

CO-BUILD THE TREATMENT OF SOLID AND LIQUID WASTE

INFORMATION PACK

cométha



l'agence
métropolitaine
des déchets
ménagers

SIAAP
Service public de l'assainissement francilien

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INTRODUCTION

Cométha is Syctom's and SIAAP's shared project for the treatment of solid and liquid waste.

It aims at an optimal production of biomethane starting from methanisation and other innovative processes.

After a research and development phase, two groups will build and operate two pilot units over several months.

With time, an industrial installation could be built.

Syctom is the first European public operator of household waste treatment and recycling, covering an area of nearly 6 million residents, i.e. half the population of the Île-de-France Region.

SIAAP, the Interdepartmental Syndicate for Sanitation of Greater Paris, is the reference public player for the sanitation of domestic and industrial waste water and stormwater, serving 9 million inhabitants.



Cométha: designing a shared solution for sustainable and efficient treatment

PARTICIPATING IN SUSTAINABLE DEVELOPMENT

Syctom and SIAAP ensure essential missions of public interest: the treatment of domestic waste and sanitation of waste water. When it comes to public city services, manufacturers and energy producers, Syctom and SIAAP make environmental preservation a strategic priority. Cométha participates directly in **achieving international, national and regional goals, by aiming to increase the production of biomethane with innovative technological solutions that respect the environment.**

The action of Syctom and SIAAP is part of the international agenda in addressing many of the Sustainable Development Goals (SDGs) on the United Nations 2030 Agenda.

At national level, Syctom and SIAAP participate in achieving the objectives set by the Energy Transition for Green Growth Act, which includes in particular a factor 4 reduction in CO₂ emissions by 2050 and an increased share for biogas (7% of consumption in 2030). Additionally, according to French gas distribution and transport operators, achieving a 100% renewable gas mixture is possible by 2050, through methanisation, pyrogasification, hydrothermal gasification, methanation, etc.

Finally, at local level, the Île-de-France Region that covers Paris and its metropolitan area, in its Energy Climate Plan, provides for renewable energy to represent 40% of consumption in the Île-de-France Region in 2030 and 100% in 2050. In time, Cométha will offer a local, sustainable supply.

THE SUSTAINABLE DEVELOPMENT GOALS TARGETED BY COMÉTHA



ANTICIPATING THE EVOLUTION OF THE REGULATORY CONTEXT

The respective strategies of Sycotom and SIAAP are based on the evolution of practices and related treatment needs so that the two providers can **ensure the continuity of public services with installations suited to the nature and volume of the waste collected.**

Their strategies also take into account the evolution of the regulatory context. Specifically, Cométha should explain to Sycotom and SIAAP the alternative solutions to returning to the soil for the recycling of certain products.

In fact, in the management of sewage sludge, the return to the soil is traditionally carried out via spraying or composting. However, the growing expansion of farming areas, increased complexity of constraints of management and research for more effective recycling of the deposits of biogas require research into other forms of sustainable and proximity recycling.

For waste management, major developments are in progress and will accelerate in the years to come: the deployment of separate collection of biowaste, the end of landfills and improved energy performance of plants.

The treatment solutions are known, except for some residual waste, like wet waste, likely to remain in domestic waste even after the deployment of separate collection of biowaste, and for which return to soil is not desirable.

These two liquid and solid types of waste - sewage sludge and the wet part of domestic waste - share the same high content of organic matter and **their common treatment offers interesting perspectives in terms of energy recovery and material recovery.**

COMÉTHA MUST EXPLAIN
TO SYCTOM AND
SIAAP THE ALTERNATIVE
SOLUTIONS TO RETURNING
TO THE SOIL FOR THE RECYCLING
OF CERTAIN PRODUCTS



THE PERSPECTIVES OFFERED BY COMÉTHA

Cométha offers an experimental ground for many promising processes and practices in waste treatment and waste water sanitation.

The comethanisation of waste of various sources is nothing new, and Cométha aims at showing that a common treatment achieves an energy and environmental balance much higher than that achieved by separate process chains. Thus, Cométha conducts research into several ways: optimisation of existing processes, research and development of devices for preparation and pretreatment, etc.

