USE OF METHANE IN WASTEWATER TREATMENT PLANTS

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Global Methane Initiative

AQUALOGY

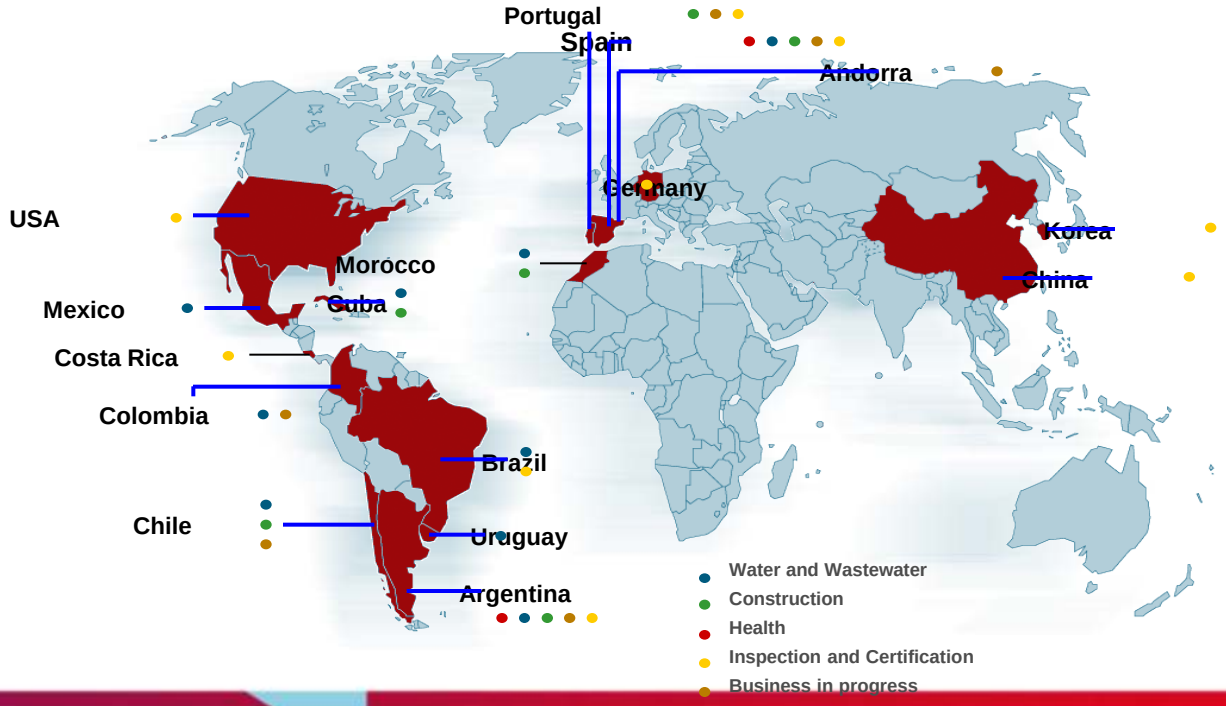
AQUALOGY it's the solutions brand of AGBAR related with the world of water.
AQUALOGY offers solutions and technology in 4 areas:

- ENVIRONMENT. Solutions for companies of water and environment area.
- INFRASTRUCTURES. Projects of construction and hydraulic engineering.
- SOLUTIONS. Services and solutions oriented to improve water companies.
- KNOWLEDGE. Services based on knowledge and people management.

Numbers in Agbar Group – Wastewater

International data:

Municipalities served:	545
Equivalent pollution load (inhabitants):	21,009,950
Treatment plants in service and assistances:	579
Volume treated treatment plants (m3/year):	1,196,716,489



Technologies

Agbar Group manages over 500 treatment plants, in Spain and internationally, from small sizes (less than 2,000 inhab.) to more important sizes (Santiago de Chile, La Farfana WWTP: **8.8 m3/s**).

