The 11th NEDO-CDTI Joint Workshop

"Technologies for Hydrogen Valley in Spain and Japan – Regional H2 Value Chain"

Challenges and opportunities of renewable hydrogen projects in a sustainable water cycle

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Aqualia

NEDO

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

CDTI INNOVACIÓN

CO_2 FREE FUEL H_2YES Yamanashi Hydrogen Energy Society

AeH2 ASOCIACIÓN ESPAÑOLA DEL HIDRÓGENO

Company

FCC Group
Diversified business model

Business Areas

aqualia

Environment

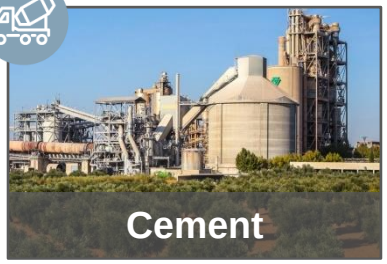
- Refuse collection
- Street cleaning
- Urban waste treatment and recycling
- Ground maintenance
- Sewer networks maintenance
- Building Cleaning & maintenance
- Industrial waste treatment and recycling
- Remediation of polluted soils

Water

- Integrated management of public services
- Operation, maintenance and technical assistance services
- Design, construction and financing of water infrastructures

Construction

- Civil Works
- Railway Works
- Building
- Industrial
- Concessions
- Infrastructure maintenance



Cement

- Cement
- Trading
- Other businesses
  (Concrete, Aggregate, Mortar Waste reduction in USA)

Company

Activities

Municipal concessions for the management of the end-to-end water cycle public service

Aqualia's main activity is to ensure access to water through the management of public services such as abstraction, treatment, purification, distribution, sanitation and purification, as well as analysing the quality of the water.

Infrastructure concessions in BOT model contracts

Aqualia designs, builds, finances and operates long-term infrastructures, treatment plants (purification, filtration and desalination) or re-use installations.

