

# LIFE CABEZO GREENH<sub>2</sub>: MW-scale green hydrogen production plant to decarbonize the treatment of meat residuals

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LIFE CABEZO GREENH<sub>2</sub> aims to integrate hydrogen (H<sub>2</sub>) technology to contribute to the mitigation of CO<sub>2</sub> emissions by replacing natural gas used as a fuel in the meat residual treatment by renewable hydrogen generated onsite. For this purpose, a hydrogen production plant based on a water electrolysis technology will be installed in Muel (Zaragoza), an important industrial area of Spain in order to produce more than 100 tons of green H<sub>2</sub> per year, which will be used in the decarbonization of this local industry. The project that has a duration of 3,5 years (July 2021- December 2024) has been awarded with 2,5 M€ by the 2020 LIFE program of the European Union.

## Residuos Aragon: Treatment and valorization of animal waste in Spain

In Spain, about 2 million tons of animal waste are generated each year, the collection and treatment of which represents an approximate annual cost of 150 million euros. This animal waste, called **Sandach**, are parts of animals that cannot be used for human or animal consumption and need to be managed adequately. For sanitary reasons, these residuals need to be treated following a regulated protocol in accordance with European legislation based on their danger to health or the environment [1].

Residuos Aragon, located in Los Pitarcos (Muel, Zaragoza) is one of the four Spanish companies that operates in the treatment and valorization of animal waste (Sandach), including the entire value chain: collection, transportation, treatment, storage and transformation into value added products. The installation (with a surface area of 30,000 m<sup>2</sup>) is designed to treat more than 70,000 tons of Sandach per year with the possibility of extending the production facilities to reach a capacity of 210,000 tons per year.

The innovative process used by Residuos Aragon results in the transformation of the animal waste into different sorts of fats/oil that can be later used in other industrial processes. It also generates biofuels and a calorific powder for the production of cement. Its strong investment in technology has made it the most modern plant in Europe.

Today, Residuos Aragon is using large amount of natural gas as fuel for producing steam in the main thermo-oxydador, Figure 1, which generates up to 17.000 kg steam/ hour needed in the transformation process. This steam brings the animal residuals to very high temperatures, which allows to separate fat from the rest of the solid parts, and collect it in liquid form. The exhaust gases are transferred to the area of combustion where maximum temperatures are reached and allow the oxidation process which eliminates the bad smell and recuperates residual water.

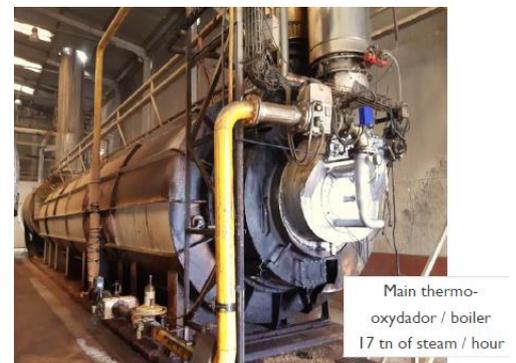


Figure 1. Main thermo-oxydador of the Residuos Aragon process

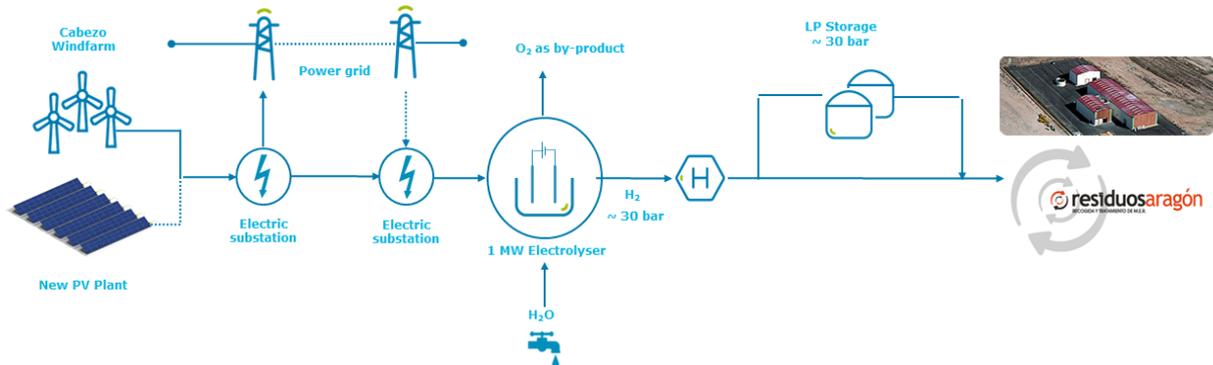
The main objective of this project is to demonstrate the integration of green hydrogen in the treatment and transformation process of meat residuals inside Residuos Aragon, achieving up to a 20 volume-% of green hydrogen in the natural gas stream supplied as a fuel. As the natural gas and hydrogen are gases with different properties and characteristic, hydrogen cannot simply replace natural gas because equipment is not ready for it. It requires a revamping on the existing boiler to get hydrogen ready [2]. This revamp will be carried out and equipment will be adjusted to avoid, among other, high levels of corrosion caused by the presence of hydrogen in the blending that is injected in the boiler.