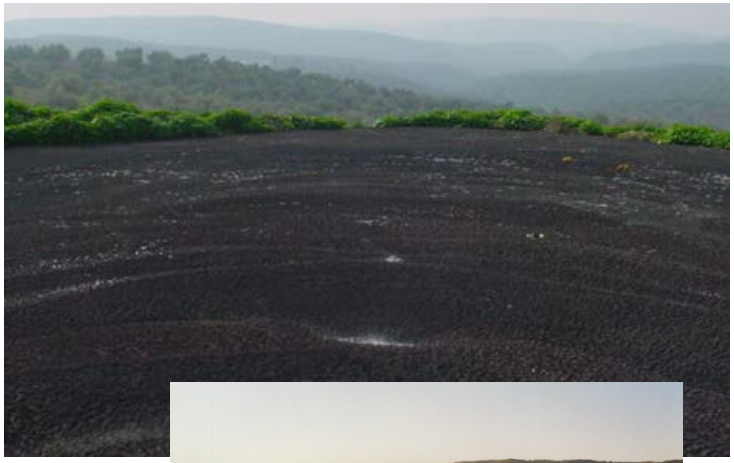
Practically all the water treatment in Spain is **biological**.

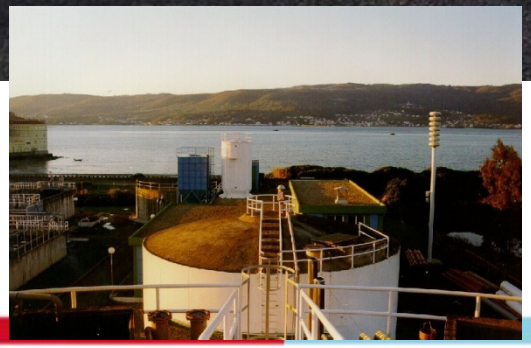
The following stand out in **sludge technologies**:

- **Biological stabilization through anaerobic sludge digestion** (32 treatment plants).

- **Thermal drying of sludge** (solar or high/low temperature)

-**Composting of sludge.**





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1- Operation of big plants in Santiago de Chile

2- WWTP La Farfana

- Treatment of biogas for use in city gas
- GHG reduction – Carbon credits
- Biogas methanisation
- Carbon footprint calculation

3 – WWTP Trebal-Mapocho

- Use of biogas in cogeneration

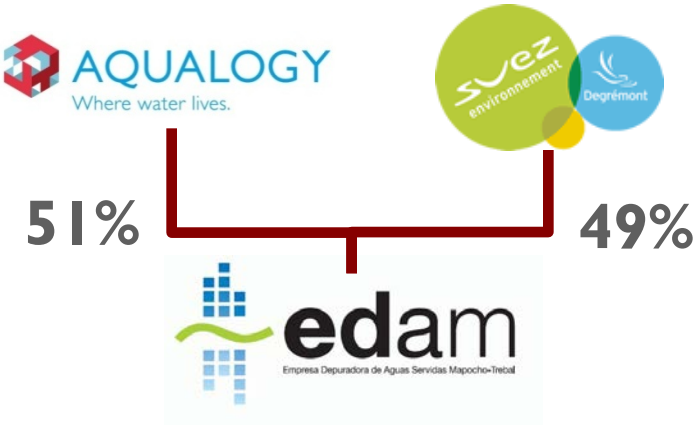
OPERATION OF BIG PLANTS IN SANTIAGO DE CHILE

WWTP LA FARFANA

EDAS operates La Farfana since 2007, after an international tender.

5 year contract (2012) renewable for 5 years (2017)

WWTP TREBAL-MAPOCHO



EDAM operates Trebal-Mapocho since april 2010, after an international tender.