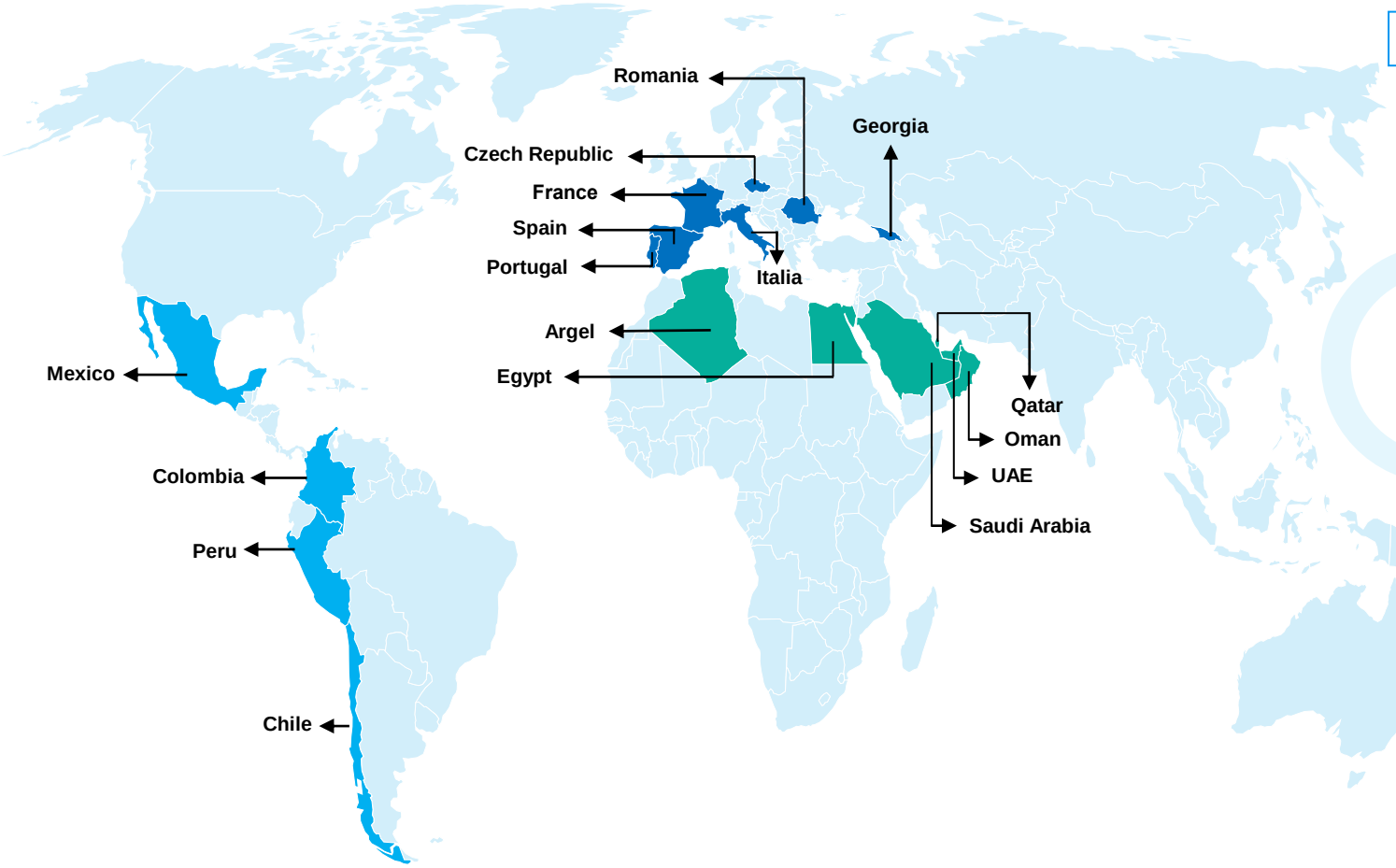
O&M services

The company operates, maintains and exploits infrastructures.

EPC Models

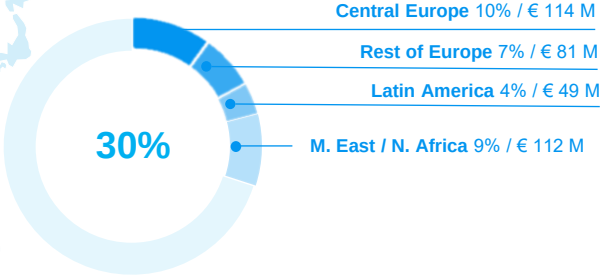
Aqualia creates design and construction projects (Engineering, Procurement and Construction).

Products, services, technologies of the company



International Revenue 2021

Total : € 404 M



International backlog*

(Dec. 31, 2021) **€ 8,212 M** (7 years)

*53.5% of the Total

Products, services, technologies of the company

29,662,500
Population served (GWI*)

17
Countries present

9.818
Employees

866
WWTP's

45,399 km of managed networks

239
WPP's

708 hm^3 / year
Drinking water produced

28
Desalination Plants

2,867
Drinking water repositories

5
Laboratories certified according to ISO-17025

22
Sports centres

Main challenges and solutions in the project/case presented

Developing novel solutions on biomethane and hydrogen since 2012

E-Fluent-EX

RenovaGas

ULTIMATE

ECLOSION

WATER
REWATERGY
ENERGY

ZEPPELIN

Main challenges and solutions in the project/case presented

Concept: “Power to gas”, public-private collaboration in innovation

RenovaGas

Ayuntamiento de Jerez

BIOGAS → $CH_4 + CO_2$

Electrolysis → H_2 ; H_2O

Methanation → CH_4 → To the grid

95.6%

250 kW
LCOE = 70 – 240 €/MWh

enagas CSIC FCC Aqualia Centro Nacional del Hidrógeno gasNatural fenosa tecnalia Inspiring Business ABENGOA HIDROGENO

