Life Ecodigestion

Descriptive Summary

LIFE ECOdigestion 2.0 is a pilot demonstration project, funded by LIFE Programme and with a budget of more than 970,000 EUR, which generates biogas in sewage treatment plant digesters by mixing putrescible organic waste (slurry, poultry, organic fractions, MSW, horeca, etc.), thus transforming sewage sludge into green energy through technology.

The initiative led by Global Omnium, (Spain), in collaboration with the Finnova Foundation (Belgium) and Águas do Centro Litoral (Portugal) aims to become the most versatile digestion control tool on the market, achieving environmental and economic benefits through the production of biogas by making optimal use of waste.

Thanks to this technology, it favours the reduction of greenhouse gas emissions and the use of sewage sludge generated in wastewater treatment processes, thus achieving a positive impact on the environment. This programme is easily scalable with other funds such as FEDER, NextGenerationEU or RePowerEU.

Background

The energy consumed in waste-water treatment plants (WWTPs) in the European Union (EU) is between 1 and 3 % of the total energy produced in the EU, i.e. about 10,000 GWh/year, which results in the emission of more than 27 million tonnes of CO2 into the atmosphere. Moreover, this electricity demand is set to increase by approximately 20% in 15 years.

In this context, and in view of the need to reduce greenhouse gas emissions through the production of renewable energy (Directive2009/28/EC of the Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable resources), energy recovery from wastewater is crucial, as it is estimated that the energy contained in wastewater is around 2.7 kWh/m^3.

Apart from the energy that can be extracted from wastewater, extra energy can be obtained in WWTPs by co-digestion of substrates, such as food waste or slurry. In this sense, the production of agri-food waste is about 88 million tonnes per year in the EU, and, on the other hand, between 2010 and 2014, in the EU, the production of slurry was 283 million tonnes (which caused the emission of 46,387 million tonnes of CO2-equivalent with

its direct application as fertiliser).

Energy production through co-digestion of waste in WWTPs has significant environmental advantages in terms of energy production, offering an attractive alternative to fossil fuels in the production of power and heat. These advantages are in line with the commitments made in the Paris Agreement on CO2 emissions reduction. In addition, it allows waste to be transformed into raw materials, as recommended by Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

Aims and Goals

The main objective of LIFE-ECOdigestion2.0 is the scale-up of technology in order to produce biogas on demand with WWTP sludge, using agri-food waste and slurry as a co-substrate. The technology is based on the one developed in the previous LIFE ECODIGESTION project LIFE13 ENV/ES/377, which targeted the development, implementation and demonstration on a pilot scale of an innovative technology that worked on the automatized control for the dosage of waste in anaerobic digesters of WWTP and, consequently, maximized biogas production and waste treatment capacity.

The software tool developed in LIFE-ECOdigestion2.0 aims to control of on-demand biogas production in digesters that treat sewage sludge, food waste and/or manure, achieving the following objectives:

1. On demand biogas production at full scale
2. Increase biogas production by the use of co-substrates
3. Control of anaerobic digestion, maintaining process stability
4. Economic management, considering the cost of co-substrates and the potential biogas that can be produced
5. Calculation and correction of biochemical methane production during the operation (important to manage the co-substrate to be added)
6. Simulation of co-digestion before the addition of co-substrate to the digester
7. Stability management that enables the addition of a buffer in the event of a drop in pH.

By achieving these, ECOdigestion 2.0 will be the most versatile digestion control tool on the market.