7 year contract (2017) renewable for 5 years (2022)

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WWTP LA FARFANA

Construction: 2003, Ondeo Degrémont

Exploitation: Degrémont (2004-2007) and EDAS (2007- present)

Start up of biogas treatment plant: 2008

Design flow: **8,8 m^3/s** (average), **15,0 m^3/s** (maximum)

Treatment of 57% of Santiago wastewater: **3.294.000 people**

Investment : **315 millions US$**

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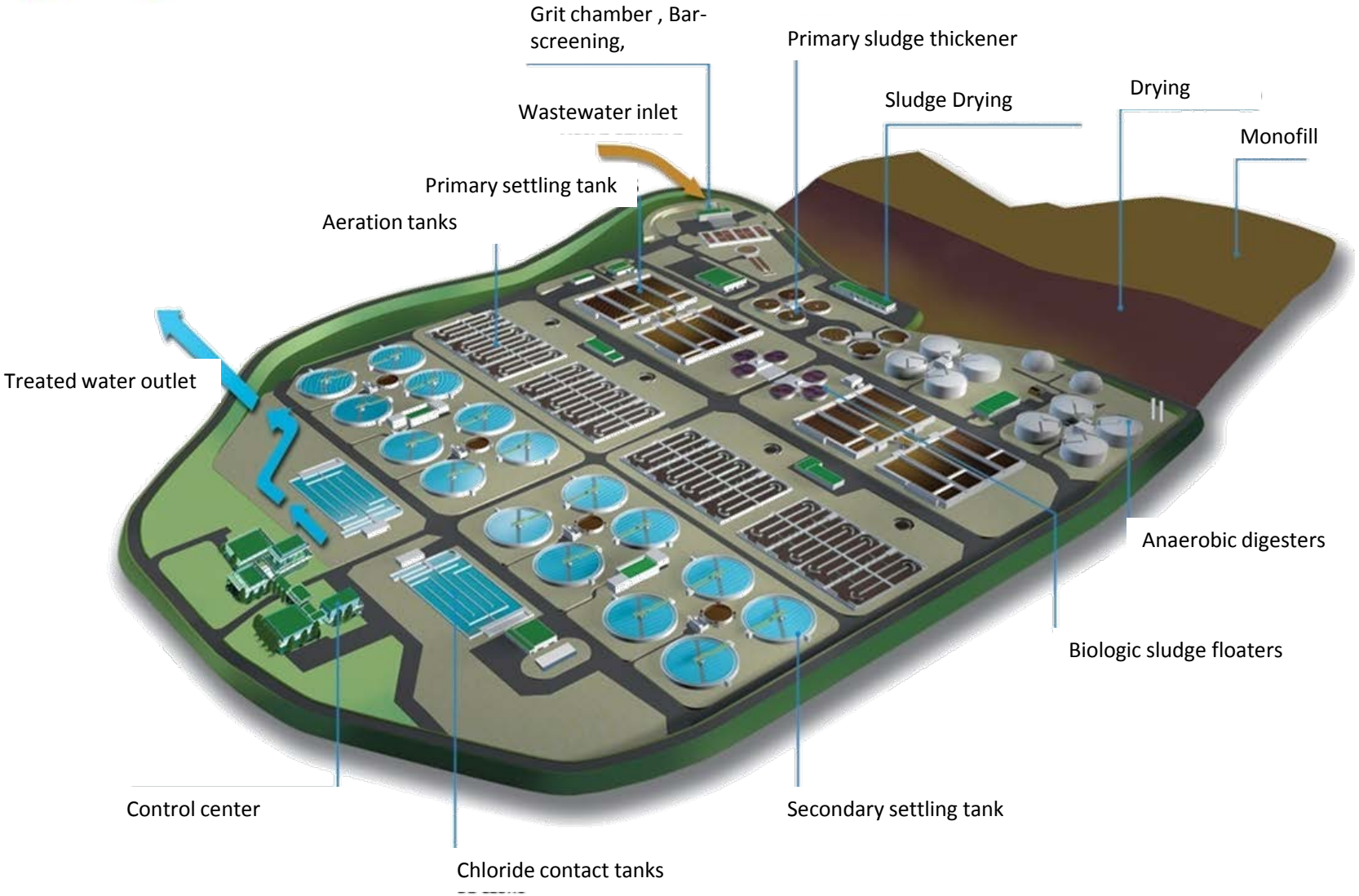

Grit chamber , Bar-screening,
Primary sludge thickener
Drying
Sludge Drying
Wastewater inlet
Monofill
Primary settling tank
Aeration tanks
Treated water outlet
Anaerobic digesters
Biologic sludge floaters
Control center
Secondary settling tank
Chloride contact tanks