Main challenges and solutions in the project/case presented

E-Fluent-EX

A1 GREEN ENERGY SOURCES AND ENERGY STORAGE

A3 SMART SYSTEM FOR BIOFACTORY OPERATION

Energy optimization software

A2 BIOMETHANE AND GREEN HYDROGEN FROM BIOWASTES AS ENERGY CARRIERS

Pruning

Agroindustry

Biowastes

Sewage sludge

Anaerobic digestion

Biogas

Upgrading biogas

Bio-CH_4

Reforming

H_2

Pyrolysis gas

H_2

Digestate

Leachate

NH_4^+

Concentration - transformation

Fuel Cell

Solar hygienization and drying

Pyrolysis - activation

Catalyst

Biosolids

Biomass boiler

Biochar

Soil amendment

A4 BIOPRODUCTS: BIOFUEL, ENERGY CARRIER AND OTHER USES

Main challenges and solutions in the project/case presented

IndUstry water-utiLiTy symbIosis for a sMarter wATEr society

ULTIMATE

Electrical efficiency**	Up to 57%
Overall efficiency**	Up to 88%
Seasonal space heating energy efficiency class	A+++
Annual fuel consumption***	22.000 kWh per year
Fuel types	Natural gas according EN 437 Bio methane LNG
Fuel inlet pressure	Max pressure: 25 mbar Min pressure: 15 mbar
Water consumption	up to 32 l/day