Cométha is also the opportunity to evaluate the thermal treatment processes alternative to incineration, notably pyrolysis, hydrothermal carbonisation and gasification.

They find a very interesting place in a complete chain of treatment, as they enable us to:

- ▀ maximise the production of synthesis gas, a large part of which is recyclable as biogas;
- ▀ produce residues in minimal amounts;
- ▀ achieve the energy balance of an entire chain.

Methanation is a process complementary to thermal treatments that enables more biogas to be produced from synthetic gas.

In sum, Cométha allows the study of a number of technologies for the recovery of nitrogen and phosphorus, essential nutrients for farming. France has no primary sources of phosphorus, whose supply is considered essential.

A FEW DEFINITIONS

METHANISATION is the production of biogas and digestate through a biological process of degradation of organic matter in the absence of oxygen. **BIOGAS** is a gaseous product consisting essentially of methane, carbon dioxide and water vapour. Once purified, it forms **BIOMETHANE** (consisting of over 97% methane) that can be injected in the natural gas distribution network or used as fuel for some vehicles. **DIGESTATE** is a solid wet product consisting of organic matter not degraded by methanisation and of mineral matter. In the case of Cométha, digestate is transformed with **THERMAL TREATMENTS** (pyrolysis, gasification, carbonisation, etc.). With the action of heat and/or pressure and in controlled atmosphere and oxygen, these processes transform part of the digestate into **SYNTHESIS GAS**, essentially consisting of nitrogen, carbon dioxide, carbon monoxide, methane and hydrogen. This synthesis gas can be recycled to produce heat or converted to biogas through **METHANATION**.

CROSS INTERVIEW

Martial Lorenzo

Director General
of services, Sycptom

Jacques Olivier

Director General, SIAAP



Cométha, a bridge connecting the waste and sanitation sectors

In what way does Cométha represent a major evolution of Syctom's and SIAAP's practices?

J. O.: With their size and role, Syctom and SIAAP have specific responsibilities, including the innovation of general interest. Cométha demonstrates the engagement of our two public services and illustrates the emergence of a transversal approach between our two sectors.

M. L.: Syctom and SIAAP have already worked together in the past, but Cométha has created an open dialogue, sustainable and permanent, both between us, and also with the research, business and expertise sectors.

Why is Cométha the representative of the goals of Syctom and SIAAP?

J. O.: Cométha shows that we are slowly transforming our water treatment plants from decontamination sites to transformation sites for the recycling of resources. This project showcases the approaches of SIAAP, translated into the SIAAP 2030 strategic plan.

M. L.: Cométha addresses a number of strong commitments of Syctom: boosting the cooperation between the public services, a search for effectiveness and innovation. We hope that the benefits of this work will be shared in time with all the communities affected.

What are the challenges you need to address to continue the project?

J. O.: We will follow very closely testing on the various processes in order to evaluate precisely their opportunities, limits, risks and impacts. These issues are a priority for Syctom and SIAAP, as they ensure the continuity of public services essential to the lives of millions of residents in Paris and its urban area.

M. L.: Cométha, as many other ongoing projects in France, contributes to the emergence of new treatment technologies and process chains that are part of the environmental and energy transition. We hope that this approach will be followed by the government, notably by changing regulations.

The innovation partnership for the realisation of **Cométha**

A PROCEDURE FOR THE RESEARCH AND DEVELOPMENT AT THE SERVICE OF PUBLIC ACTION

Cooperation constitutes one of the three main issues of the UN 2030 Agenda, mentioned in SDG No. 17: “*Encourage and promote effective public, public-private and civil society partnerships*”. Cométha addresses this goal directly by proposing a new partnership framework between public institutions, research institutes and businesses, promoting the emergence of innovative approaches and creating an experimental ground for cutting-edge technologies.

As regards their expectations in terms of innovation, Sycotom and SIAAP have chosen **to create a partnership of innovation.**

It creates competition among several groups, in a setting that promotes research and development projects, enabling the emergence of game changing solutions.

The groups—consisting of businesses, laboratories/universities and startups—are paid for their work, receive the means necessary for their research and are protected in terms of intellectual property.