The specific objectives are the followings:

- Scale-up the tool for automatic co-digestion in WWTP of with agri-food and manure to obtain energy on demand feeding the digesters recipes that will be generated and updated every 15 min.
- Adjust of 98% between target (production desired by the end user) and simulated biogas production
- Obtaining an adjust of 90% between target and produced biogas after the automated dosage of co-substrates.
- Increase in 192% the amount of manure and agri-food waste that can be treated in each WWTP being studied, which means 85,191 t during the demonstration at real-scale.
- Obtaining 14% more biogas with the co-digestion compared to digestion of each

substrate separately.
- Improve the stability of the co-digestion process under different operational conditions with various co-substrates, established by reference of stability the acidity/alkalinity ratio.
- Valorize 27,375 t/y of agri-food waste and 102,200 t/y of manure by changing their destination from incineration, agriculture, compost and landfill disposal to co-digestion. This implies: i) avoiding the emission of GHG, about 7,900 and 16,442 t CO_2-eq in agri-food and manure co-digestion demonstration respectively; ii) total annual methane production with agri-food waste of 2,729,471 Nm^3 and 951,400 Nm^3 with manure, which means 14,571 MWh and 7,540 MWh, respectively.
- 4 qualified full-time employments will be consolidated and 1 will be created during the execution of the project (specialized technicians).
- Regarding the impact to EU, the implementation of the tool in all WWTP with anaerobic processes (5,477 WWTPs) will imply an energy production of 58,330 GWh/y in EU-28. In addition to this, an annual reduction of GHG of 66.2 Mt CO2and 17.1 t NOX, and in of gases that promote acid rain in 23.7 t SO2 will be achieved.

Actions taken

1. Reengineering of the software developed in previous project

This action intends to equip with new applications the software already developed. These applications focus on improving usability and implementing higher stability, economic balances determination, its use as simulator and scaling-up to systems with continuous operation at real-scale.

The update of the tool makes it possible to face unexpected variations of the operating parameters in the inlet of digesters caused by deviations inherent to the operation of a WWTP. This will be achieved through the use of machine learning, a solution used in other computer applications developed by Global Omnium.

2. Modification of the existing demo plant

The validation of the automatic dosing and control system is carried out in a pilot plant that was designed and built in the previous LIFE13 ENV/ES/000377 project. This plant had to be modified to adapt it to the new needs of the technology and of the substrates to be validated.

3. Software validation in a pilot plant

In this action the new software (ECOdigestion 2.0) is validated in the pilot plant. For this, the responses of the system are studied with the operation under different operational situations, such as the use of different substrates, different methane curves, acidification, etc.

4. Technology demonstration in operational environments at real-scale with agri-food waste as co-substrate

Once the new ECOdigestion 2.0 automatic dosing control technology has been validated on a pilot scale, the technology is demonstrated in operational environments at real-scale. To do this, ECOdigestion 2.0 is installed in the digesters of the Quart-Benàger WWTP (Valencia, Spain), in order to automatically control the dosage of agri-food waste.

5. Technology demonstration in operational environments at real-scale with pig manure waste as co-substrate

After the demonstration of ECOdigestion 2.0 on a pilot and real scales, the replication and validation of the technology with manure is carried out at the Coimbrão WWTP (Leiria, Portugal).

6. Business plan

The main objective of this action is to promote the entry into the market of ECOdigestion 2.0. To this end, this action is focused on the analysis and study of market conditions, identification of other competing technologies, analysis of financial tools and sales and distribution channels to promote their commercialization.

Main Achievement to date

The following achievements have been made to date:

1. A waste census was conducted to find the availability and distance to the WWTPs (100%)
2. The adaptation of the mathematical model ADM1 for manure digestion was carried out (80%)
3. The reengineering of the software developed in previous project is in progress of completion (85%)
4. The existing demo plant has been modified (100%)

The latest developments regarding the status of implementation of the lifecodigestion project can be found here: https://www.lifecodigestion.com/en/project-actions/

Partners
Global Omnium Águas do Centro Litoral Finnova Foundation

Lessons, replicability and scalability potential

LIFE ECOdigestion 2.0 replication plan will show the potential to replicate and continue with the results obtained in this project. The team aims to obtain a close to market solution that will be commercialize at European scale. Moreover, LIFE ECOdigestion 2.0 has the potential to scale up through a possible LIFE ECOdigestion 3.0 or other EU funded opportunities.

Affiliation
FINNOVA

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Website
https://www.lifecodigestion.com/

E-mail address
juanmarevuelta@finnova.eu

Nexus Dimensions
Ecosystems
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Food
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City
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