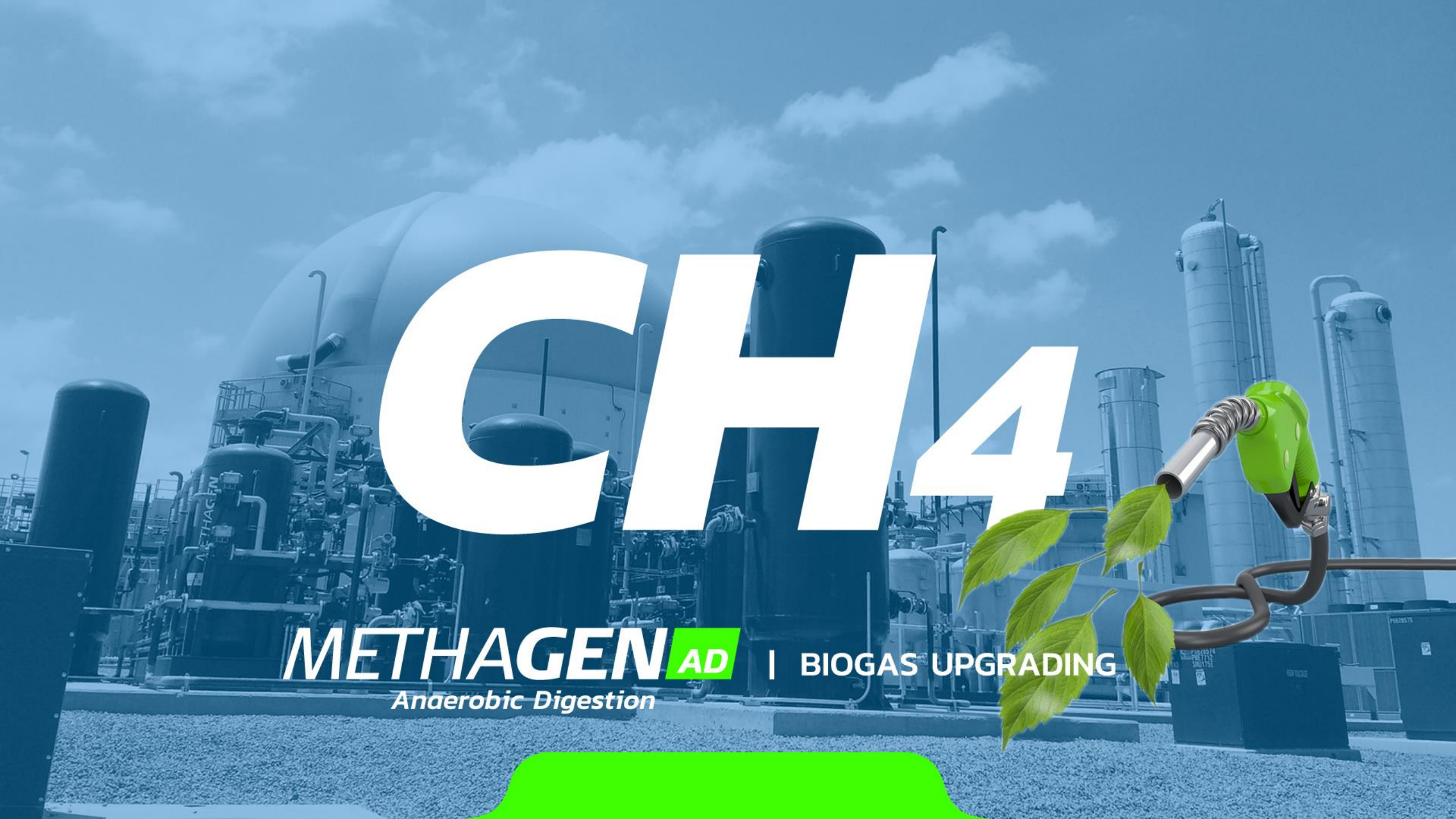
CO_2

O_2

BIO

Produção on-site de **oxigénio** para redução de H_2S em estações elevatória




CH_4
METHAGEN AD
Anaerobic Digestion
| BIOGAS UPGRADING

BIOGAS SOURCES AND APPLICATIONS | Pathways for profitability

MANY BIOGAS SOURCES

WWTP

Landfill

Anae. Digestion

MANY PATHS to PROFIT

Grid Injection

bioNGV

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

METHAGEN AD

METHABOOST

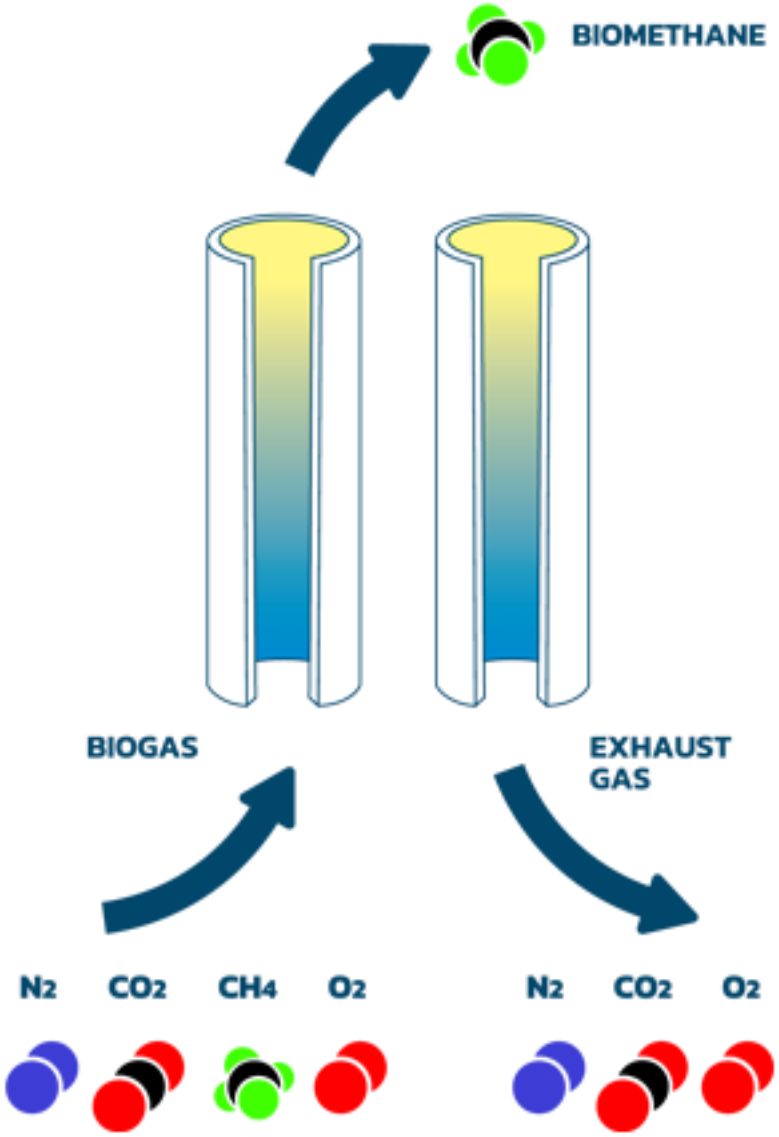
METHAGEN AD | BIOGAS UPGRADING

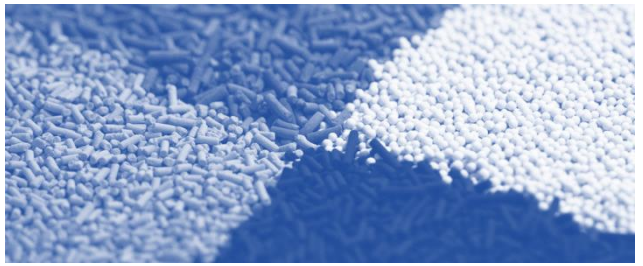
Anaerobic Digestion

sysadvance®

VPSA TECHNOLOGY