Higher electricity and heat production compared to conventional CHP

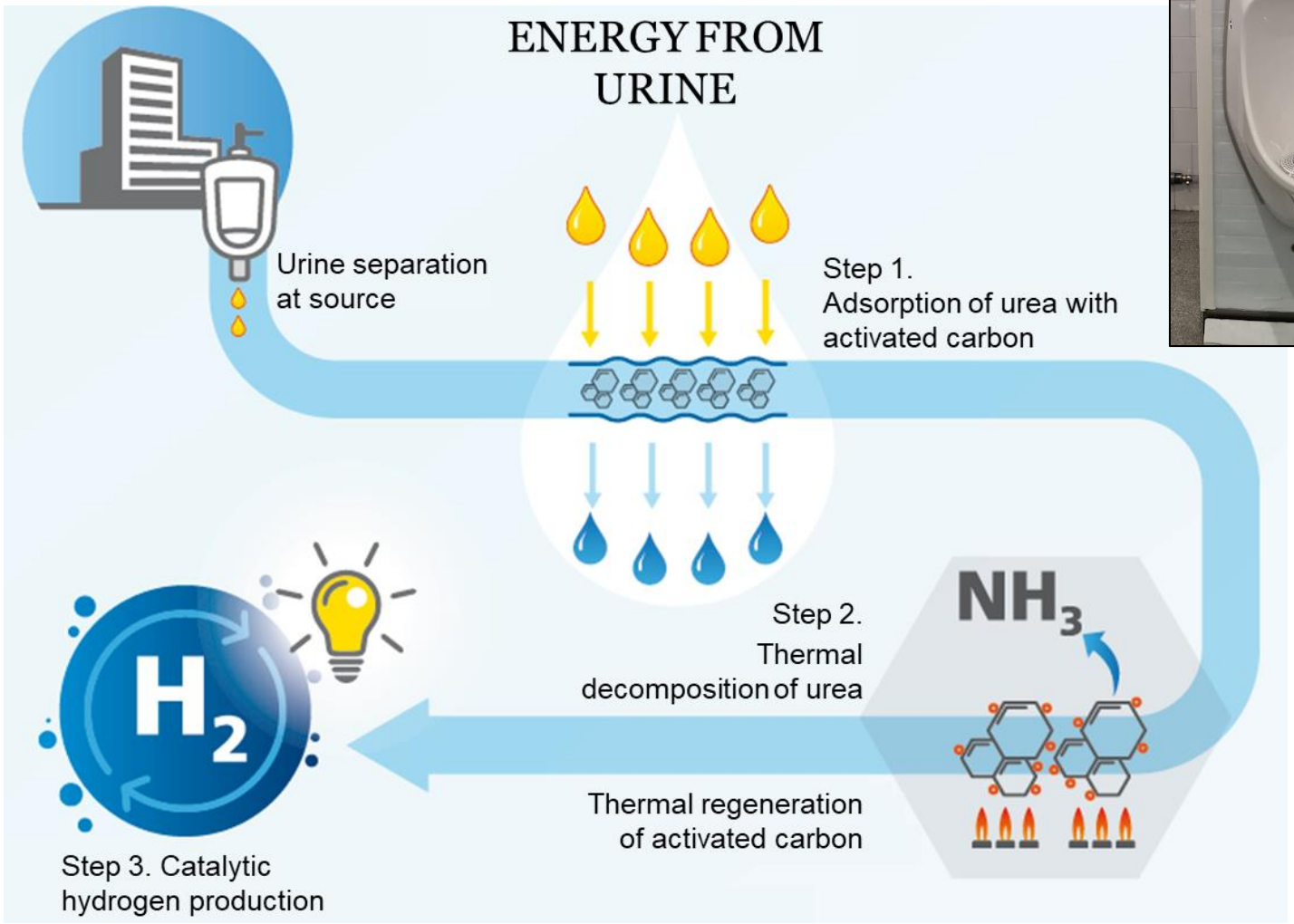
2022

1.5 kW

WWTP LLEIDA

First initiative in Spain using Fuel Cell in wastewater treatment plant

Main challenges and solutions in the project/case presented



Main challenges and solutions in the project/case presented

Benefits

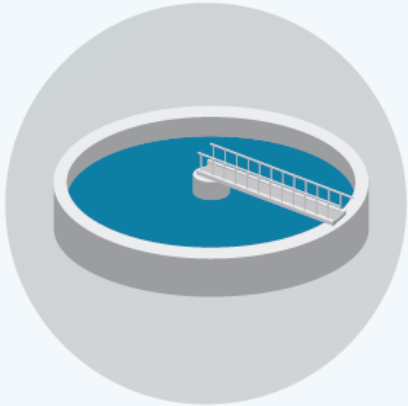
Adoption of the system by Kōfu population

