In a few words..

HERA, VALMET, and AYRION have joined their forces and expertise to achieve the goal of the LIFE STEAM project, which is to create an industrial prototype for converting waste wood biomass into biogas/biomethane through a biological process.
The biomass after the steam explosion process is able to produce more than 3 times the biogas produced by untreated material.
The project results have demonstrated the technical feasibility of the technology and indicated that economic and energy sustainability is achievable with a full-scale plat.
The lignocellulosic biomass treated with this process can make a significant contribution to achieving European decarbonization goals and biogas production targets.

www.lifesteam.eu

www.linkedin.com/company/lifesteam/

www.gruppohera.it

www.ayrionsustech.it

www.valmet.com

LIFE STEAM project has received funding from the LIFE Programme of the European Union under Grant Agreement LIFE18 ENV/IT/000092.

LIFE18 ENV/IT/000092

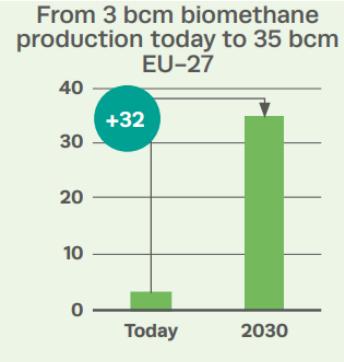
www.lifesteam.eu

LEYMAN's REPORT

the LIFE STEAM project

Green waste valorization for biogas and biomethane production through an innovative steam explosion system.

The goal



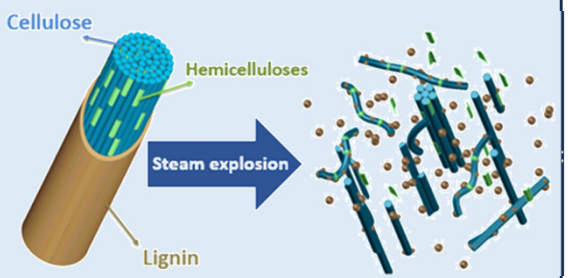
Biomethane is a sustainable alternative to fossil gas, which can be stored, distributed and used according to demand.
Biomethane can play a significant role towards achieving the EU's clean energy objectives. It can also be used to further diversify the EU's gas supplies, phasing out Europe's dependency on Russian fossil fuels and reducing the exposure of consumers to volatile natural gas prices.

For these reasons, there is a clear need to **scale-up biomethane by 2030**, as outlined in the REPowerEU Plan of 18 May 2022. As a renewable and dispatchable energy source, increasing the production and use of biomethane also helps to address the climate crisis. The EU's biomethane production, either as biogas or its upgraded version, needs to reach **35 billion cubic metres (bcm) per year by 2030**

The **green waste** collected in Europe constitute an important feedstock that, through appropriate pretreatments, can significantly contribute to achieving biogas production targets.

The **LIFE STEAM** project goal was to **develop a prototype at industrial scale** based on the **steam explosion** process in order to treat efficiently **green waste** to be utilized in the anaerobic digestion process to produce **biogas.**

Steam explosion explained:
High-pressure steam treatment breaks the bonds between cellulose and its protective structure made up of lignin. The cellulose, freed from its protective "shell," becomes available for bacteria that can convert into biogas.



The partnership

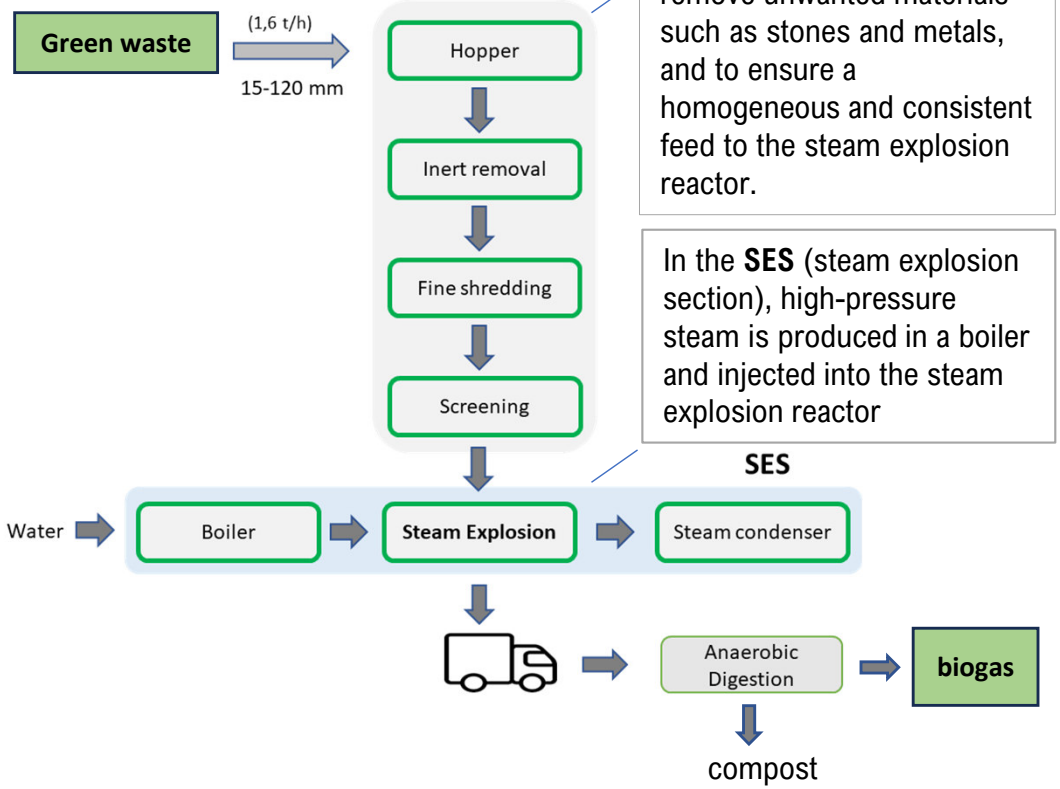
HERA S.p.A, the LIFE STEAM project Coordinator, is one of the Italian largest multi-utilities operating in environment, water and energy sectors. Managing 80 treatment plants for the recovery and disposal of municipal and special waste, Hera has been producing renewable electricity from biogas generated by organic waste since 2009;

