Biomethane Department

CALL FOR PROJECTS

DIGITAL SOLUTIONS FOR OPTIMISING FEEDSTOCKS AND BIOLOGY IN ANAEROBIC DIGESTION

- **DATE:** 18/07/2023
- **VERSION:** VF
- **TARGET AUDIENCE:** START-UPS, COMPANIES, MANUFACTURERS, BIOMETHANE PRODUCERS, RESEARCH CENTRES/LABORATORIES, UNIVERSITIES, EQUIPMENT MANUFACTURERS
- **CONTACT FOR FURTHER INFORMATION:**

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Disclaimer : This document is a translation of the French specifications document "Cahier des charges – Appel à projets : Solutions numériques pour optimiser les intrants et la biologie en methanisation" available here. In case of ambiguity for the application process, the terms of french version will be used in priority.

SUMMARY

LEXICON

CFP: Call for Projects

Producer: biomethane producer

bcm: billion m3

ABOUT GRDF

GRDF is the main gas distributing company in France and Europe. It is responsible for designing, building, operating, and maintaining the gas distribution network in France, in accordance with the law, the public service contract with the French government and the concession agreements signed with local authorities.

GRDF delivers gas to customers on behalf of all suppliers on the French market, guaranteeing each of them and renewable gas producers free and non-discriminatory access to the distribution network. The company develops the network with the dual aim of ensuring economic balance and equal access to the gas network. Through all its missions and at the heart of its industrial business, GRDF ensures the safety of people and property.

On a day-to-day basis, GRDF carries out the following tasks:

- Design, build, maintain and operate over 200,000 km of gas distribution network under concession;
- Transport gas on behalf of suppliers, with complete impartiality;
- Distribute gas safely to its 11 million customers;
- Promote the use of gas and the profitable development of the network and gas energy;
- Support and connect renewable gas producers to the distribution network on a non-discriminatory basis.

As a key player in gas energy, that has its place in the energy transition, GRDF is strongly committed to this development. By anchoring gas as a vector of transition, strengthening links with local authorities, and making network modernisation a priority, GRDF is at the heart of change management.

ENTITY ISSUING THE SPECIFICATIONS

These specifications are being drawn up by GRDF's Biomethane Division. As part of its public service mission, GRDF is contributing to France's ecological and energy transition by aiming to make its gas networks greener. Its teams are strongly committed to supporting the development of anaerobic digestion. They help biomethane producers to connect their facilities to the gas network for injection and ensure that the biomethane reaches the end consumer.

In concrete terms, GRDF achieves the following:

- Studies to validate the feasibility of injection;
- Connecting anaerobic digestion facilities to the grid, from the injection station to the existing grid;
- Managing the various phases that will validate the possibility of safe injection;
- Commissioning of the injection station;
- Operation and maintenance of distribution networks.

In May 2023, 577 anaerobic digestion sites were producing and injecting biomethane into metropolitan France's networks, including 481 on GRDF networks (83%), with an installed capacity of more than 10 TWh/year.

BACKGROUND TO THE CALL FOR PROJECTS

Europe is implementing an ambitious policy to develop the biogas sector. In 2021, the EU produced 18.4 bcm of renewable gas, or 37 TWh. According to the EBA (EU Biogas Association), by 2050 the EU could be producing 167 bcm, covering up to 60% of its gas requirements.

France is one of the most dynamic countries, reaching a biomethane injection capacity of 9 TWh in late 2022.

Local production of renewable gas is an essential lever for decarbonising energy and ensuring France's energy sovereignty. With this in mind, ADEME has set an ambitious vision for 2050[1] : a French gas system based 100% on renewable gas, with final demand estimated at around 300 TWh.

In line with this ambition and the rapid development of the anaerobic digestion sector, GRDF has set itself the target of achieving 20% green gas in the networks by 2030. This means

[1] https://transitions2050.ademe.fr/cooperations-territoriales

speeding up the development of the anaerobic digestion sector, as well as that of emerging sectors (pyrogasification and hydrothermal gasification in particular).