200 t/year green hydrogen

20M km by car
550 times around the world

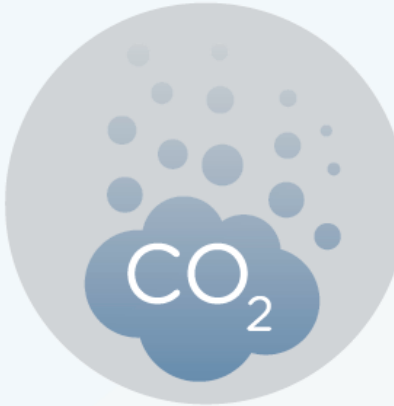
1,200 MWh/year electricity

Supply to 850 people
3,500 solar panels



30 % reduction energy demand at WWTP

2,000 MWh/year
400,000 €/year



CO_2 emissions reduction

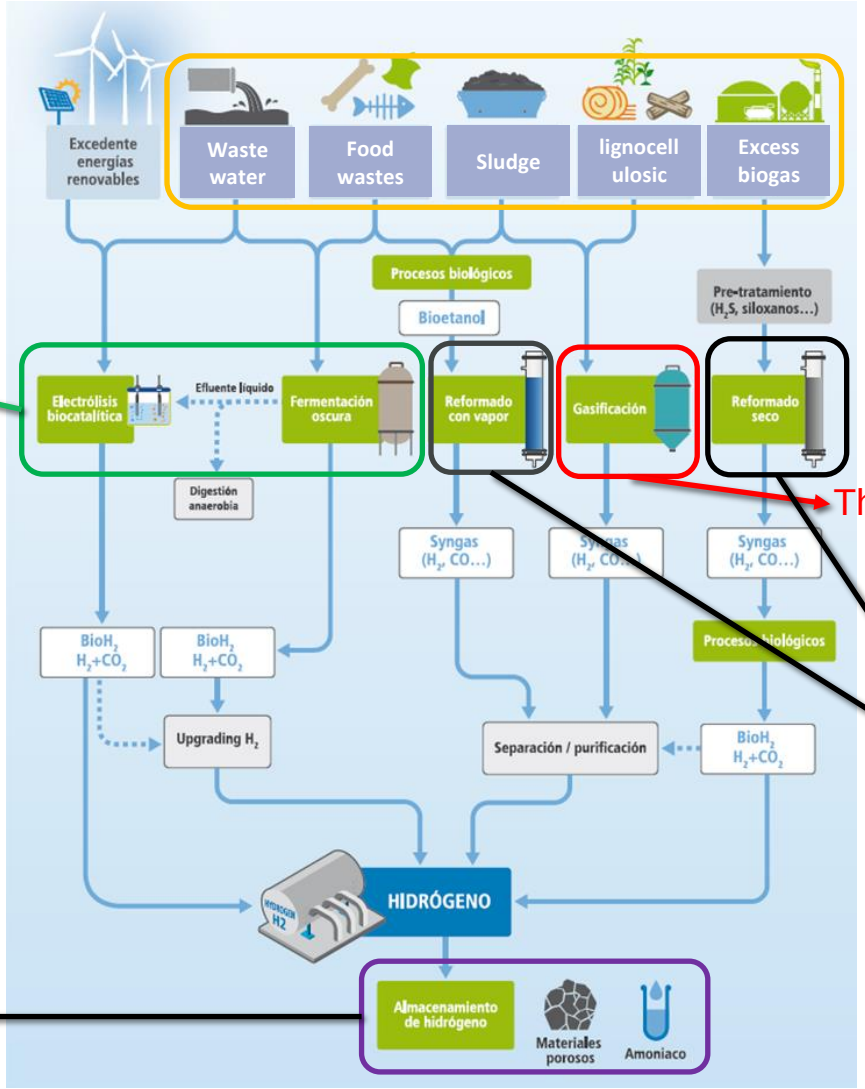
700 t/year
25,000 trees

Main challenges and solutions in the project/case presented

ZEPPELIN

- Hydrogen production and storage technologies based on the use of **waste and by-products**, seeking to significantly improve the costs and efficiency.
- To develop a range of technologies **unlinked to the availability of high-quality water** for the production of H2.
- To give the **entire national territory** the option to produce sustainable green H2.

Microbiological technologies



Thermochemical technologies

Catalytic technologies

Storage

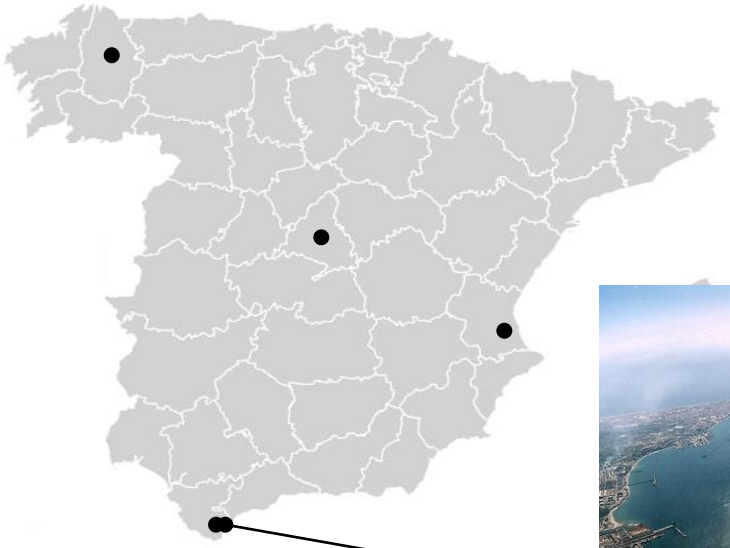
Main challenges and solutions in the project/case presented

