

# POSITIVE ENERGY BALANCE BY CODIGESTION IN THE GRANOLLERS WWTP

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## Abstract

The landscape is changing as technologies and concepts are being developed to allow plants to be energy independent or even net energy producers.

In order to do the Wastewater Treatment energetically sustainable, there is a commitment to enhance the use of biogas, and therefore, for technologies that increase its production. The codigestion process is one of the alternatives and compared to other technologies that aim to increase biogas, the codigestion achieve a 100% increase, while the others range from 20-30%.

The codigestion is based on adding industrial wastes in the digestion process, and depending on its nature, there is a particular potential of biogas production.

## Keywords

WWTP; sludge anaerobic codigestion; industrial waste characteristics; biogas production; electricity generation.

## INTRODUCTION

The Wastewater Treatment Plant (WWTP) Granollers, with a treatment capacity of 30,000 m<sup>3</sup>/day, has had anaerobic digestion for sludge treatment since 1998. This line of treatment processes around 2,000 tons of annual dry matter and it produced 1 M Nm<sup>3</sup> of biogas annually. Since November 2009 and after the installation of a cogeneration engine of 499 kW, the biogas has been used in order to produce and export electrical energy.

The potential electricity generated from biogas is estimated between 30% and 50% of the total energy consumed by the WWTP.

In the case of Granollers WWTP the average energy production before the implementation of codigestion process was 3,700 kWh/day (40% of total consumption of the WWTP), far from the 12,000 kWh/day that could be provided by the cogeneration engine installed.

## Background

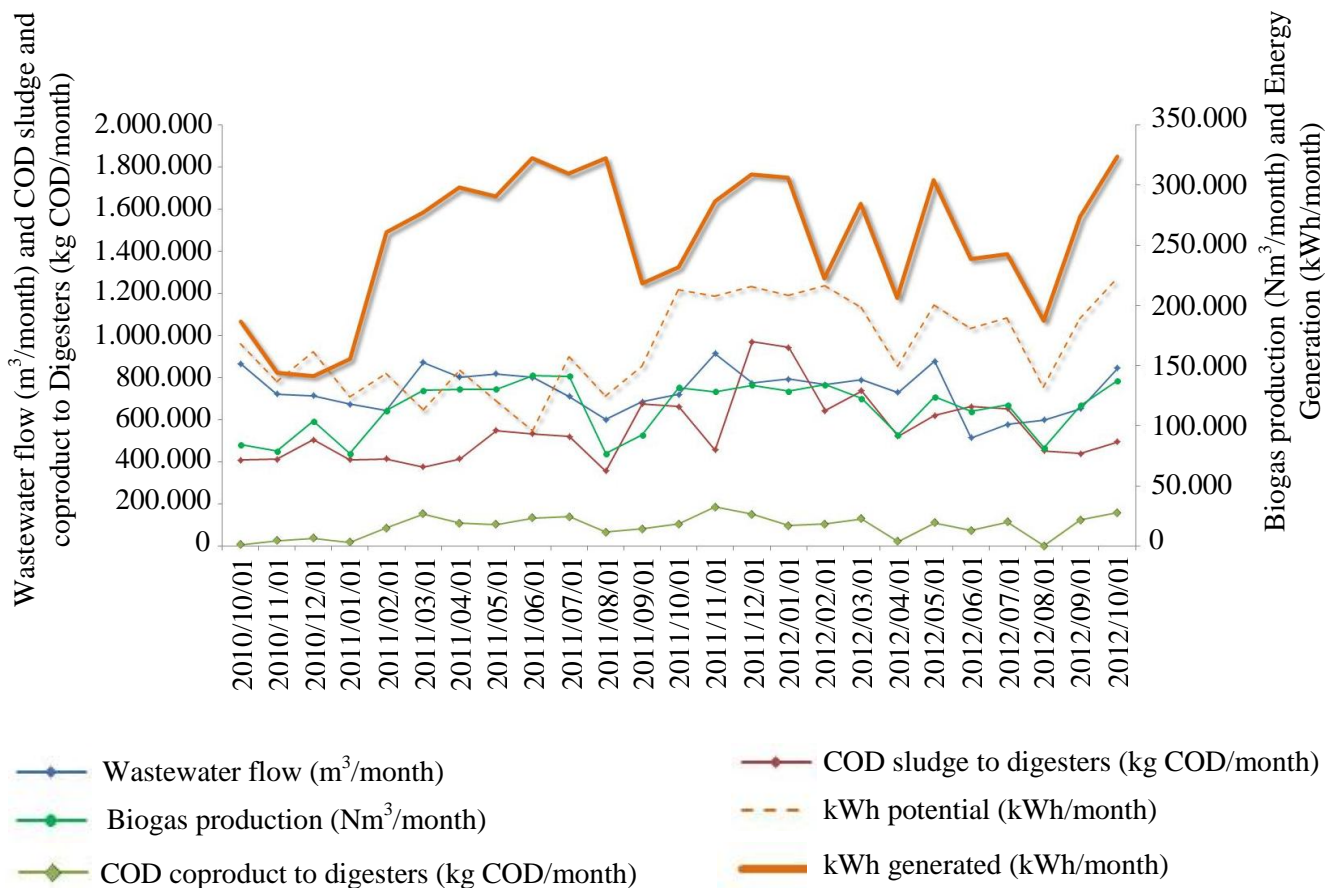
For the implementation of the codigestion process there a prior study was performed in which a series of industrial waste was identified, which are energetically recoverable as coproduct for the sludge anaerobic codigestion. This industrial waste is characterized by: (1) having a high concentration of carbonaceous material which is rapidly biodegradable anaerobically, (2) they are not toxic for the sludge anaerobic digestion process, (3) they are not toxic for the use sludge, (4) they have a negligible concentration of phosphorous and nitrogenous matter and anaerobically non-biodegradable compounds, (5) they do not generate an increased production of final sludge and (6) they are produced in sufficient quantity to ensure continued operation of codigestion anaerobic processes and, consequently, of production of biogas.