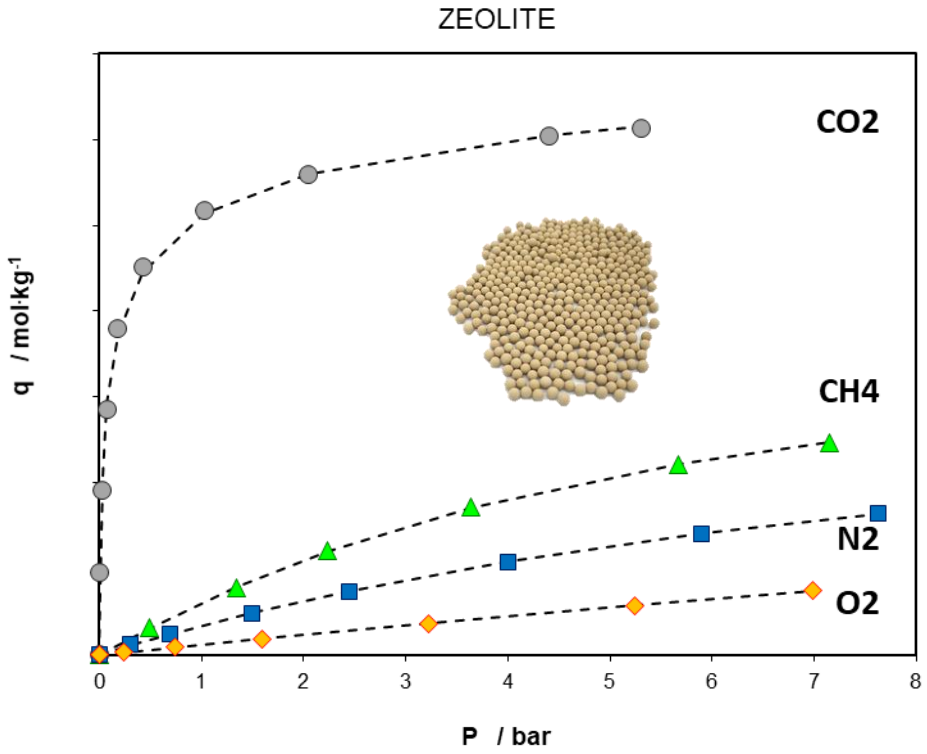
Range: 50 - 4800 Nm^3/h

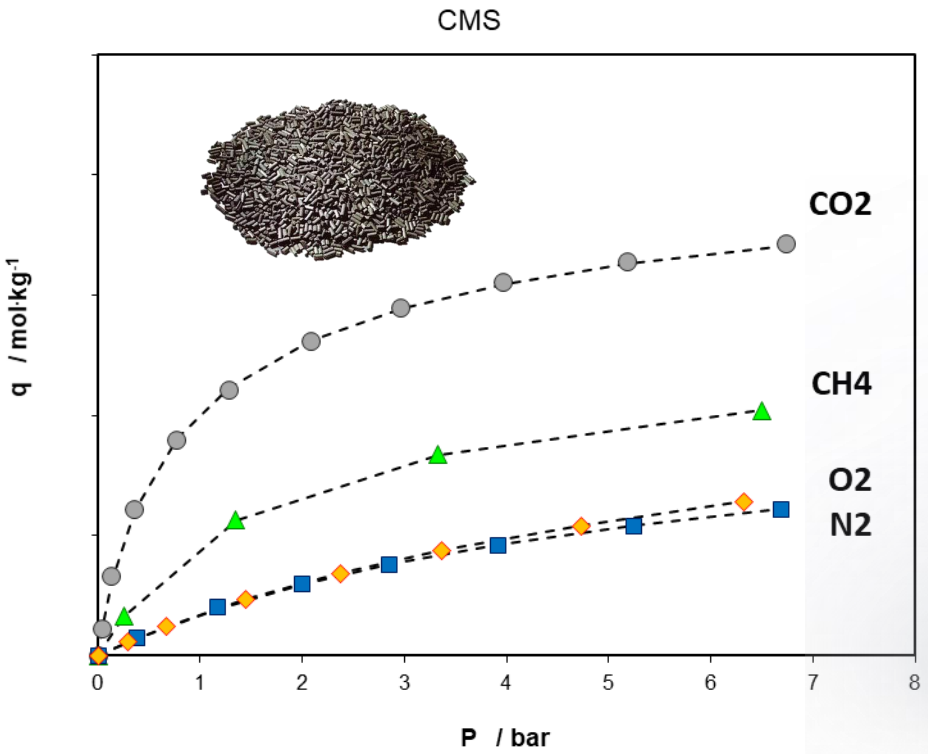




ZEOLITE MOLSIEVE vs. CARBON MOLSIEVE

EQUILIBRIUM SEPARATION

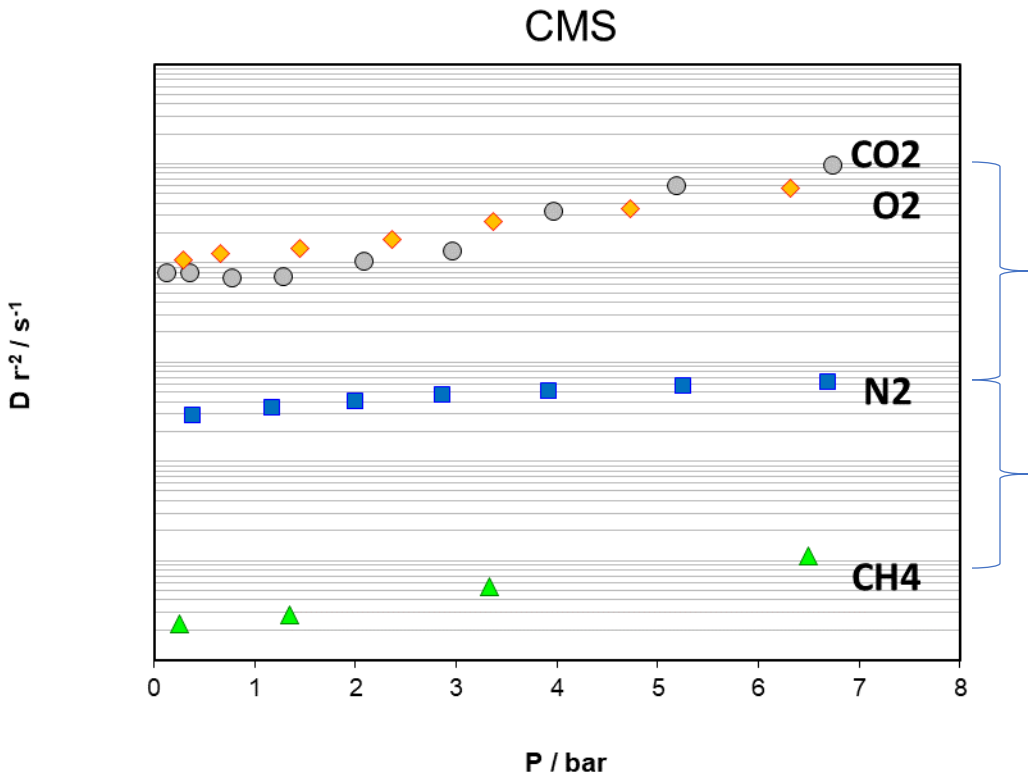




Source: SYSADVANCE ADSORBENTS DATABASE

CARBON MOLSIEVE

KINETIC SEPARATION



+ 2 orders of magnitude

2 orders of magnitude

Source: SYSADVANCE ADSORBENTS DATABASE

METHAGEN AD | ADVANTAGES

Anaerobic Digestion

sysadvance®

- 100% CH_4 recovery > ZERO emissions - METHABOOST$_{option}$
- Lowest OPEX > 0.22 kWh/Nm^3 of biogas
- Lowest CAPEX
- High CH_4 purity > up to 99%
- Efficient O_2 and CO_2 removal
- N_2 reduction capability
- Dry process – no water or chemicals
- Non-cryogenic tech

METHAGEN AD | ADVANTAGES

Anaerobic Digestion

sysadvance®

- Water removal – Dewpoint < 50 ppm_v H_2O
- High reliability/ high availability
- Simple installation & operation
- Small footprint
- Fast plant operational readiness
- Quick start & stop
- 4.0 Enabled > remote control & dynamic reporting
- Full turnkey upgrading solution
- CO_2 recovery option (CCU)

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

Single stage

METHAGEN AD Anaerobic Digestion

plant for organic waste digester

In cooperation with:

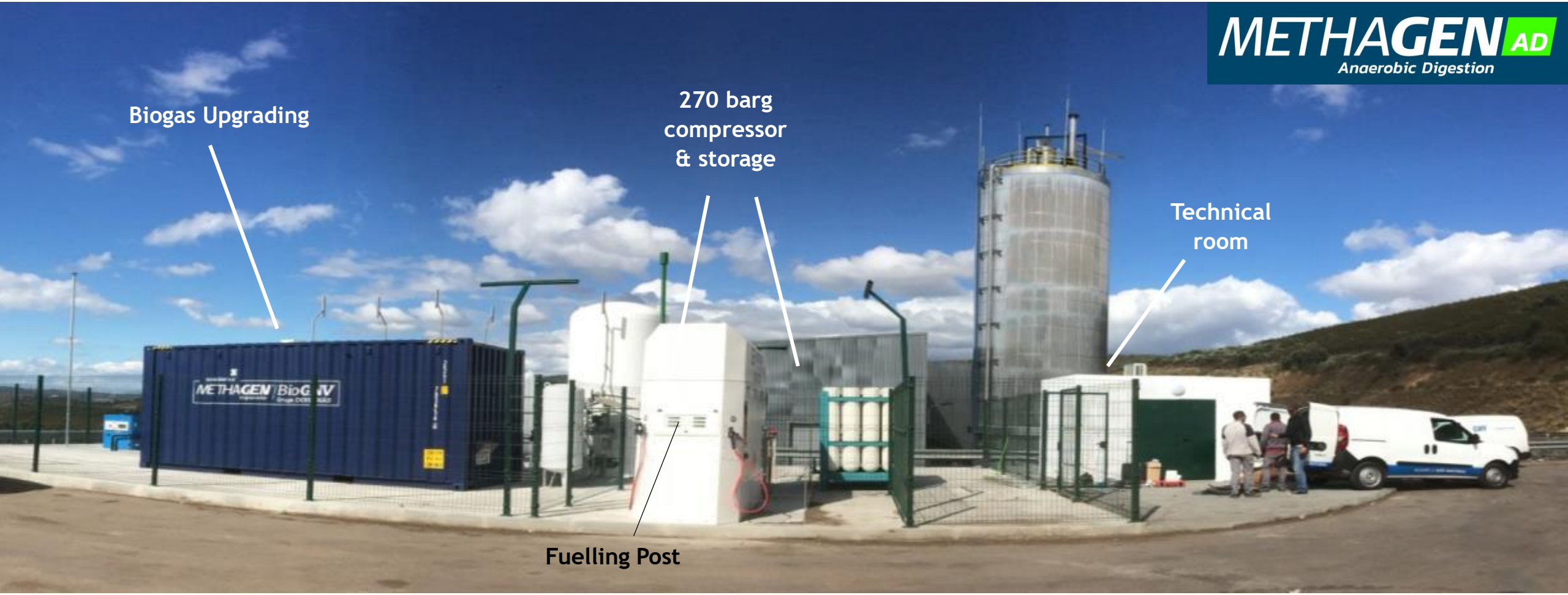
dourogás

EUROPE

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®



In cooperation with: dourogás

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

Single stage

METHAGEN AD
Anaerobic Digestion

plant for organic waste digester

In cooperation with:

dourogás

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

	Application	MODEL/RNG PROD CAP	BIOGAS SOURCE	KPI
	Compressed RNG for NGV (PORTUGAL) *Started 2017*	METHAGEN XP1 0.6 million Nm^3/yr	URBAN WASTE DIGESTER	< 0.42 kWh/Nm^3 RNG > 98 % CH4 Purity > 99 % CH4 Recovery