ZEPPELIN

REPSOL · TECNICAS REUNIDAS · Naturgy · Redexis · reganosa

PYME · perseo biotechnology · norvento enerxía

Technological Centre · energylab · Universidad de Valladolid · AITIQ · idea energía · Ciemat · Cidaut · inmati



Main industrial centers of southern Spain

Puerto de Algeciras · Linde (Making our world more productive) · viesgo · Naturgy · REPSOL · Air Liquide · EVOS · exolum · endesa · INDORAMA VENTURES · CEPSA · APM TERMINALS (Lifting Global Trade) · ACERINOX

Main challenges and solutions in the project/case presented

Objectives

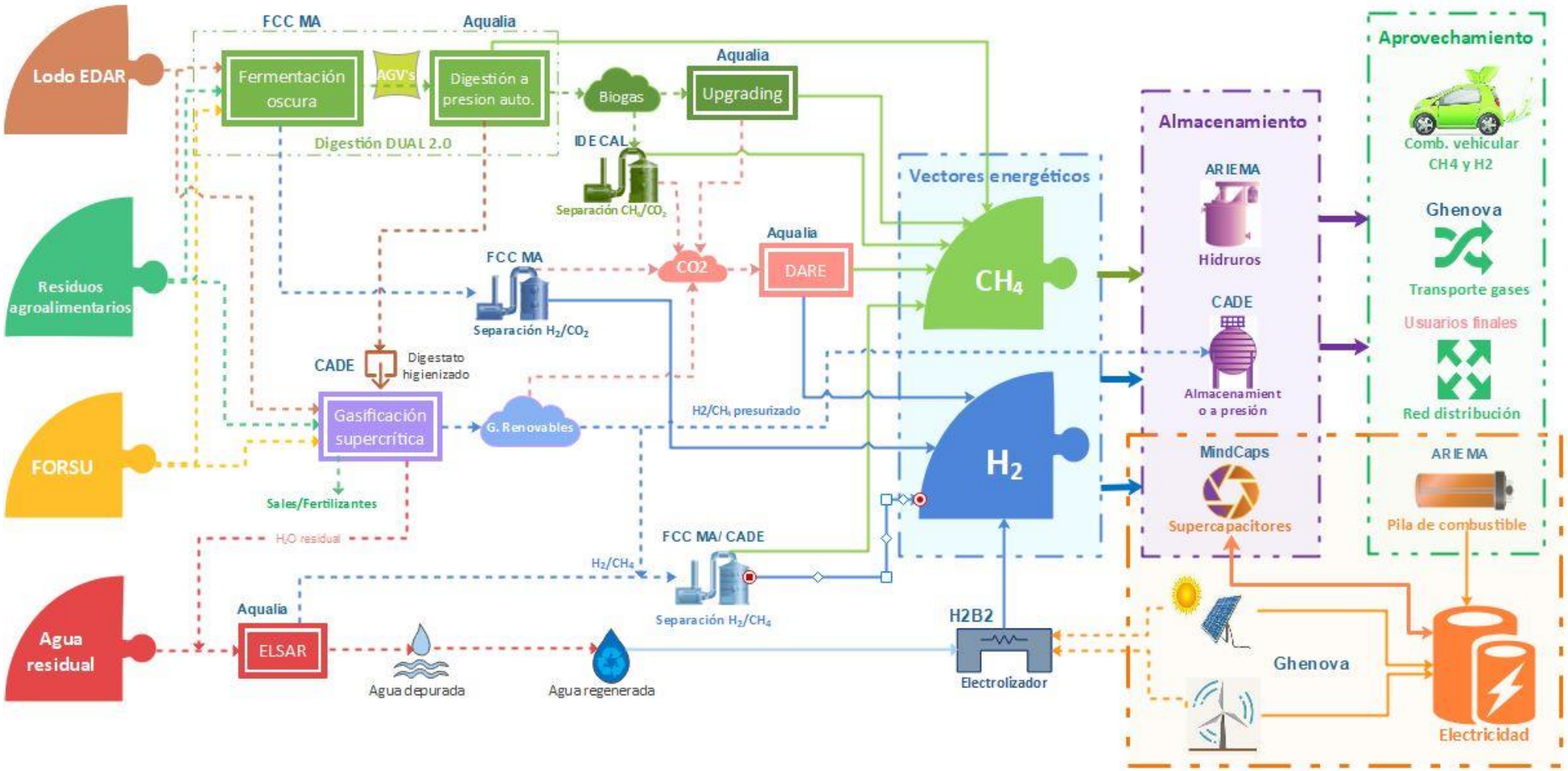
ECLOSION

- **Development of new technologies and processes to obtain green H_2.** Electrolyzers, bioH2 through biological / biochemical / bioelectrochemical processes and gasification of biowastes.
- **Obtaining new materials for various technologies:** gas separation membranes, supercapacitors, ionic solutions and energy storage.
