



GREEN METHANE

BIOGAS UPGRADING TO BIOMETHANE ITALIAN “BEST AVAILABLE TECHNIQUE”



Offering solution for different processes in renewables

About us



UNI EN ISO 9001:2015
UNI EN ISO 14001:2015
BS OHSAS 18001:2007

SISTEMI DI GESTIONE
CERTIFICATI

Marchi Industriale



Factory of Marano Veneziano (VE) - IT

About us

Green Methane was founded in 2013 by two Italian Enterprises:
Marchi Industriale Group & Giammarco Vetrocoke Group.

1873 Ferruccio Marchi opens first fertilizer factory

1900 A factory was established in Marano Veneziano.

1984 Marchi Industriale Holding was created.

2010 Marchi Energia was established: a new company focused on renewable energy.

Giammarco Vetrocoke

About us

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CO₂ removal plant based on Giammarco-Vetrocoke Process – Ragusa (Italy)

- 1950** Giammarco-Vetrocoke was founded. Giuseppe Giammarco patents a selective CO₂ absorption process based on K₂CO₃ solutions. GV process is widely applied to various gases with different pressure, temperature and composition.
- 2019** GV is now one of the top three licensors of CO₂ absorption technology in the world, with more than 370 licensed units installed.

GM technology

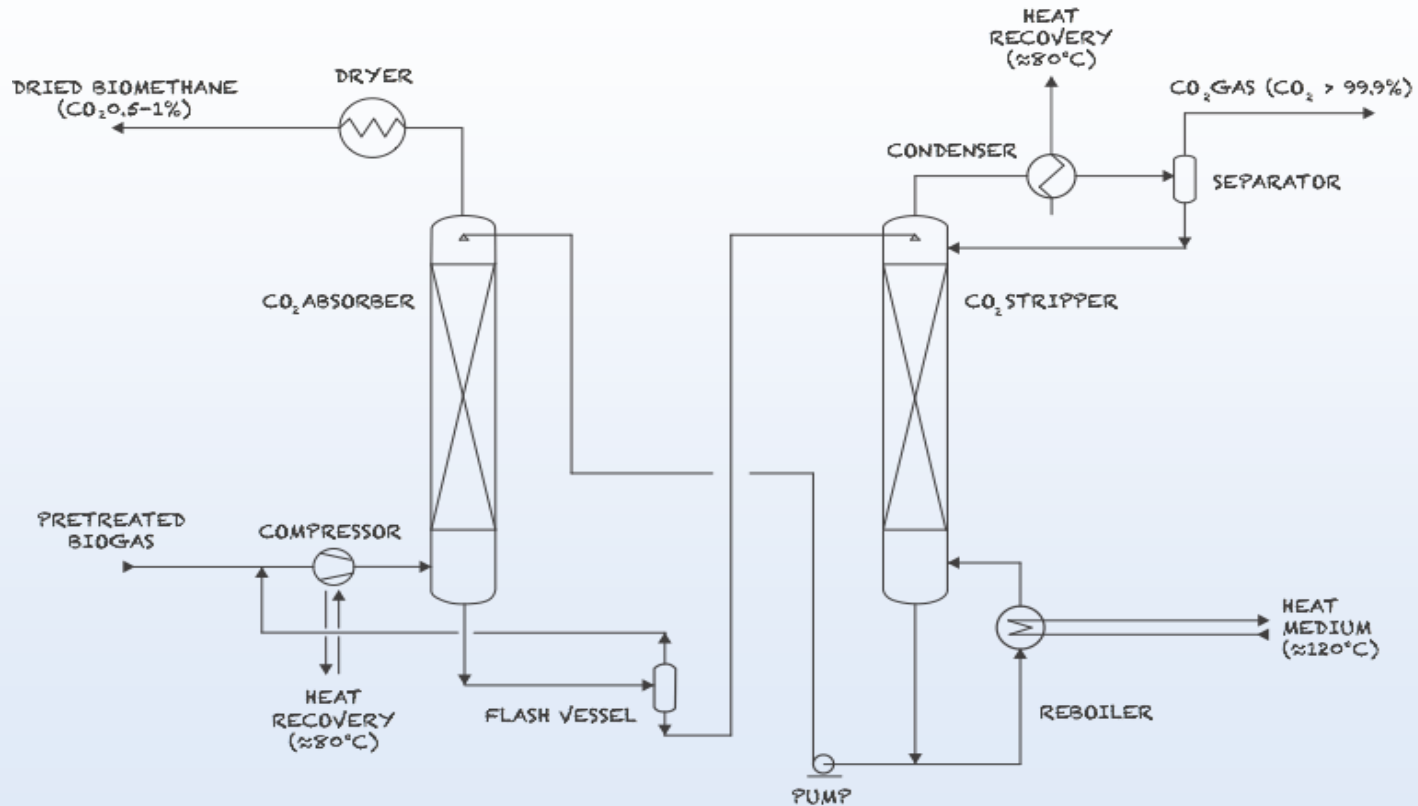


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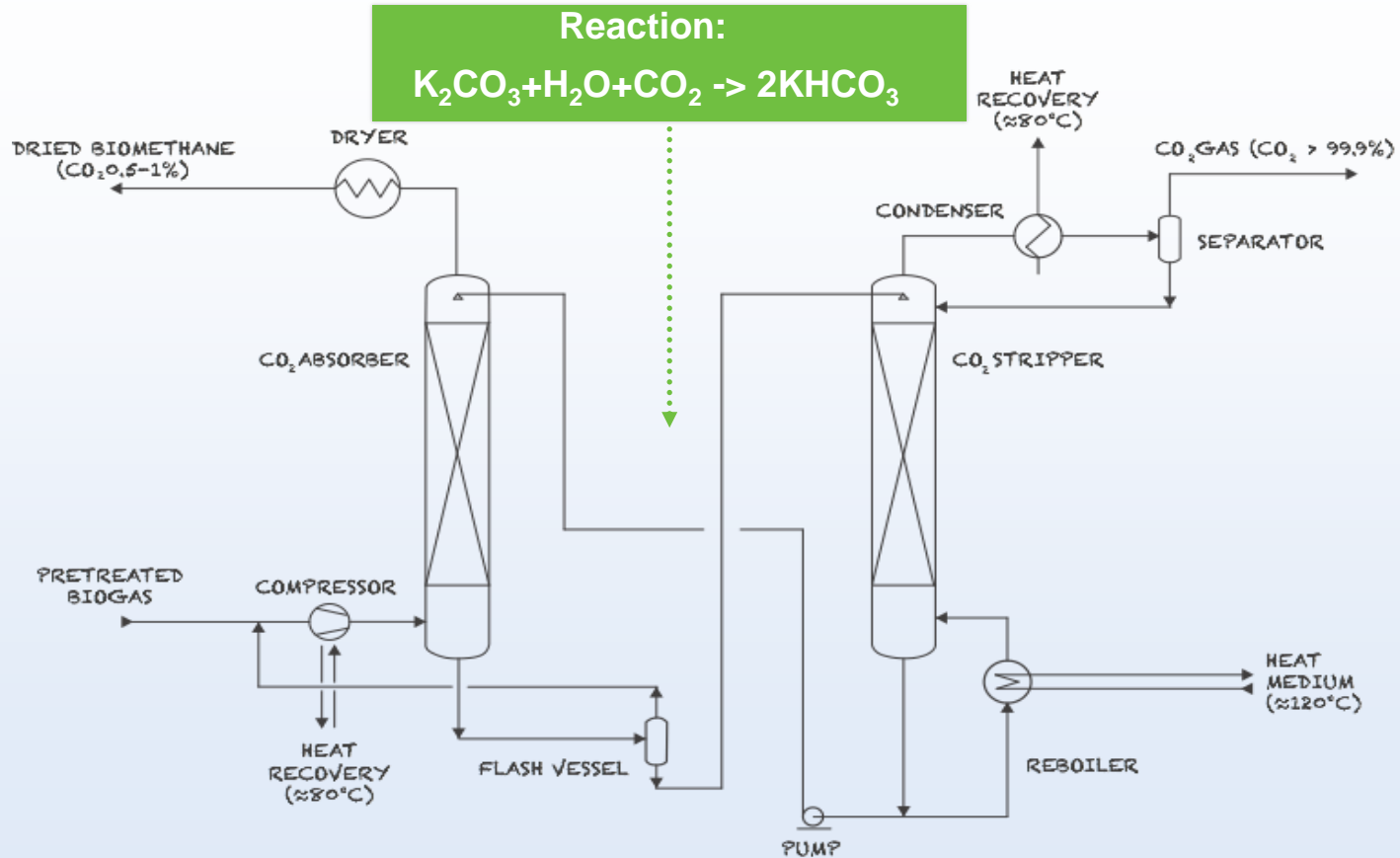