BIOGAS TREATMENT FOR CITY GAS USE
LA FARFANA

La Farfana biogas production

38 MMm³/year (300 ppm H_2S)

12,5%

87,5%

- ✓ Biogas is used in boilers to heat digesters

- ✓ Biogas available for its valorisation in city gas network

Treatment of biogas (<25 ppm H2S)

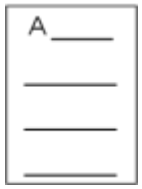
Metrogas

City gas supply to homes

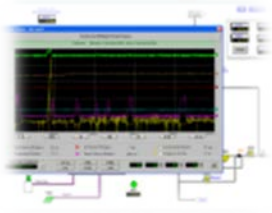
- ✓ Unused biogas is burned in torch

BIOGAS TREATMENT FOR CITY GAS USE
LA FARFANA

Project benchmarks





1 — Oct-07

2 — Nov-07

3 — Feb-08

4 — May-08

5 — Oct-08….

1) Contract signature with Metrogas

2) Start of the engineering project

3) Conclusion of the engineering project

4) Start of the plant building

5) Start of operation

BIOGAS TREATMENT FOR CITY GAS USE
LA FARFANA

Wash tower: scrubber + biological reactor

95% H_2S from biogas removal

Cooling + Compressing

Exceeding water elimination by condensation

Biogas compression to inject it in gas pipeline

Metrogas

Maximum flow: 4.175 m^3/h
Dew point : 4°C
Delivery pressures : 0,6 - 1,0 bar

BIOGAS TREATMENT FOR CITY GAS USE
LA FARFANA

References (year 2011):

- Biogas production: 38 MMm^3
- Biogas destination:
  - 12,5% selfconsume in boiler
  - 87,5% to supply or torch burning
- Biogas availability: 33,3 MMm^3
- Supplied to Metrogas: 14,1 MMm^3
- Burned in torch: 19,4 MMm^3
- Composition: CH_4 = 63% / CO_2 = 36% / Others

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WWTP LA FARFANA EMISSIONS

Carbon footprint calculation of installations using self-developed tool CAFCA. This tool, keeps in touch with all processes emissions.

WWTP La Farfana carbon footprint 2010: **87.590 t CO_2, 0,325 kg CO_2/m^3**

Production (potable water plant) **Transport and distribution** **Sewerage** **Offices**	Emissions from energy consume Emissions from transport Emissions from reactive consumption
Depuration (WWTP)	Emissions from water and sludge treatment processes

Action plan for anual emmisions reduction

GREENHOUSE GASES REDUCTION – CARBON CREDITS LA FARFANA

Fossil fuel substitution in city gas production

- ✓ Annual reduction of CO_2e = **19.873 tCO_2e**
- ✓ Its estimated to obtain 7 carbon credits per year. We are in verification-certification stage.
- ✓ CDM methodology was developed (Aproved by United Nations in August 2008 – AM0069)

- ✓ Burning efficiency in torch: is 99%
- ✓ There are no methane emissions remaining, because almost every methane is burned (DICTUC)

BIOGAS TREATMENT FOR CITY GAS USE LA FARFANA

RESIDENTIAL CUSTOMERS

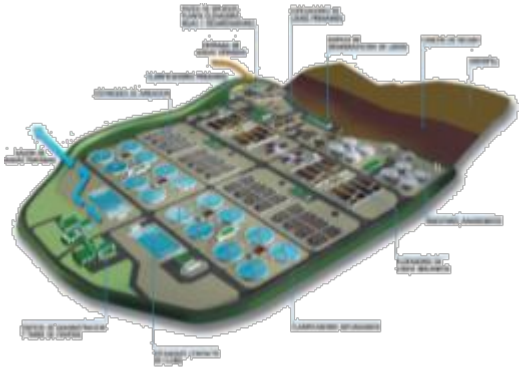
City gas supply for 35.000 homes

City gas

CITY GAS FACTORY

WWTP LA FARFANA

Wastewater
(organic waste)