- **Design and implementation of integration and optimization tools to generate, store, distribute and use energy from renewable sources -biowaste- with a very significant reduction in energy, economic and environmental costs.**
- **The integration of the ECLOSIÓN solution in the design of eco-efficient, flexible and intelligent energy systems:** from origin to enduser, optimal energy management (thermal and electrical) and electrical networks that include renewable energies in terms of decision-making on production , storage and demand of the renewable resource.

FCC Medio Ambiente · aqualia · GHENOVA · ariema enerxía · cade engineered technologies · H2B2 · iDECAL · mindaps

8 partners	10 R&D entities (12 groups)	5 activities	71 Direct jobs	42% women	11 new jobs

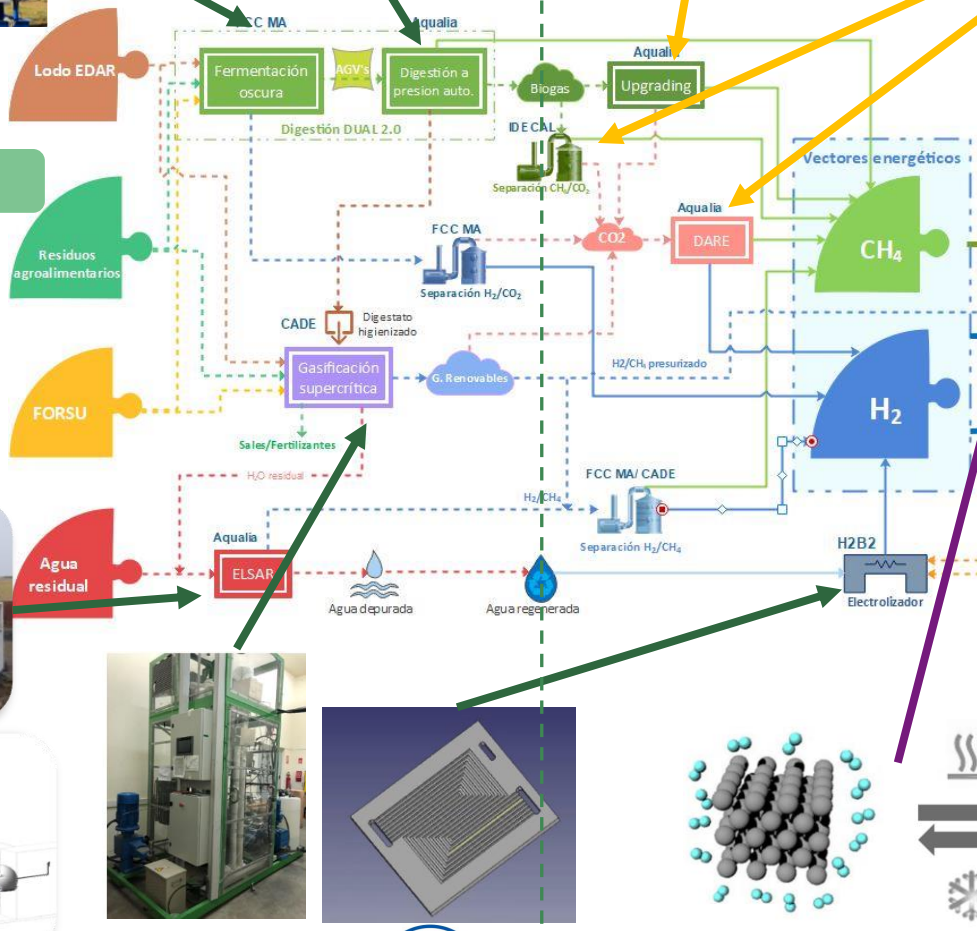
Main challenges and solutions in the project/case presented
ECLOSION solutions