AYRION S.p.A. is an Italian company active in the research, consultancy, production and commercialization in the renewable energy sector. AYRION is shareholder of five biogas plants in Italy where electrical energy is produced from renewable sources such as biomasses and by-products from the agro-food and poultry sector.

VALMET AB is a Finnish company in the field of the development, design, engineering, manufacturing and marketing of process equipment, systems and services, related to the processing of lignocellulosic materials and raw materials for pulp, paper, panel board, energy and power production, and the emerging area of biorefinery products worldwide.

The project

The LIFE STEAM prototype, built at the Ozzano dell'Emilia (BO) site, is capable of treating up to 1.6 tons of green waste per hour.



The steam-exploded material is transported by truck to the anaerobic digestion plant in Voltana, near Ravenna. During the anaerobic digestion process, the cellulose in the biomass is converted by bacteria into biogas. The solid residue that remains after the process is converted into compost, a natural fertilizer useful for agriculture.

DURATION: 01/09/2019 – 30/06/2024

TOTAL BUDGET: **2.568.578 €**

EU CONTRIBUTION: **1.350.154 €**

The biomass in cleaned, shredded and screened before entering the reactor

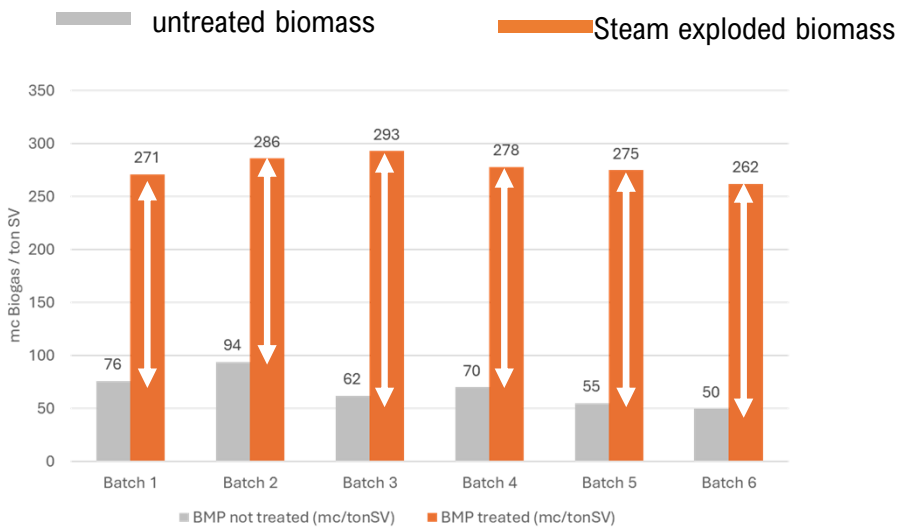
The reactor is continuously fed with biomass and injected with high-pressure saturated steam, operating at around 16 bars

The output of the reactor passes through a cyclone to separate the solid exploded biomass from the steam, which is condensed and sprayed onto the biomass to increase the moisture content.

The steam exploded material is then transported by track to the anaerobic digestion plant of Voltana, near Ravenna.

The results

Biogas production:
The results collected during the project have confirmed a significant increase (about 3x) in biogas production from lignocellulosic material subjected to steam explosion treatment.
Both laboratory tests (BMP) and biogas production at the Voltana anaerobic digestion plant have indicated that, by optimizing treatment conditions, it is possible to achieve a producibility of around 300 cubic meters of biogas per ton of treated material



Inhibition effects:
During steam explosion, due to the high temperatures reached (around 200°C), compounds that can inhibit the activity of anaerobic bacteria may form, potentially reducing or blocking biogas production. During the 6-month experimentation period, no inhibition phenomena of the anaerobic digestion process were observed at Voltana, and chemical analyses reported non-concerning concentrations of inhibitors.

Technical reliability:
During the experimental phase, numerous technical challenges were successfully addressed, related to the quality of the input material, steam management, and the definition of optimal operating conditions. A good operational continuity was gradually achieved, which made it possible to produce the necessary quantities of material for the experimentation.


untreated biomass


Steam exploded biomass

Energy balance and business plan:
During the experimental phase, a series of parameters were measured to estimate the energy and steam consumption and other utilities of the plant. The collected data allowed for the execution of an energy balance, which proves to be positive starting from sizes approximately five times larger than that developed in the prototype. Thanks to its size, the plant is able to efficiently reduce and regulate steam consumption

Based on the experience gained and the data collected, a business plan has been developed for a full-scale plant. This facility will be capable of processing approximately 100,000 tons of green waste per year, with a theoretical production of 9,3 million cubic meters of biomethane.