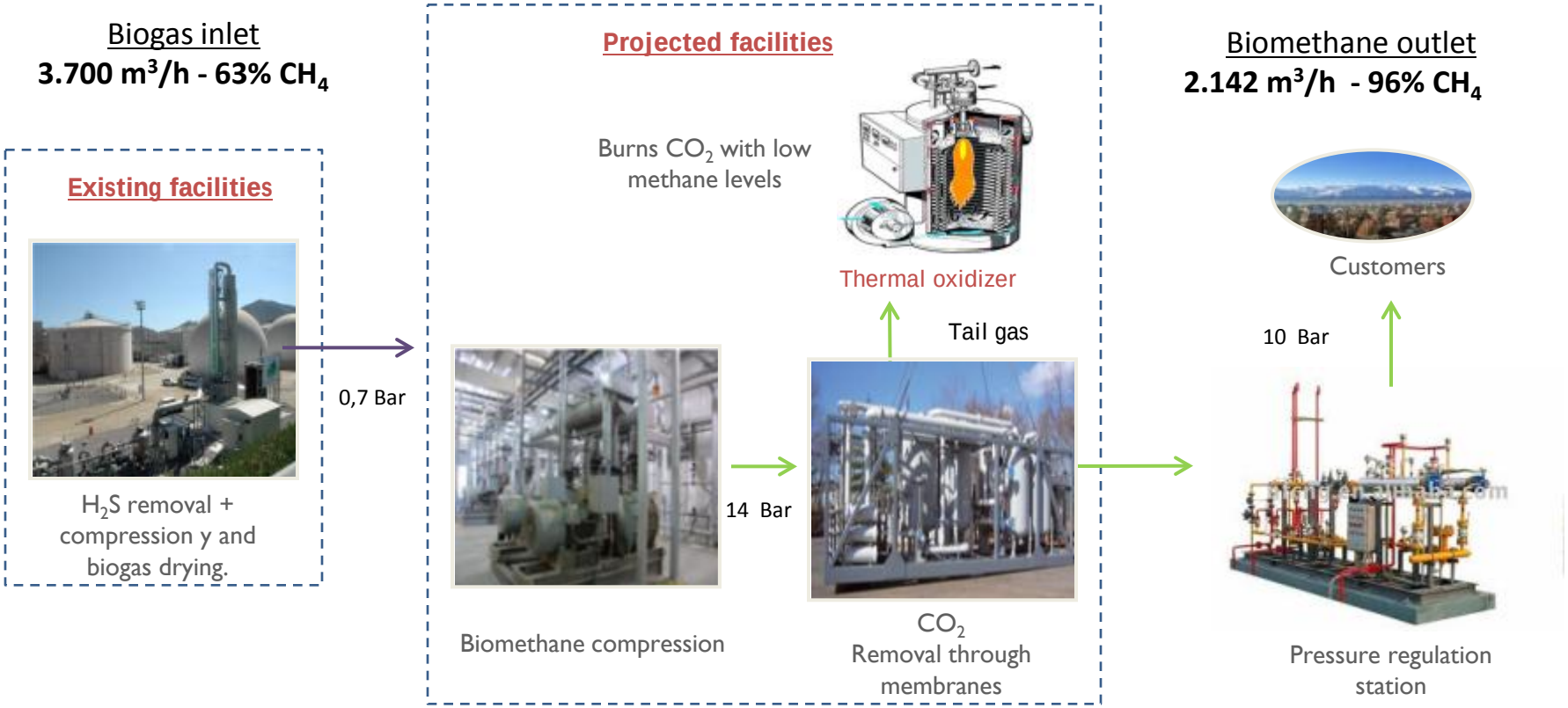
Treated biogas
(<25 ppm H_2S)

Biogas production
38 MMm³/year

"Energetic input for Santiago, La Farfana becomes environmental asset…"

FUTURE PROJECT
BIOGAS METHANISATION
LA FARFANA

After H_2S elimination, biogas is compressed to 14 bar, to make CO_2 removal through *Air Liquide* membranes, rising CH_4 concentration from 63% to 96%, making biogas compatible with natural gas defined in NCH 2264.



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WWTP MAPOCHO-TREBAL

Operation start: 2001 (Trebal) y 2012 (Mapocho).