Main challenges and solutions in the project/case presented

Cleaning and upgrading

From waste to Energy



End users

Electricity integration

Main challenges and solutions in the project/case presented

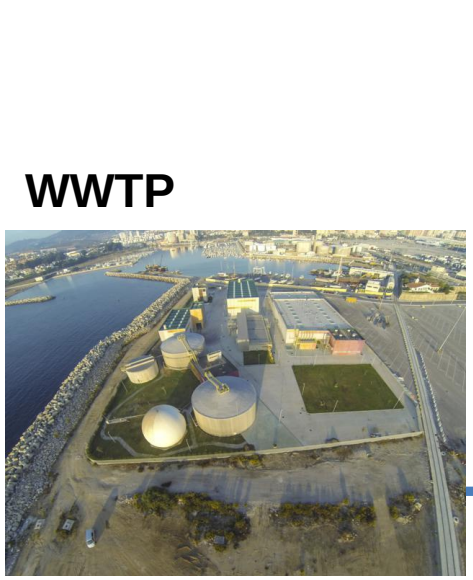
Demonstration sites

Main challenges and solutions in the project/case presented
Scheme for solutions integration at WWTP Jerez

Ideas for a Japan – Spain collaboration

Objectives and outputs	tCO_2 saving >10 tCO2	€/kg H_2 < 3€/kgH_2	New materials, technologies and processes (7)
From waste to energy	Dual anaerobic digestion Bio-electrochemistry	Bio-electrochemistry	Bio-electrochemistry Dark fermentation Self-pressurized digestor
Supercritical gasification	Supercritical gasification		Supercritical gasification
Gas cleaning and upgrading	CO2 value (methanation = synthetic biomethane)		MMM, G/L contactors, CO2 capture and valorization, gas cleaning and upgrading (H2 and CH4)
Energy carriers	AEM electrolyzer Hydride compression Supercapacitor	AEM electrolyzer	AEM technologies, hybrid supercapacitor and compression with hydridies
Integration and optimization	Renewable energy soures hibridation	Renewable energy soures hibridation (PV/Eolic))	Artificial intelligence (electrolyzer + PV + supercapacitor. Virtual model “energy island”.

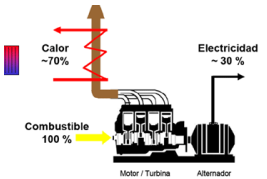
Ideas for a Japan – Spain collaboration
Water industry contribution on green hydrogen production



WWTP

Effluent

Digestor



Cogeneración

Onsite use of the O_2

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Aqualia, www.aqualia.com

Gracias. Thank you. ありがとう