Anaerobic digestion is the natural biological process of degrading animal or plant organic matter in the absence of oxygen (anaerobic), thanks to the action of multiple micro-organisms. It occurs naturally in certain environments, such as marshes, or can be implemented voluntarily in dedicated facilities.

Anaerobic digestion produces:

- biogas, known as biomethane after purification. Biomethane is injected into networks for industrial use (heat), domestic use (heating, domestic hot water, cooking) or mobility (BioGNV).

- digestate, the by-product of the anaerobic digestion process, made up of bacteria that are surplus to organic and mineralised matter. Digestate can be in liquid or solid form and is used as a natural fertiliser.

However, effective management of this complex process requires an in-depth understanding of the key parameters and mechanisms involved. To maximise the performance of anaerobic digestion plants, it is essential to control the biochemical reaction and maintain optimum conditions.

In-depth knowledge of the feedstocks used, and their properties is of vital importance to avoid undesirable inhibition of the anaerobic digestion reaction:

- Imbalances in the essential nutrients present in the feedstocks can lead to inhibition. For example, an excess of ammoniacal nitrogen can cause toxicity for methanogenic micro-organisms, while a lack of trace elements can limit their growth and metabolic activity.

- Certain substances present in the feedstocks can directly inhibit methanogenic microorganisms, by slowing down their metabolic activity or creating an unfavourable environment for their survival. Compounds such as heavy metals, phenolic compounds or other chemicals present in certain industrial wastes can have an inhibiting effect on the anaerobic digestion reaction.

These imbalances can lead to a reduction in biogas production, an increase in hydraulic retention times or an excessive accumulation of undesirable by-products.

Feedstock and ration management is therefore a key lever in anaerobic digestion, as it directly affects biogas production and the characteristics of the digestate. Some of the challenges are:

- **Seasonality of supply.** The availability of raw materials (feedstocks) varies according to the season, requiring precise planning to ensure a continuous supply of feedstocks throughout the year. The climatic hazards should not be overlooked, which means that strategies need to be put in place, such as diversifying sources of supply, setting up long-term supply contracts and regularly monitoring external conditions that could affect the availability of feedstocks.

- **Diversification of feedstocks.** As mentioned above, it is important to diversify the sources of anaerobic digestion feedstocks in order to reduce the risks associated with dependence on a single resource. This also makes it possible to take advantage of market opportunities (bio-waste, for example).

- **Feedstock quality**. The physico-chemical parameters of the feedstocks must be accurately assessed to guarantee their compliance and compatibility with the anaerobic digestion process. Regular analyses must be carried out to measure dry matter and organic matter content, methanogenic potential, nutrient composition (nitrogen, phosphorus, sulphur, etc.) and the presence of undesirable elements or contaminants.

- **Supply logistics**. Collecting, transporting, and storing feedstocks requires well-organised logistics to ensure that they are delivered on time and in the right quantities. Proximity to sources of supply, adequate storage infrastructure and suitable means of transport are therefore essential aspects in optimising feedstock management.

CHALLENGES OF THE CALL FOR PROJECTS

Through this call for projects, GRDF aims to encourage technological innovation and support the development of digital solutions for the anaerobic digestion sector, to support its development, which should see the emergence of thousands of injection units over the next few decades.

Projects must address at least one of the following issues:

- Know the properties of feedstocks and be able to characterise them in detail in a short timeframe so that operators can control their anaerobic digestion plants as effectively as possible.

- Helping the Producer to make the right decisions about ration preparation/planning and feedstock incorporation according to the physico-chemical needs of the reactor, in particular by simulating the effects of changes in process parameters (e.g. feedstocks) on the process and its products.

- Optimising the anaerobic digestion process in terms of the quantity and quality of the products (biogas and digestate)

SCOPE OF THE CFP

The aim of this call for projects is to develop digital solutions for stabilising and optimising production and providing day-to-day support for all types of anaerobic digestion units. It is aimed at **start-ups, companies, manufacturers, biomethane producers, research centres / laboratories, universities, and equipment manufacturers**[2] capable of proposing innovative laboratory analysis and/or sensors, based on the use of sensors, models and data analysis methods, to respond to at least one of the areas below.