Exploitation: Aguas Andinas (2001-2010) y EDAM (2010- present)

Design flow: (4,4 + 2,2) **6,6 m^3/s** (average)

Treatment of 43% of wastewater from Santiago

Investment: **200 MMUS$ in Trebal and 140 MMUS$ in Mapocho**

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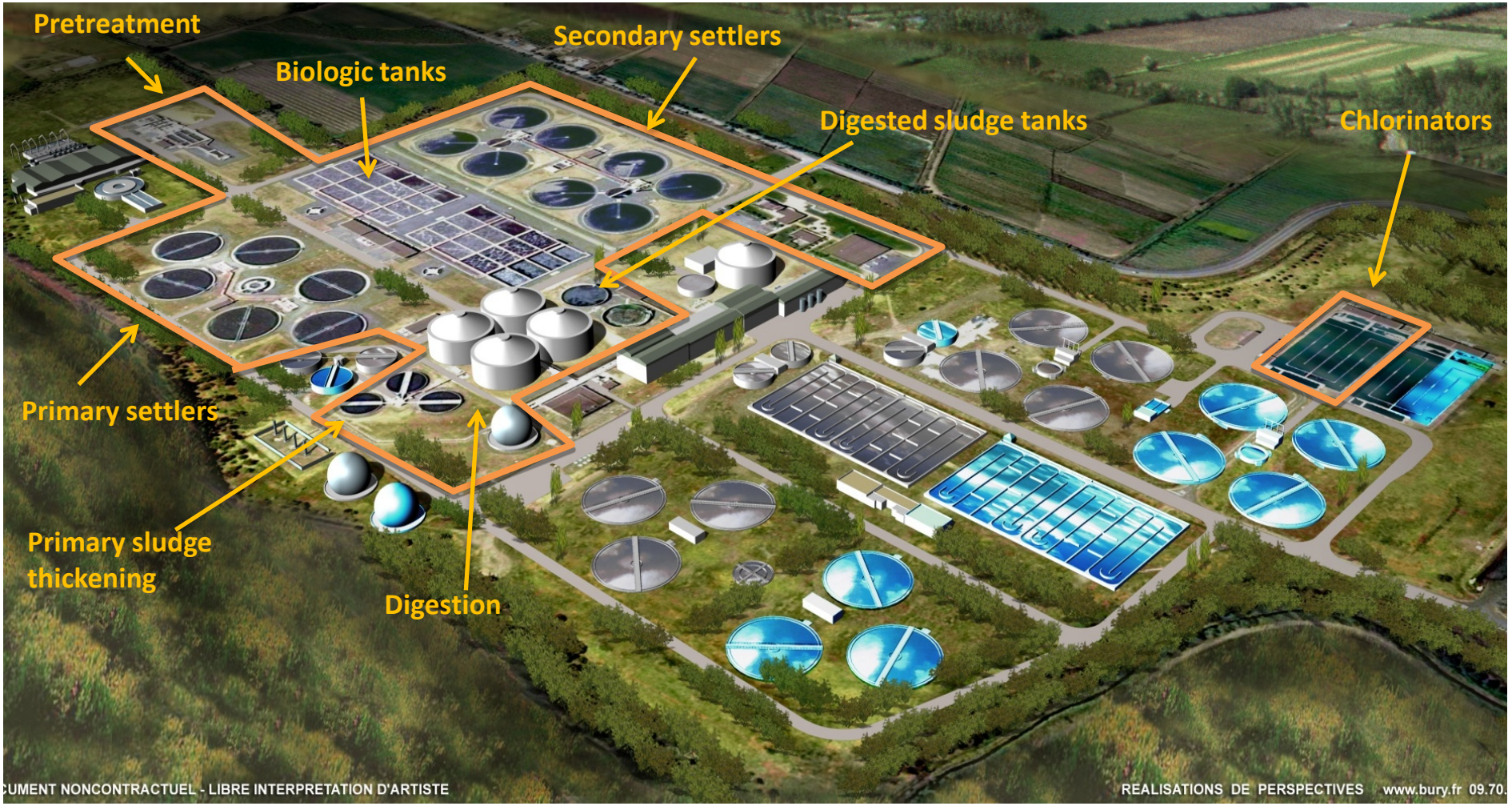
WWTP MAPOCHO-TREBAL



BIOGAS USE IN ELECTRIC COGENERATION MAPOCHO - TREBAL

- In WWTP Mapocho – Trebal, biogas is conditioned through **H_2S removal, cooling, condensed water elimination and volatile organic compounds and siloxanes removal** through activated carbon filters.

