

Italy Demo Case

Ex-situ BioMethanation

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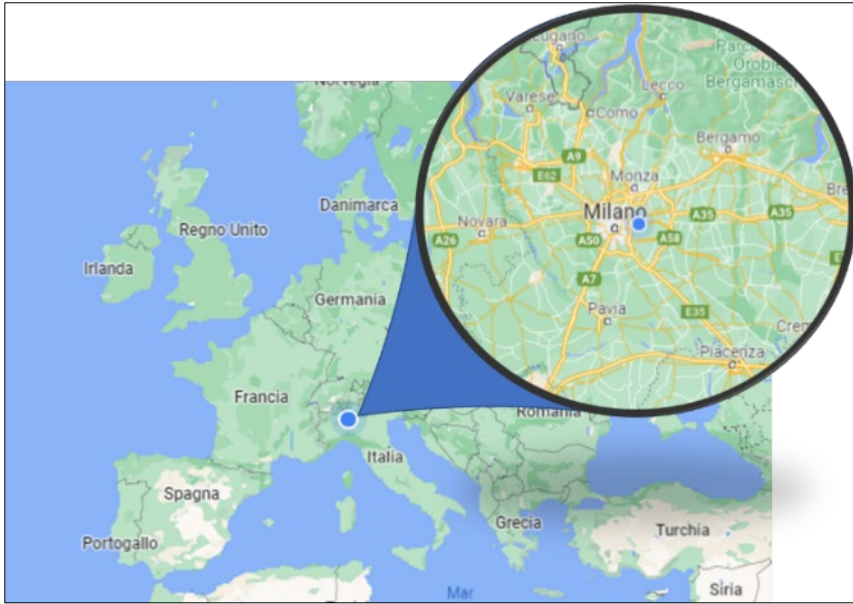
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Brief description of the site



Experimental site for the Italian case will be the Wastewater treatment plant of Bresso-Niguarda, which is located in the city of Milano and managed by CAP.

It is a 320.000 P.E. urban wastewater treatment plant, with two parallel anaerobic digestion lines for sludge treatment and valorization to biogas.

In 2018 in the Bresso-Niguarda WWTP was installed the first biogas upgrading plant to obtain biomethane from sewage sludge-produced biogas.

Currently, the plant produces about 600.000 m³ per year that are injected to the national distribution grid.



Challenges

pre-treatment via ozonolysis

avoid ineffective transfer yields and malfunctions related to clogging problems

Ex-situ biological upgrading

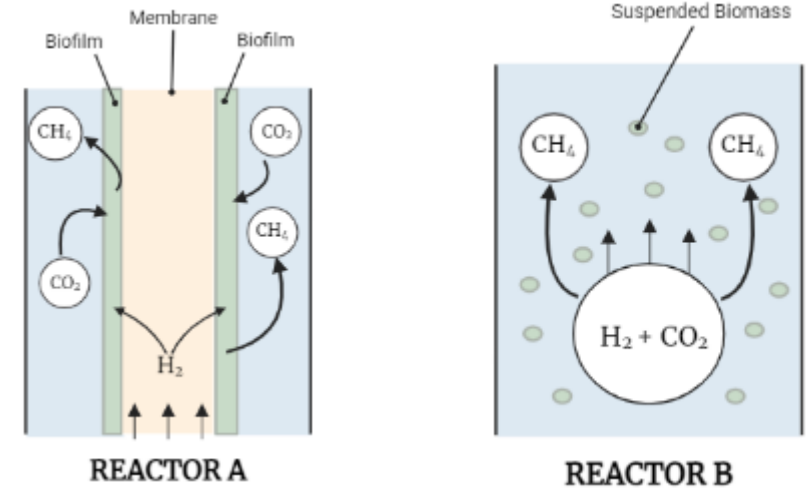
Increase the efficiency of the mass-transfer of hydrogen into the medium that highly influence the process yield

Co-digestion pilot

Fast and reliable analytical tools for supporting of digester modelling are currently one of the main bottlenecks for process modelling integration at real scale facilities.