SISTEMI DI GESTIONE
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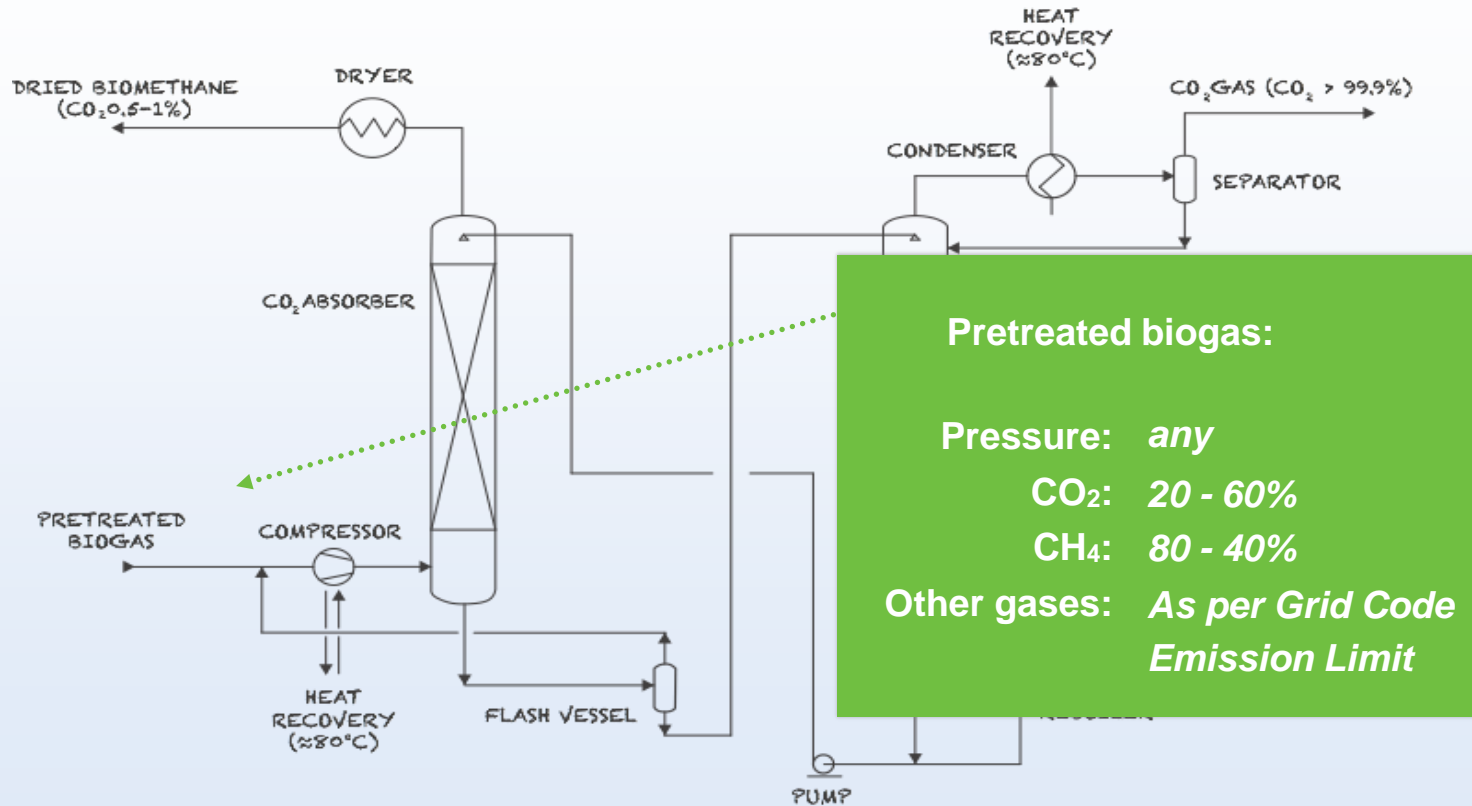
Process scheme