	RNG for Grid Injection (FRANCE) *Expected 1Q 2020*	METHAGEN XP3 1.3 million Nm^3/yr	DAIRY/ FARMING DIGESTER	< 0.42 kWh/Nm^3 RNG > 97 % CH4 Purity > 99 % CH4 Recovery

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

Biogas from urban waste but with very stringent specs for NG grid

Perris, California – First injecting biomethane in the NG grid

1000 Nm^3/h processing capacity and biomethane product meeting RULE30

CR&R INCORPORATED environmental services

USA

In cooperation with:

GREENLANE RENEWABLES™

METHAGEN AD | BIOGAS UPGRADING

Anaerobic Digestion

sysadvance®

CO_2 Purification for industrial application

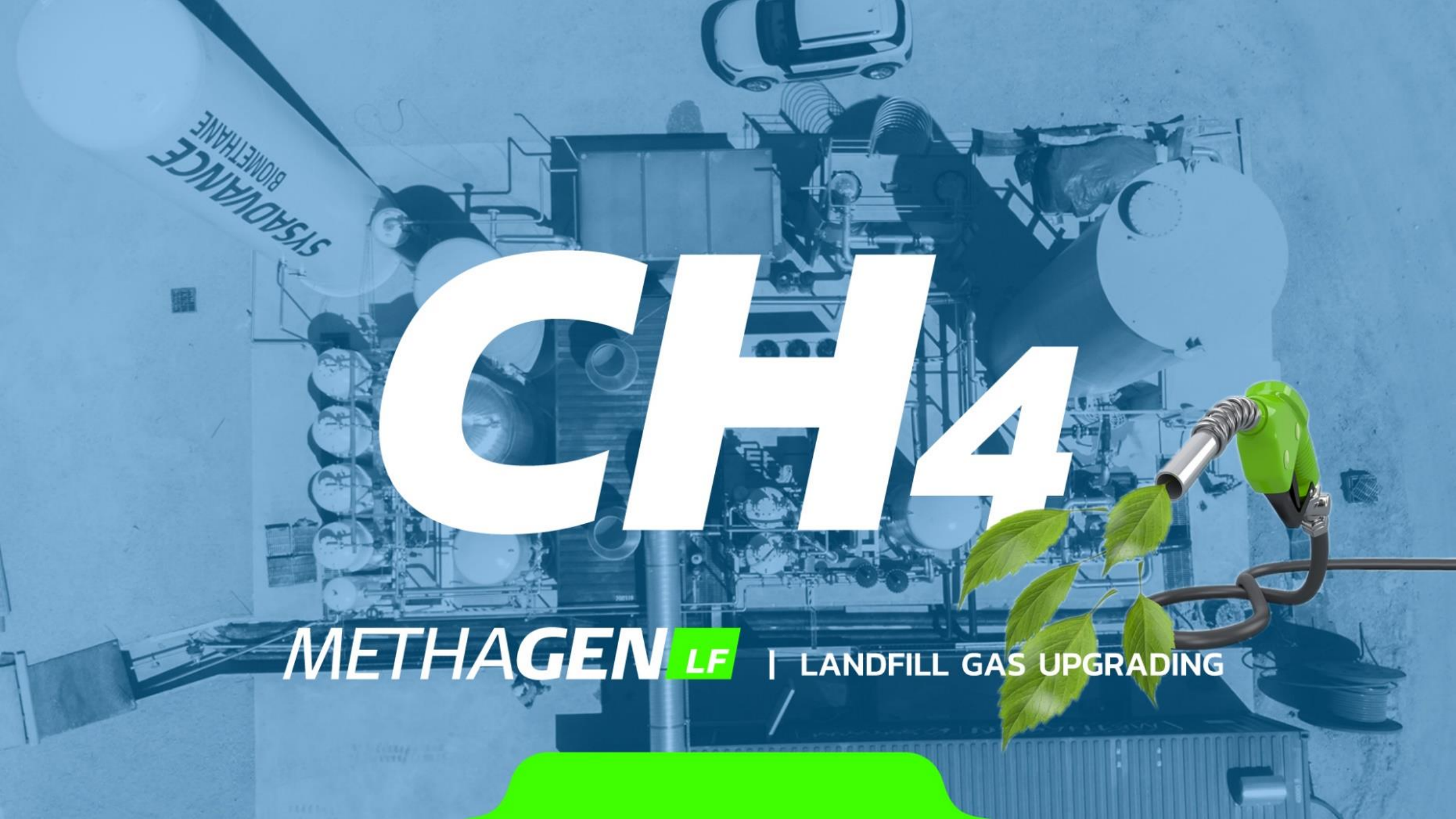
1500 Nm^3/h processing capacity and 98% CH_4 recovery with METHABOOST module