Hence, clients obtain a customised treatment system, currently not available on the market, within a reasonable period of time and without reopening the competition following the first steps of R&D.

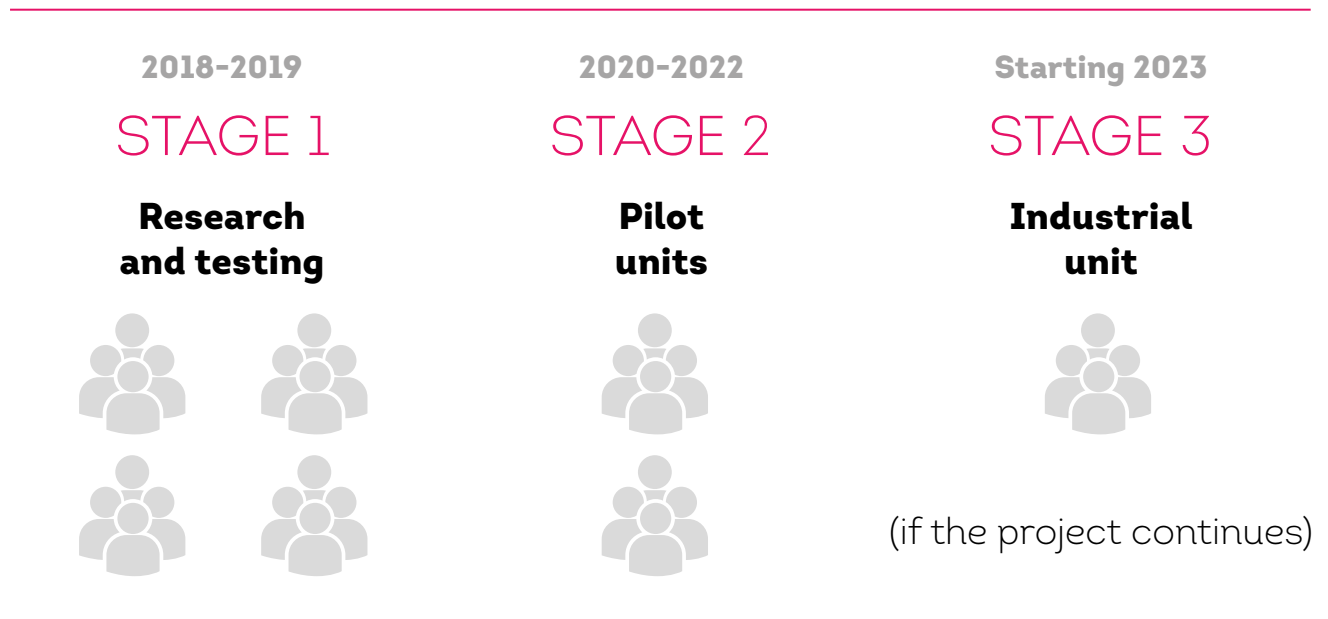
THE STAGES OF THE INNOVATION PARTNERSHIP

Syctom and SIAAP have opted for a 3-stage innovation partnership. Gradually, **they select the projects that seem to be the most promising and that best meet their expectations.**

During the 18 months of Stage 1, four groups have designed treatment process chains, based on the information provided by Syctom and SIAAP and their own research and laboratory testing.

This first phase, defining for the future of Cométha, was highly informative for Syctom and SIAAP, particularly by showing the technical opportunity of common treatment of solid and liquid waste.

After this Stage 1, two groups have been selected by Syctom and SIAAP.



Stage 2: building and evaluating two pilot units

THE GOALS OF THE PILOT UNITS

Following Stage 1, focused on research and development, Stage 2 aims at building and using pilot units in order to design an industrial unit.

A pilot unit is a model industrial installation used to confirm the feasibility of what has been designed in the laboratory and to evaluate the performances that it is actually possible to obtain, in conditions that imitate as much as possible those of an actual industrial unit. Pilot units do not necessarily operate continuously.