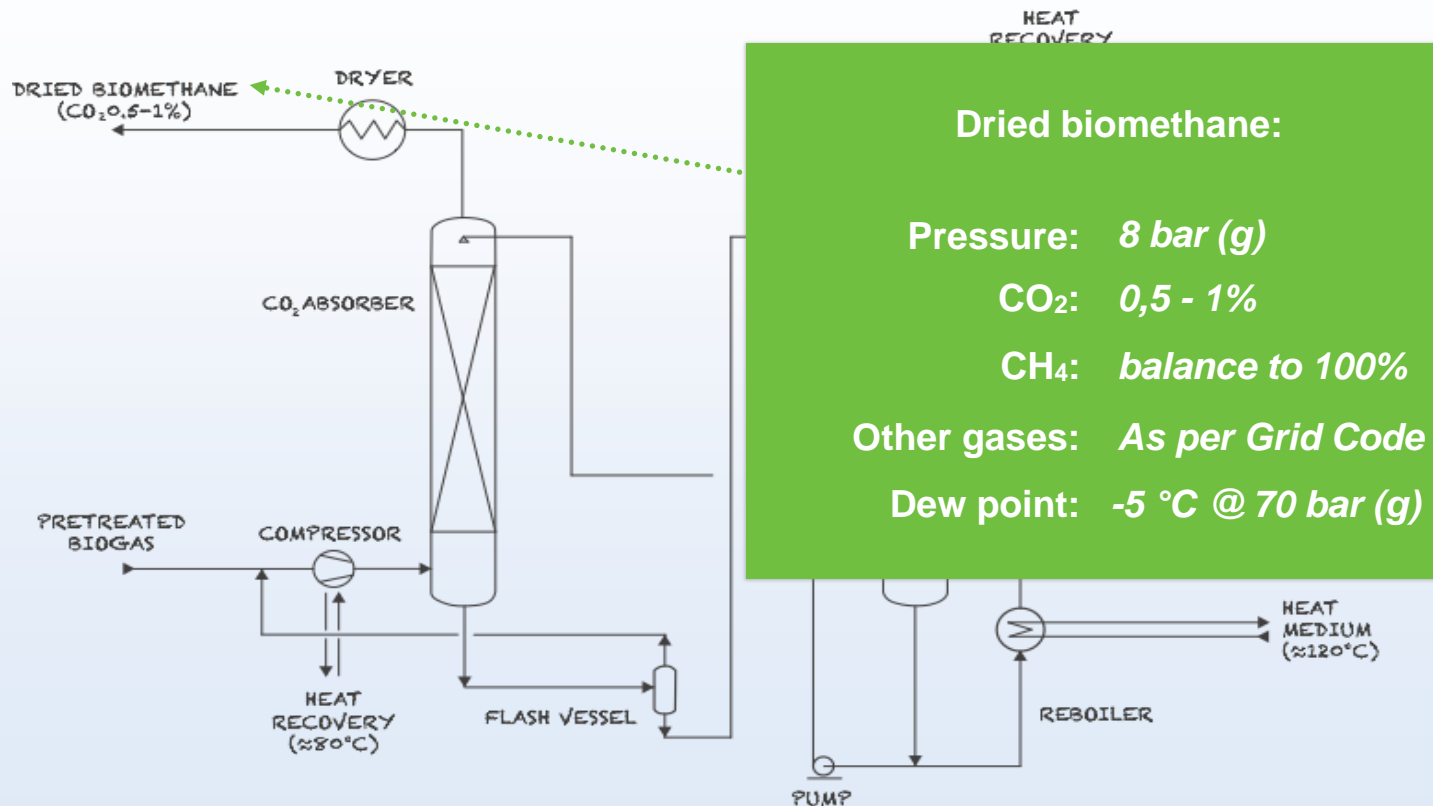
Process scheme



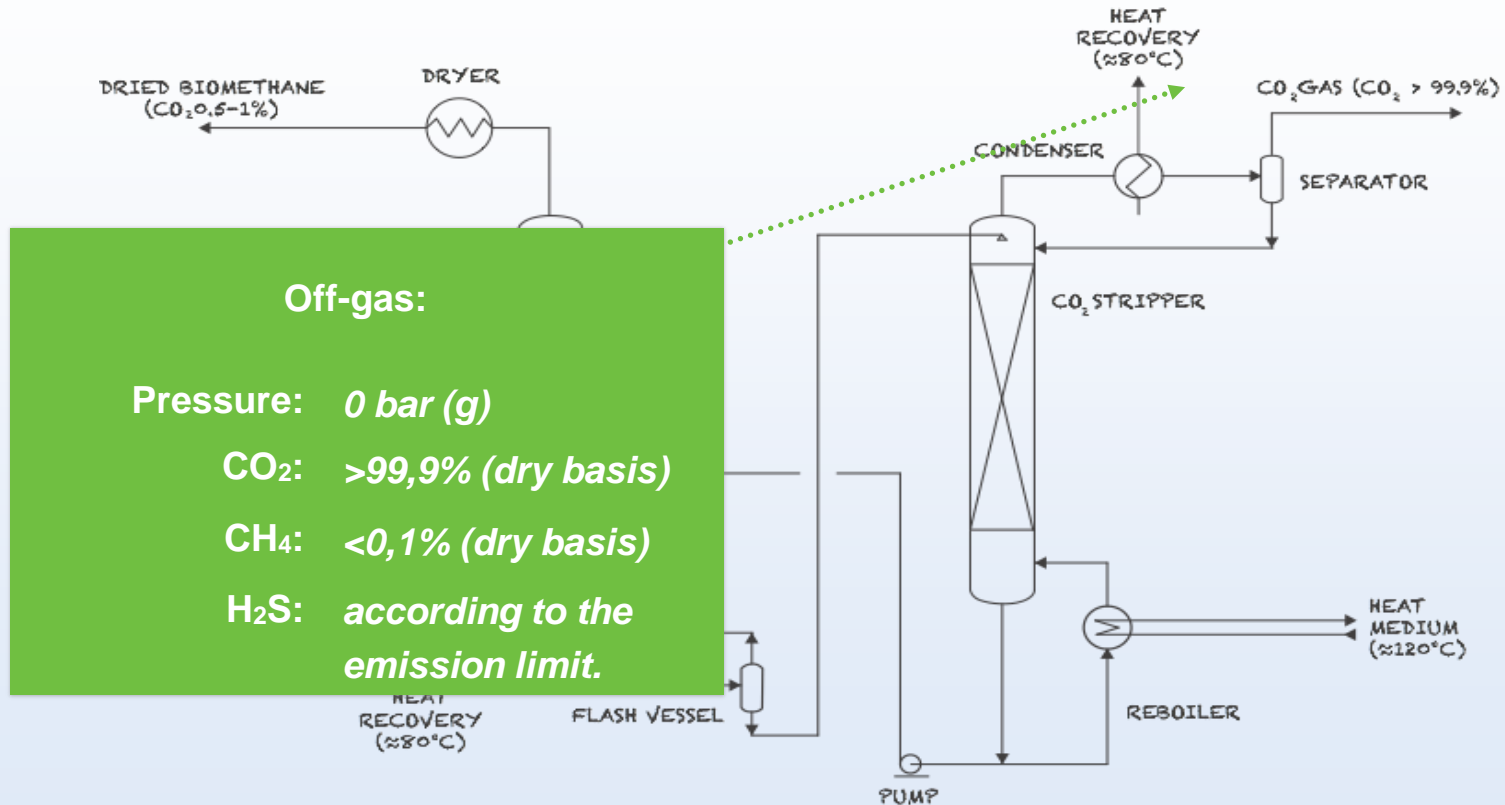
Process scheme



Process scheme



Process scheme

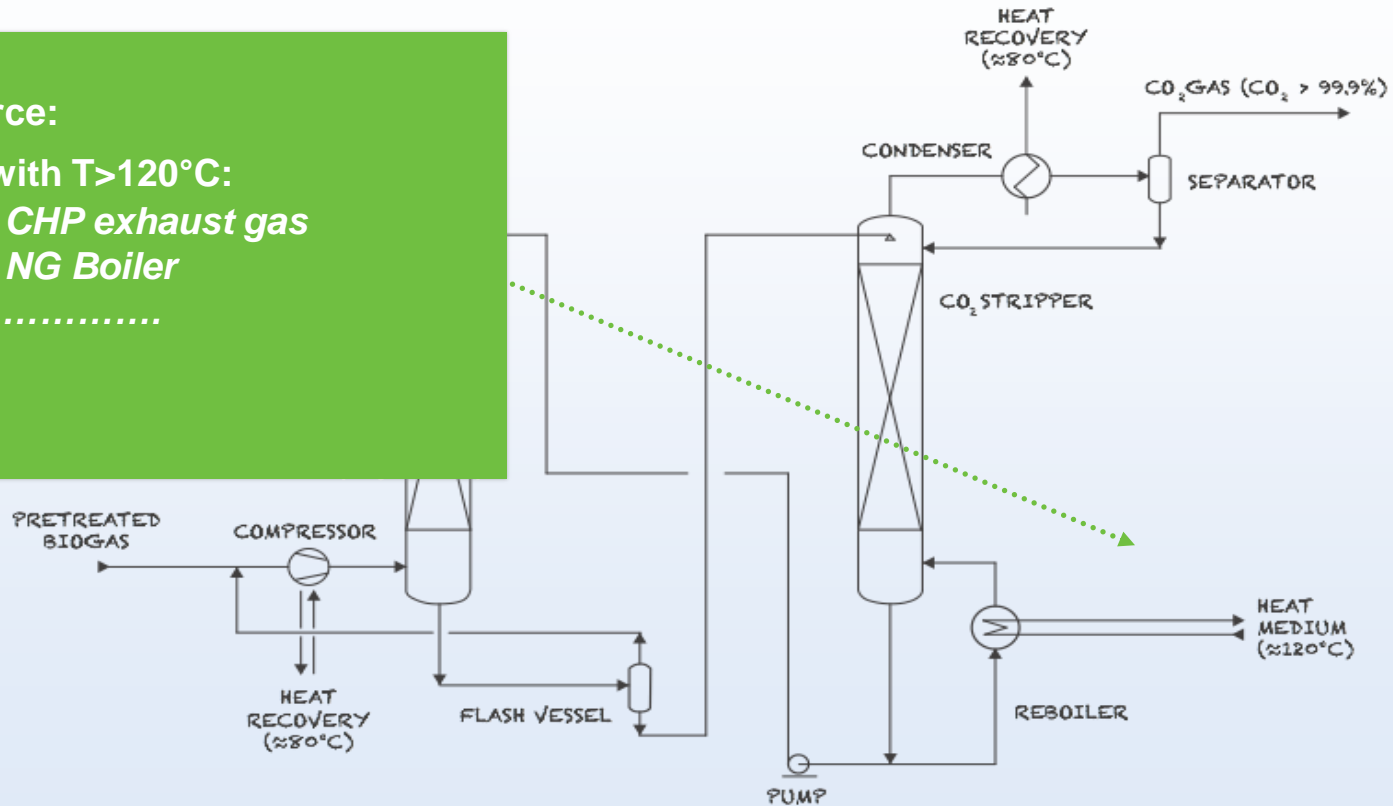


Process scheme

Heat source:

Any, with $T > 120^{\circ}\text{C}$:

- *CHP exhaust gas*
- *NG Boiler*
-



REFERENCES

Operating:

- ★ ROMA, 750 Nm³/h biogas from OFMSW.
- ★ ROVIGO, 750 Nm³/h biogas from industrial by-products
- ★ FERRARA, 1100 Nm³/h biogas from agricultural by-products

Start-up phase:

- ★ MILANO, 1500 Nm³/h biogas from OFMSW

Construction phase:

- ★ ANCONA, 750 Nm³/h biogas from OFMSW

QUALITY OF BIOMETHANE AND ATMOSPHERIC EMISSIONS

CNR-IIA (Consiglio Nazionale delle Ricerche - Istituto sull'Inquinamento Atmosferico, Italian National Research Council - Institute for Atmospheric Pollution) carried out two sampling and analysis campaigns on Biogas, Biomethane and Off-gas streams.