CITY OF PORTLAND, OREGON 1851

In cooperation with:

USA

GREENLANE RENEWABLES™

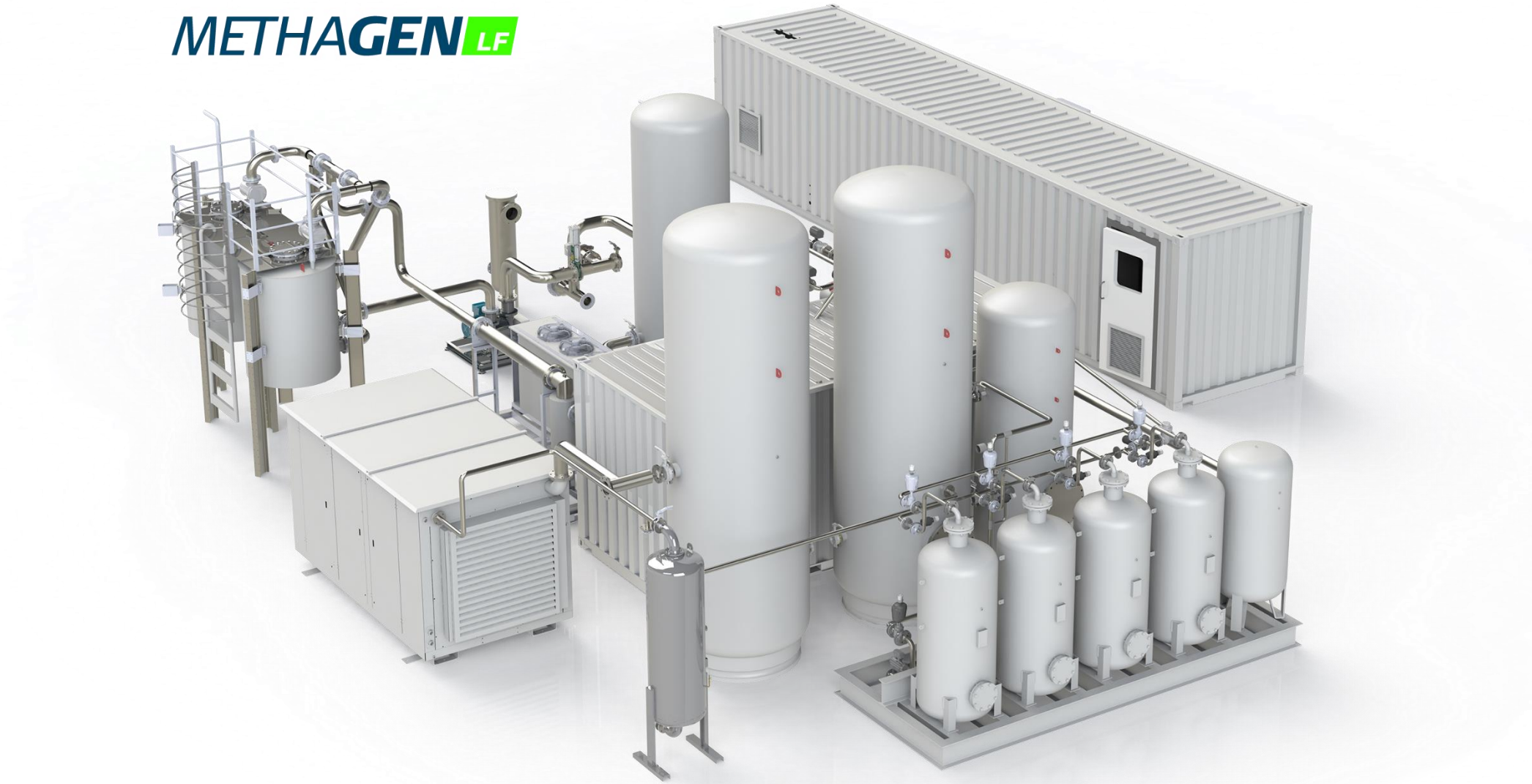


CH_4

METHAGEN LF | LANDFILL GAS UPGRADING

METHAGEN LF | LANDFILL GAS UPGRADING

sysadvance®

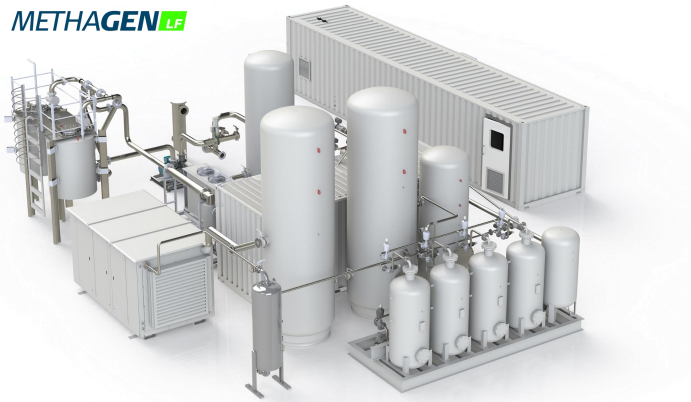


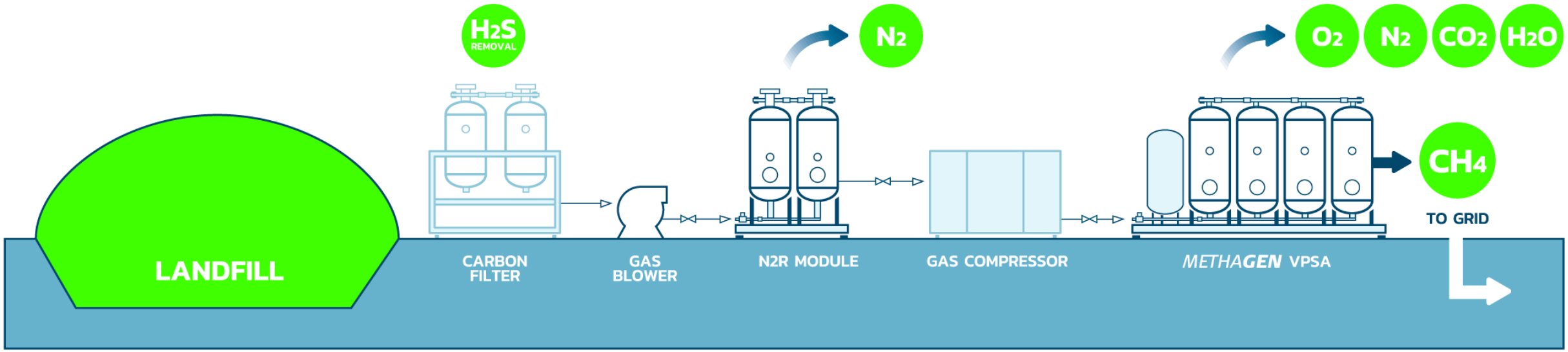
METHAGEN LF | LANDFILL GAS UPGRADING

sysadvance®

Pat. pending N_2R module

AIR removal up to 19%





METHAGEN LF | LANDFILL GAS UPGRADING

sysadvance®

GROUPE Semardel ENVIRONNEMENT SERVICE

Southern Paris, France (2018)

First Landfill injecting in the NG grid w/ non-cryogenic technology

fcc

Southern Spain (2020)