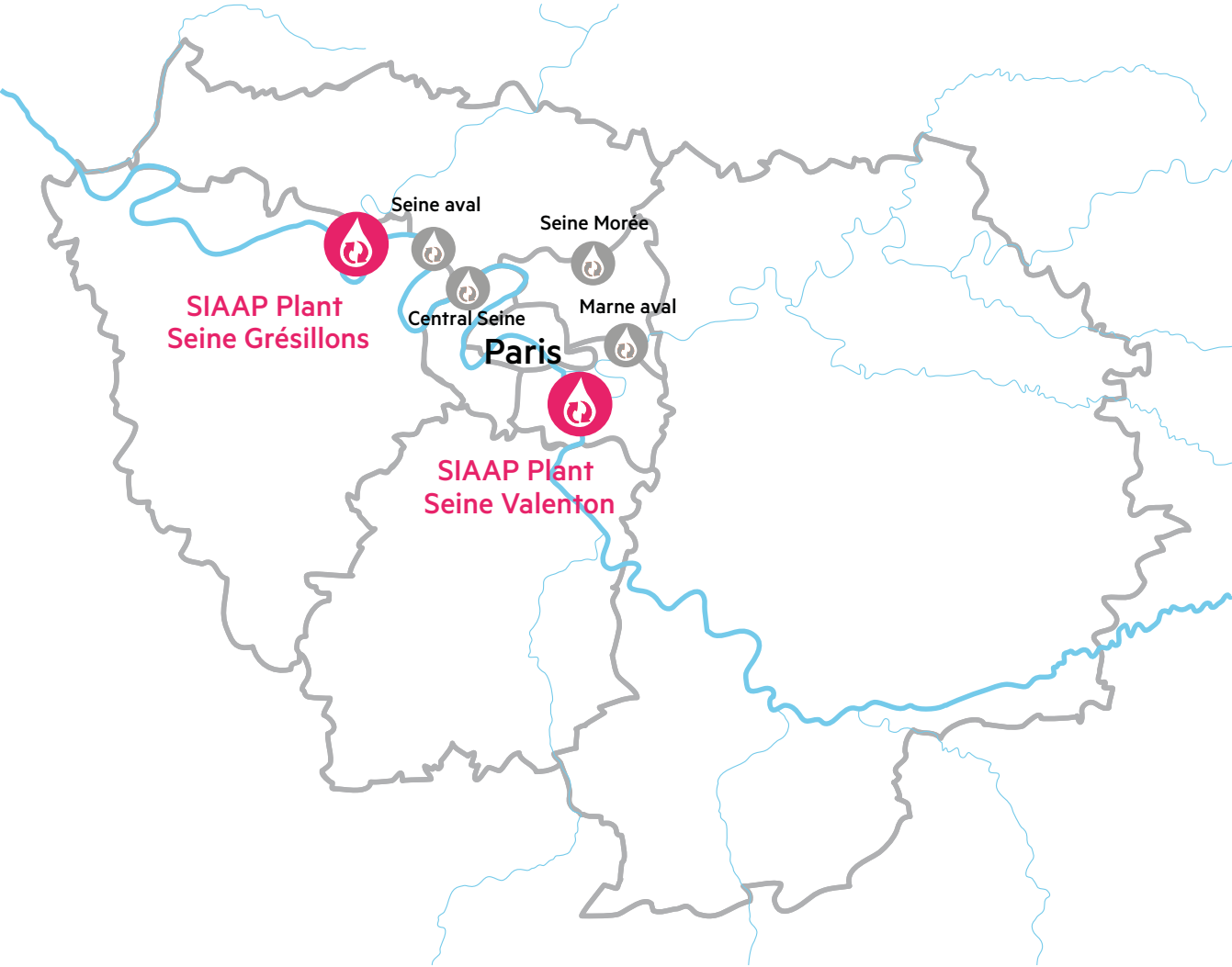
Hence, Cométha's pilot units will treat very small volumes of solid and liquid waste, generating limited amounts of biogas and producing small amounts of nutrients.

Very different in the way they operate, the pilot units imagined by the groups share the following:

- ▀ the use of a unique mixture of solid and liquid waste;
- ▀ the optimal production of biogas, through the optimisation of methanisation and/or of other production technologies;
- ▀ the reduction of the volume of solid by-products, through the use of thermal processes.