The results achieved are summarised in the report CNR IIA 0003441/2017 “**Verifica delle prestazioni di un impianto per l’upgrading del biogas a biometano tramite Hot Potassium Carbonate**” (Checking of performance of a biogas upgrading to biomethane plant by Hot Potassium Carbonate).

The results show that:



Biomethane produced meets the requirements of UNI TR 11537-2016 and EN 16732 standards



Methane lost with Off-gas is lower than 0.1% of total methane in biogas feed (measured loss = 0.06%)



Higher yield

Lower environmental footprint

Biogas Upgrading: Life Cycle Cost Analysis

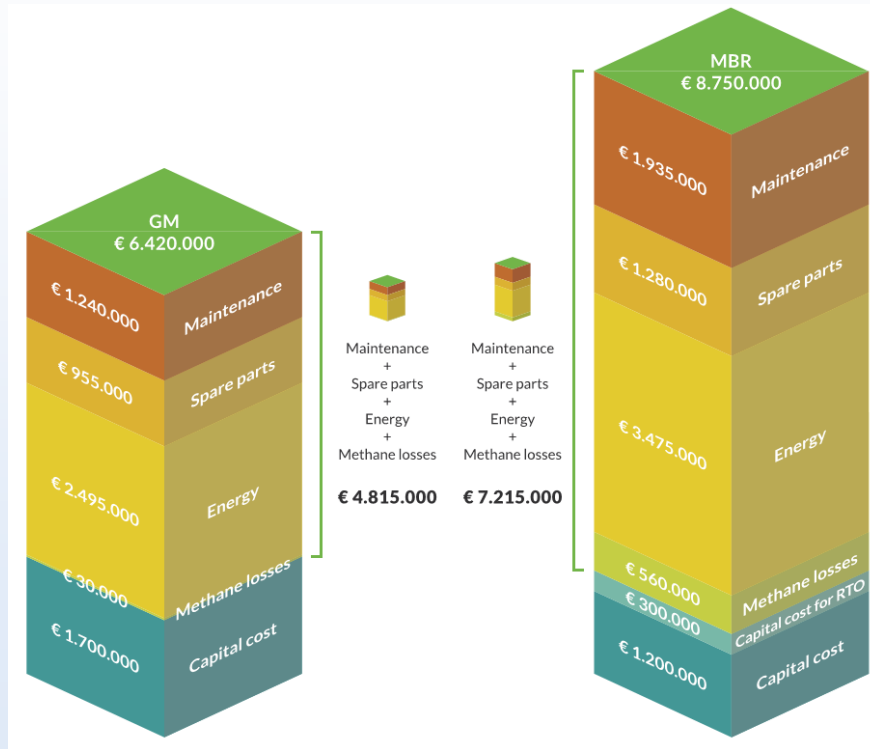
HOW MUCH YOUR UPGRADING PLANT COSTS?

A comparison between GM washing and MBR for an upgrading plant treating 1000 Nm³/h of raw biogas in Italy

INPUT	Unit	GM	MBR
Electric Power Price from Grid - from CHP	€/MWh	160-100	160-100
Thermal Power Price	€/MWh	30	30
Capital Cost	€	1700000	1200000
RTO	€	0	300000
Methane Slip	%	0.05	1
Electric Power Consumption (Biomethane delivered @ 12 bar)	kWh/Nm ³ BG	0.209	0.28
Thermal Power Consumption (heat @ 130°C)	kWh/Nm ³ BG	0.425	0
Thermal Power Recovery (heat @ 80°C)	kWh/Nm ³ BG	0.36x65%	0.08
Activated Carbon Consumption for VOC Removal	% of nominal cap.	75	110
Maintenance Cost for Upgrading	€/yr	80000	80000
Substitution of Separation media	€/yr	4000	50000
Inflation Rate	%	1	1
Weighted Average Cost of Capital	%	4	4

Biogas Upgrading: Life Cycle Cost Analysis

CUMULATIVE UPGRADING COST FOR 20 YEARS PLANT LIFETIME (EUR 2019)