## 1 MW PEM H<sub>2</sub> production plant

For this purpose, 1 MW PEM electrolyzer will be developed in the frame of the project by a Spanish company called H<sub>2</sub>Green. The electrolyzer will be based on advanced cell configurations with low-cost manufacturing methods. These advancements will not only reduce the cost of the components being developed, but also maximize the global efficiency of the system. The electrolyzer is expected to produce 18 kg per hour of high-quality H<sub>2</sub> (99.999%) and operate dynamically in a 5-100 % range, responding in a fast way to the fluctuations of the renewable power inputs.

The electrolyser will be powered from a wind farm located around 5 km from the industrial site. The Cabezo San Roque Windfarm developed and operated by Falck Renewables from 2004 in the same Muel Village has already a proved track record in terms of electrical generation. The wind farm has an installed capacity of 23.25 MW and operates at an equivalent hour of 2,179.5 h per year. From 2016 until 2019, the wind farm has been consistently registering an average 50.782 MWh annual production.

To maximize the utilization of renewable energy sources for green hydrogen production and minimize the degradation of the electrolyser due to an extremely dynamic operation, the capacity of the electrolyser has been fixed in 1 MW. According to previous simulations, the Wind-H<sub>2</sub> system, Figure 2, would provide around 100 tons/year of green H<sub>2</sub> considering more than 5000 operating hours directly with renewable energy. However, given the intermittency of power production at Cabezo San Roque windfarm, it could also be considered to connect the H<sub>2</sub> plant to a nearby solar PV plant to combine both solar and wind profiles in order to increase the load factor of the electrolyser, mitigating any potential risks of electric shortages due to unfavorable climatic conditions that would affect renewable hydrogen production needed to meet the demand.



**Figure 2.** Process diagram of the hydrogen production plant developed in the frame of the project

## Environmental Impacts Expected

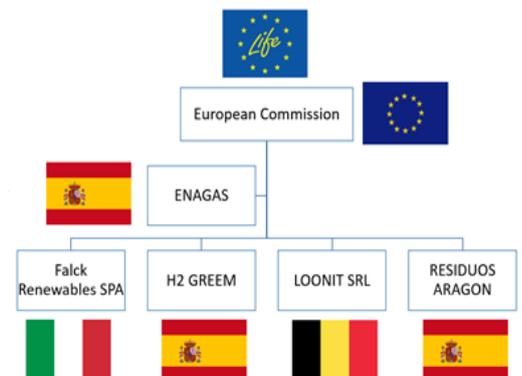
This project is fully in line with the “Energy Intensive Industry” (EII) topic in the Climate Change Mitigation (CCM) priority. It will have long-term impacts in the industry: this project will showcase the capacity of green H<sub>2</sub> to decarbonize industrial activities and maximizing the integration of renewable energy. The green H<sub>2</sub> will be integrated in an industrial site involved in the valorization of meat residuals, enabling to reduce CO<sub>2</sub> emissions and GHG in the long-term.

Residuos Aragon is one of the largest consumers of natural gas in the Region of Aragon: around 60 GWh per year, which generates more than 11.000 tons of CO<sub>2</sub> per year. As the industrial facility is not connected to the gas network, this natural gas is supplied as LNG, daily by trucks, from the harbour of Sagunto, Valencia to the Residuos Aragon site (260 km away), where it is directly gasified. The development of this project allows to reduce LNG consumption in more than 900 MWh<sub>HHV</sub>/year, which means a reduction of more than 800 tons of CO<sub>2</sub>eq/year in the industrial site.

## The consortium

The consortium is composed by 5 companies covering all the green hydrogen value chain, Figure 3:

- ENAGAS, leader and coordinator of the project. It will be involved in the design of the hydrogen plant
- FALCK RENEWABLES, proprietary of the windfarm that will supply energy to the hydrogen plant
- H2GREEM will develop the PEM electrolysis technology up to 1 MW scale
- RESIDUOS ARAGON, offtaker of the green H<sub>2</sub> produced from the plant
- LOONIT, consultancy firm (specialized in hydrogen projects) that will carry out activities related to the business plan.



**Figure 3.** Management Chart

## References

- [1] Real Decreto 1528/2012, Ministerio de Agricultura, Pesca y Alimentación, 2012.
- [2] S. Deasley, D. Robert, L. Grigoriadi, Hydrogen blending and the gas commercial framework, Frontier Economics, 2020.