Overall

Develop a comprehensive framework to evaluate the synergies between pilots optimizing the aggregated impacts



What done so far

From Concept to Experiment: Initial Laboratory Tests

Lab Ozonolysis tests:

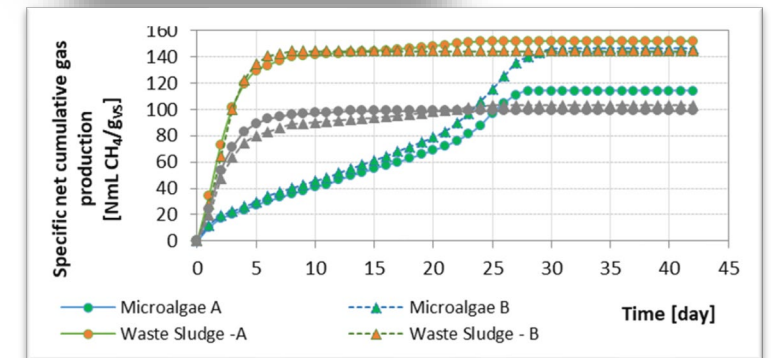
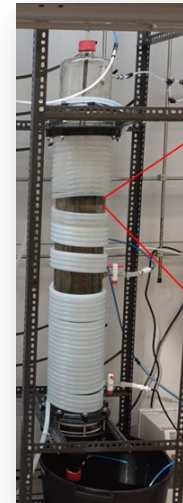
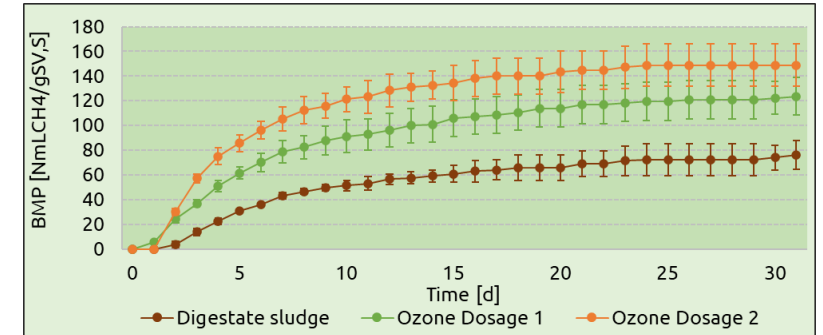
- BMP evaluation on different Ozone dosages tested
- Evaluation of solubilization of COD and proteins
- TSS reduction
- Mineralization effects evaluation

Lab EBM Experimental Campaign:

- Gas Transfer Membrane (GTM) selected and tested.
- Inoculation of 1 GMT and first lab test of H₂ conversion
- Biofilm H₂ conversion rate evaluation
- Nutrients and alkalinity consumption monitored and balanced

Co-Digestion Tests:

- Evaluation and comparison of anaerobic degradability of sludge, microalgae and sludge/ microalgae mix
- Batch BMP tests
- Semi-continuous codigestion trials at laboratory scale (on-going)



What done so far

From Data to Design: Information Gathering and System Engineering

Ozonolysis contact reactor design and construction:

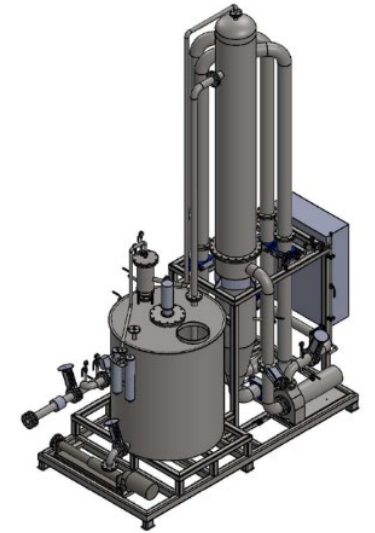
- Contact reactor layout (P&ID and constructive design)
- Remote control and automation system established for continuous operation
- Automated safety system of the process
- Electrical design
- Procurement and acquisition of all apparatus needed.
- Construction

EBM Design and construction:

- Input data: Min-max GTM Q/P/T° specifications.
- Selected fine bubble diffuser
- Online/remote monitoring and control devices defined
- P&ID and reactor layout developed for pilot plant builder.
- Process control logic established
- Construction of the pilot

Microalgae Reactor and Co-digester:

- **Raceway:** Focus on verifying productivity; optimizing operational conditions
- **Co-digester:** Revamping of existing pilot-plant (new gas counter; improved gas-line; more robust feeding line), Organizing transportation to Bresso WWTP



What done so far

From Concept to Concrete: Substantial Project Construction Completed



- **Site preparation:** basement structural design and construction; Piping configuration.
- **Security authorizations :** Fire Prevention Certification (CPI) and compliance with ATEX regulations.
- **Integration of the ozonolysis** pilot into the plant's logic
- **Revamping of conventional membrane upgrading** unit achieved through collaboration with the engineers of the Bresso WWTP.



Future activities

Continuing lab tests and experimentations

Finalization of the installation of the pilots

Pilots commissioning and starting operations

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Pilot experimental design assessment and optimization



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