- Overall Cost Difference: **€ 2.330.000**
- OPEX cumulative value is 4 to 7 times the CAPEX!
- While CHP units have similar performances, upgrading plants are very different from each other

OTHER FIELD OF APPLICATION: CO2 Removal from flue Gas

- ★ Giammarco-Vetrocoke - Intense engineering activity in North Europe
- ★ Giammarco-Vetrocoke - Pilot plant in Venice (I)
- ★ Demo plant in WTE plant in North Italy

Gasification:

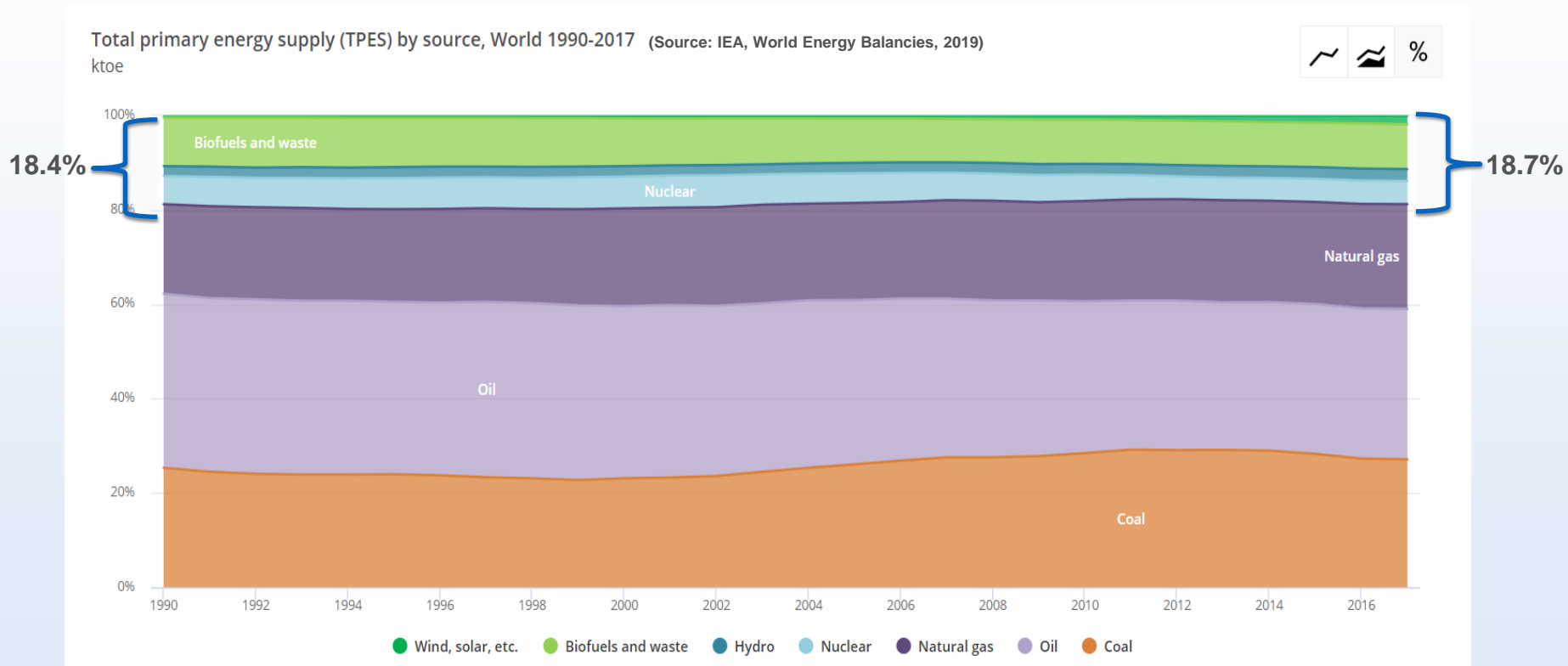
- ★ Giammarco-Vetrocoke – Pilot plant in UK

Key aspects:

→ -solution stability ←
-environmental friendly

One minute for Our Planet...are we doing enough?

SHARE OF «RENEWABLES» IN WORLD ENERGY SUPPLY



THANKS FOR YOUR ATTENTION



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