- **Generated energy is transformed from 690V to 23.000V** to be distributed in the electrical main grid in the plant, with the possibility to export to the general electrical grid. (Central interconnected system o SIC).

- **Combustion gases are used to produce steam f**or the biologic sludge thermal hydrolysis, previous to digestion.

- **Digesters temperature maintenance** using motors heat. Refrigeration through liquid-liquid exchangers.

Jenbacher (GE), JMS 620 GS-B.L. / 2.742 kWe

CAMBI

BIOGAS USE IN ELECTRIC COGENERATION MAPOCHO - TREBAL

Biogas

Q = 68.000 Nm³/d

CH4 = 65 %

Biological and chemical washing.
H2S maximum outlet: 50 ppm

Active carbon filters

Cogeneration (3 motors)
Biogas consumption=

1.075 Nm3/h*motor

Outlet energy=

2.742 kWe/motor

Self consume

CAMBI

Anaerobic digestion

Energy recovering to heat digesters

Hot water=

1.268 kWt/motor

Gas outlet=

2.439 kWt/motor

Gas holders

Torches

Boilers

3 steam boilers

550 °C

Steam

11 BarG

Hot water from boilers

THERMAL HYDROLYSIS CAMBI MAPOCHO - TREBAL

Batch Thermal Hydrolysis Plant (THP) for biological sludge. 10.000.000 €

Provider: **CAMBI**

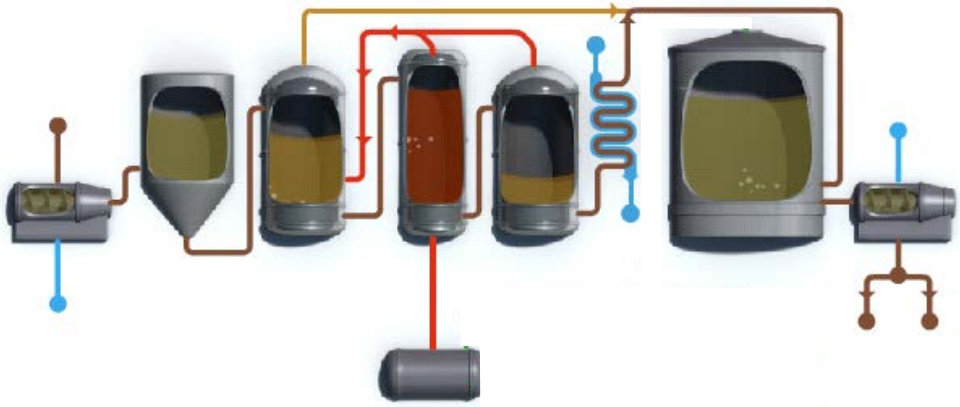
2 parallel lines with 3 reactors of 7 m^3 each

Maximum production: **25,75 m^3/h a 110-120 gr/l**

Extendable to 34,3 m^3/h

Processes consequences:

- **Dryness increase** dried sludge to 30 % and **sludge decrease** .
- **Increase of production and improvement in quality.**
- **Pathogens removal**



BIOGAS USE IN COGENERATION
MAPOCHO - TREBAL




References :

- Biogas volume produced: 68.064 Nm^3/d
- Consumed biogas volume: 68.064 Nm^3/d
- Motogenerator: JENBACHER, JMS 620 GS-B.L. (3)
- Electrical Power: (2.742 x 3) 8.226 Kw
- Thermal Power: 3.806 Kw
- Generated energy: 40.000 Mwh/year
- Consumed energy: 64.000 Mwh/year

Thanks for your attention

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