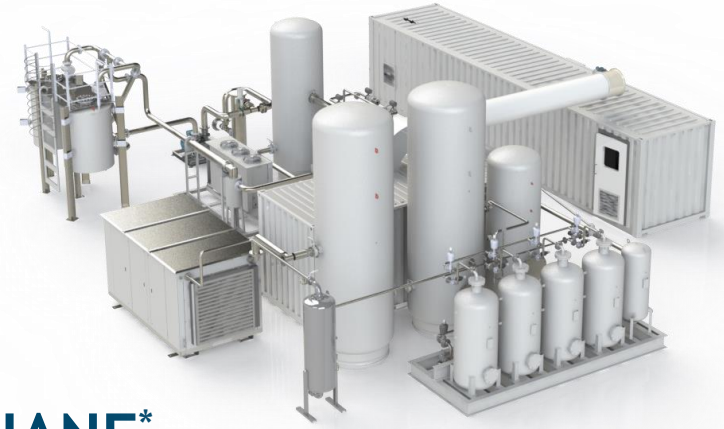
EUROPE

METHAGEN LF | LANDFILL GAS UPGRADING

sysadvance®

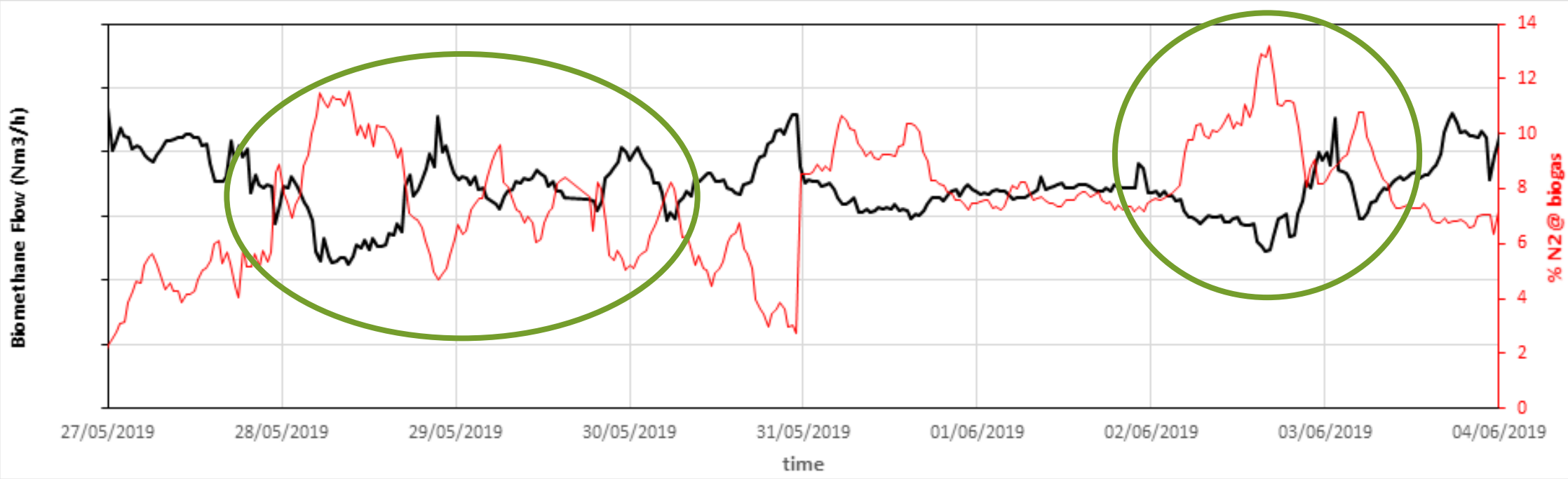
Key Performance Indicators for Double Stage VPSA for Landfill Gas

CH4 Recovery Rate	> 90 %
Biomethane Purity	up to 98 vol.% CH_4
Biomethane Delivery Pressure	> 5.5 barg
Biomethane Pressure Dew Point	< -50°C
Specific Power Consumption	0,78 kWh/Nm³ BIOMETHANE*



*Pre-treatment Included

- AIR removal capacity up to 19 vol.%
- Fast plant operational readiness
- Excellent process response to AIR steep variance



METHAGEN LF | ADVANTAGES

sysadvance®

- Lowest OPEX > 0.30 kWh/Nm^3 of biogas
- High Efficiency in O_2 and CO_2 removal
- Dry process – no water or chemicals (dewpoint < 50 ppm_v)
- Non-Cryogenic – no need for liquid N_2

CO_2

CARBOGEN

| CO_2 RECOVERY AND PURIFICATION

CARBOGEN | CO_2 CAPTURE AND PURIFICATION

sysadvance®

CARBOGEN

CARBOGEN | CO2 CAPTURE AND PURIFICATION

sysadvance®

CARBOGEN is a cleantech VPSA for capture and purification of CO2 from:

- biogas upgrading waste gas;
- flue gas streams ;
- rich industrial streams.

CARBOGEN systems capacities - ranging from 100 Nm3/h to 1000 Nm3/h of CO2 - rich gas.*

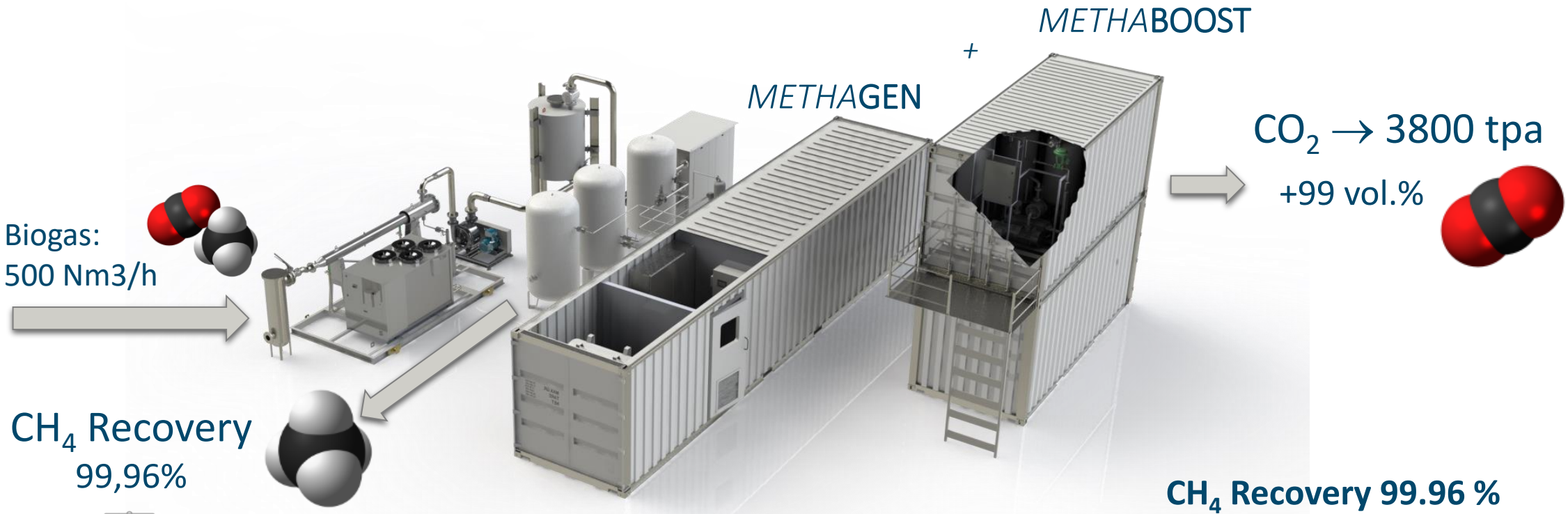
* Other capacities available under request.