## The Codigestion process



In October 2010, after performing the formalities with the “Consorci per a la Defensa de la Conca del Riu Besòs” and “Agència de Residus de Catalunya”, the feeding of the anaerobic digesters with these coproducts was initiated in a progressive and stepwise manner, starting with concentrations of less than 2% of the total COD treated and reaching up to concentrations of 25%. This coproduct

injection increased biogas production from 84,000 Nm<sup>3</sup>/month to over 150,000 Nm<sup>3</sup>/month, which ensures the production and maximizes the energy generation to 12,000 kWh/day. This energy generation transforms the Granollers WWTP into a facility of positive energy balance: the energy produced by the process of sludge anaerobic codigestion is greater than the energy consumed by Granollers WWTP itself (125% of the WWTP total consumption). The results shown in Figure 1, begins with the addition of coproduct in October 2010.

**Figure 1.** Biogas production and energy generation before and after the Codigestion.



To manage and optimize in real time the process of sludge anaerobic codigestion and the biogas cogeneration, two advanced and intelligent controls were implemented:

- (1)  which is a system that manages and monitors the co-digestion process, and establishes and manages the delivery product to the anaerobic digester based on the process state and the established biogas production set point, and (2)  a control that optimizes, manages and monitors the engine cogeneration together with the co-digestion process .

The anaerobic codigestion implementation in Granollers WWTP has been accompanied with a detailed study of the process, of the biogas produced, of the final sludge generated and its treatment. The obtained results did not indicate any change in the physical and chemical parameters of the process, and at the same time has not been observed any change neither in the composition of the biogas and of the digested and, consequently, nor in the treatment thereof.

## Results – economic impact

The Codigestion has allowed to use to the maximum the installed engine and to export all the generated energy supposing an important economic benefit. These results are shown in Figure 2.

**Figure 2.** Energy consumed vs energy produced, and energetic cost