The pilot units are built in the SIAAP plants, in Seine Valenton (Val-de-Marne) and in Seine Grésillons (Yvelines). These installations do not affect the installation of the future industrial unit.

THE INSTALLATION SITES OF THE PILOT UNITS



THE PILOT UNIT OF THE **JOHN COCKERILL - SOURCES** GROUP

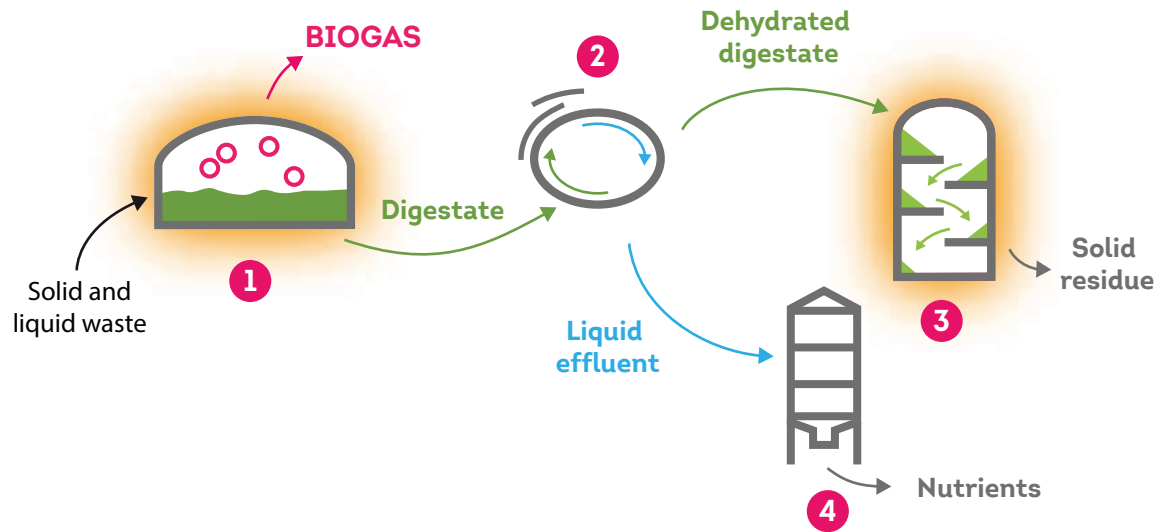
This group is led by the European group John Cockerill, associated to the French company Sources, builder of water treatment plants. The two companies work with two French academic partners: UniLaSalle Beauvais School of Engineering and Université de Technologie de Compiègne (UTC).



Olivier Bernat
*Technical Director
John Cockerill
Environment Division*

Cométha offers us the opportunity to innovate in a secure environment and develop an approach in very close collaboration with partners of university laboratories. After 18 months of research, our group has designed a solid process chain, consistent and able to meet Cométha's highly ambitious goals. The treatment process we propose is consistent with what we had initially planned, even if we have replaced drying with high-temperature pyrolysis. We have identified very clearly the main challenges to address in Stage 2. One of them is to confirm the effective operation of our pyrolysis reactor with the digestate produced by comethanisation, a product that has never been treated by this type of equipment.





1 Two-stage methanisation in liquid form

The John Cockerill - Sources group owns a two-stage methanisation process in liquid form. It makes the waste treatment more reliable and optimises the various methanisation stages. The conversion of organic matter to methane is thus improved.

2 Dehydration and drying of the digestate

3 High temperature pyrolysis

To recycle the digestate resulting from methanisation, the John Cockerill - Sources group uses high temperature pyrolysis (about 900°C). Unlike incineration, pyrolysis intervenes in the near absence of oxygen. This treatment produces a solid residue rich in minerals whose possible uses are still to be explored.

4 Recovery of nutrients

THE PILOT UNIT OF THE **GICON - TILIA** GROUP

This group is led by the German company GICON and its French subsidiary France Biogaz, designer and builder of methanisation plants, associated to the French-German company Tilia, specialised in the piloting of energy projects. The group incidentally comprises two German research institutes, Deutsche Biomasse Forschung Zentrum and Fraunhofer IGB.