CARBOGEN | APPLICATIONS

sysadvance®

- Greenhouse Farming
- Food & Beverage
- Purging of Batch Anaerobic Digester
- Control of pH on WWTP
- Algae Production
- Carbonate Production
- Concrete Curing
- Steel Manufacturing
- Methanation for PtG (Power-To-Gas)

Combined CCU and Enhanced CH_4 Recovery



CH_4 Recovery 99.96 %

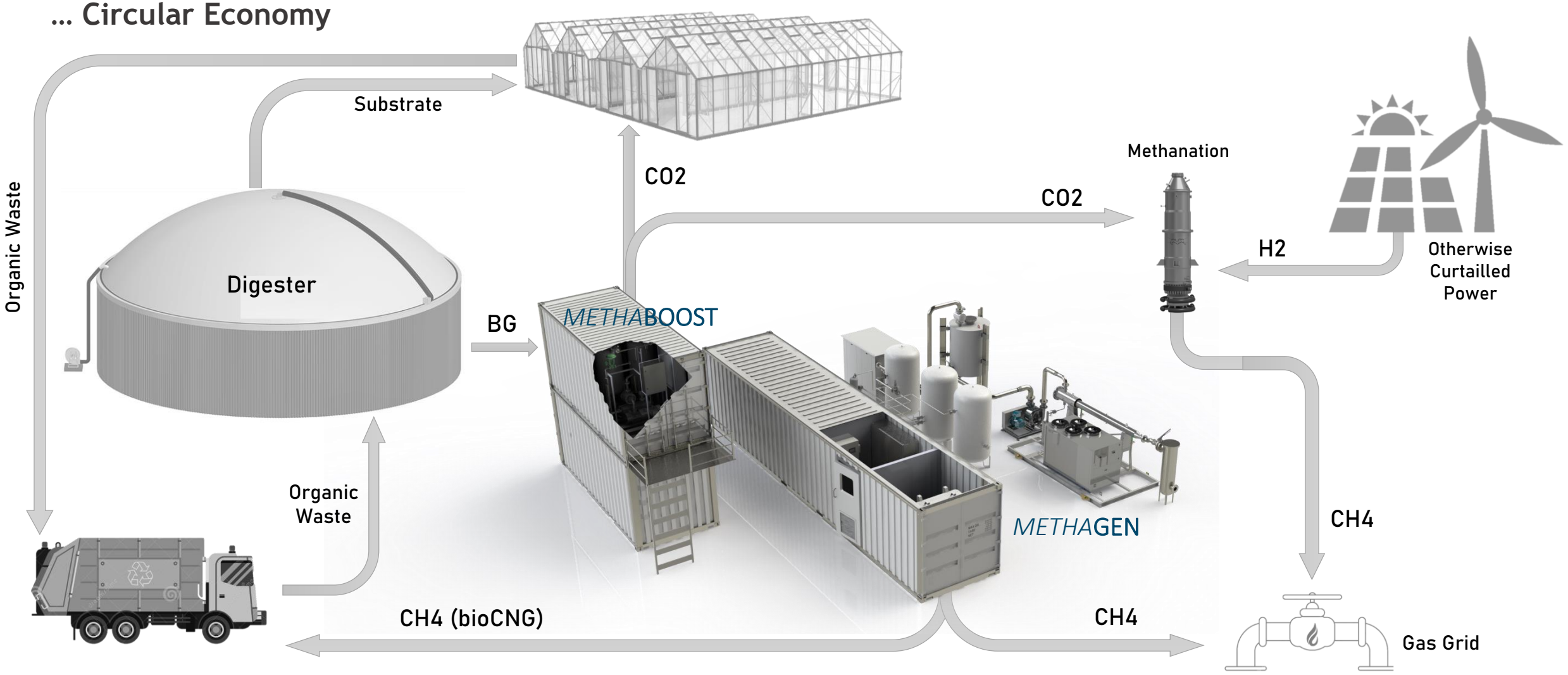
Zero CH_4 Emissions

CO_2 Production +99 vol%

METHABOOST | CCU & CH_4 Recovery from Biogas Waste Stream

sysadvance®

… Circular Economy



CARBOGEN | CO2 CAPTURE AND PURIFICATION

sysadvance®

CO2 Purification for industrial application

SOLVAY

EUROPE

In cooperation with:

Orgaworld
Part of Shanks Group

CANADA

GREENLANE RENEWABLES™

CO2 Capture and Purification

OPEX for CO2 Capture from Different Sources

CO2 Source	$CO2\%_{IN}$	$CO2\%_{OUT}$	Pot. Application	kWh/ton_{CO2}
From Flue Gas *CARBO*GEN	**10%** *Patm, sat*	**50%** *20 mbarg, Wet*	Carbonates, Concrete Curing Greenhouse, Algae Cultivation…	150
From Landfill Gas w/o Upgrading *CARBO*GEN	**42%** *Patm, sat*	**98,0%** *20 mbarg, Wet*	Greenhouse, Algae Cultivation, Fire Extinguisher…	153
After Biogas Upgrading Water Wash + *METHA*BOOST	**84%** *1,5 barg, sat.*	**99,8%** *20 mbarg, wet*	Inerting/Purging Batch Digesters	35
After Biogas Upgrading *METHA*GEN	**94,0%** *20 mbarg, wet*	**99,9%** *20 mbarg, wet*	Industrial Grade or Food Grade *(after liquefaction)*	51
After Biogas Upgrading *METHA*GEN + *METHA*BOOST	**99,9%** *20 mbarg, wet*	**99,9%** *20 mbarg, wet*	Industrial Grade or Food Grade *(after liquefaction)*	~0

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sysadvance®

www.sysadvance.com

COMPETE 2020 | PORTUGAL 2020 | UNIÃO EUROPEIA Fundos Europeus Estruturais e de Investimento

CERTIFICAÇÃO DE SISTEMAS ISO 9001 SGS | SYSTEM CERTIFICATION ISO 13485 SGS