GICON[®]
Bioenergie GmbH


francebiogaz


tilia

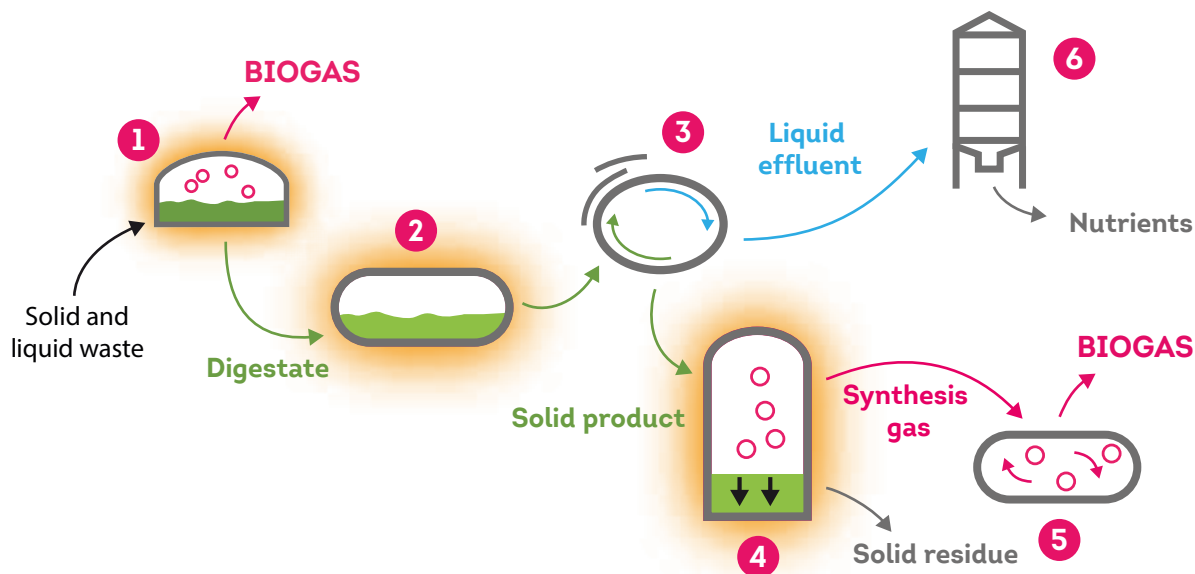

DBFZ


Fraunhofer
IGB



Christophe Hug
CEO Tilia

It is by constantly addressing needs that true innovation is developed: Cométha encourages and secures this innovation, by promoting a close cooperation between manufacturers and clients. In this spirit, in Stage 1, our group has proposed to Sycotom and SIAAP a test protocol that combines all ideas, compares the combinations and finally retains collectively the safest and most effective solution. Many options remain open for Stage 2, and the pilot unit will allow us to evaluate in conditions that very closely reproduce reality the advantages and limits of technologies and associations of processes, particularly for the recycling of digestate and the recovery of nutrients.



1 Methanisation

2 3 4 5 The recycling of digestate

The GICON - Tilia group offers a combination of several processes for the recycling of digestate. This digestate is initially placed under pressure and at high temperature in a hydrothermal carbonisation reactor. In a series of stages, the solid product is extracted and later gasified. The synthesis gas (or syngas) thus produced is later converted into biogas through a methanation stage.

6 The recovery of nutrients

The effluent resulting from each separate stage is rich in phosphorus and nitrogen. The recovery of these two nutrients is researched by the GICON - Tilia group, which conducts testing on several processes for the recovery of phosphorus (by electrochemical precipitation or by chemical precipitation) and for the recovery of nitrogen.

NEXT STAGES

The pilot units will be built starting early 2021 and will operate for several months to evaluate the performance of the various solutions. After this pilot phase, Sycotom and SIAAP will be able to envision the creation of an industrial unit. The installation site of this unit is not known at this stage. The provisional cost of the operation is estimated at approximately 100 million euros, including the definitive industrial unit.



For more information: cometha.fr/en

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