This call for projects focuses on the biological characterisation of feedstocks, which is crucial for stabilising the biology of the reactor and optimising biogas production, but does not cover the logistical and administrative aspects.

Digital solutions can integrate operational and organisational building blocks. They are divided into 2 areas.

Area 1: Biological characterisation and optimisation of feedstocks

The characterisation of feedstocks for the control of anaerobic digestion plants is crucial to stabilising the biological process and optimising biogas production. Innovative characterisation solutions must be simple, quick, and effective to implement. The proposed solutions may be based on innovative laboratory analysis and/or innovative sensors. The aim of the projects in this area is to provide producers with rapid, practical, and accessible solutions enabling them to:

- Monitor the feedstocks available to them (stock) and basic data (source, type of storage, duration of storage, etc.).
- Characterise the properties of these feedstocks and/or the recipe incorporated: organic matter content; water content; chemical composition; degradation potential; biogas production potential.
- Elaborate mix, preparation and incorporation recommendations based on feedstock characteristics.

The proposed solutions will have to be adapted to anaerobic digestion situations where the feedstock sources are varied and changeable, for instance for units treating urban bio-waste. Sensors could be used at feed level.

[2] In the case of a consortium, the principles of the consortium agreement must be specified in the application file: role, skills, complementarity, responsibilities.

In a context of gradual pressure on feedstocks supplies, tools that can characterise all types of feedstock according to market needs and constraints represent a major asset for Producers and will help to secure biomethane production capacity in France.

Area 2: Anaerobic digestion process monitoring and predictive simulation (process parameters / feeding strategies)

The second possible response, which can be seen as an extension of the previous one, consists of helping the producer to optimise and better control the anaerobic digestion process from an industrial perspective, depending on all its parameters, from quantification and characterisation of the material to the production of biogas and digestate.

The proposed solutions could be innovative in terms of software (based on existing site data collected via sensors and/or laboratory analyses) or new sensors combining data analysis and analytical solutions (IR spectroscopy, chemometrics, etc.). Whichever approach is adopted, the choice of measurement and analysis frequency should be consistent with the significant timescale of the process.

The projects features could include:

- Monitoring of the parameters applied to the anaerobic digestion process (such as heating/cooling of the anaerobic digester or agitation).
- Continuous monitoring of key biological parameters, such as the main inhibitors, as well as other measured parameters (such as pH).
- Providing a "snapshot" of the digester's state, at a relevant frequency (depending on residence time and feed rates).
- Recommending actions enabling the Producer to optimise the quantity and quality of its products (biogas and digestate) with an industrial approach.
- Simulating changes in the process, in particular (but not exclusively) by modifying the feedstocks, in order to support the Producer in a continuous improvement approach.

The development and market adoption of these technologies in the anaerobic digestion sector are particularly important to support its industrialisation, adaptability, and resilience. An optimised anaerobic digestion plant doesn't only aim at profitability, but also at extracting maximum energy and nutritional value from the biomass it processes, while minimising the environmental impact).

CALENDAR

The provisional timetable for the CFP is described below.

- Application deadline: 18/07/2023 to 02/10/2023 4pm
- Candidate presentation: week 42 (2023)
- Winner announcement: end of October 2023
- Project launch (T0): no later than 2 months after the winners are announced

SELECTION CRITERIA

The applications will be analysed by a GRDF panel based on the criteria below in order to select the winner or winners.

Overall quality of response	GRDF's CFP are intended to be **concise and effective**. Applicants are expected to provide a concise response (10 pages maximum). The jury will assess the clarity of the response and the completeness of the application.
Experience of the players	Demonstrate the **experience of** the applicant and its partners in developing solutions adapted to anaerobic digestion (or other renewable gases) and/or in the gas sector. Applications in partnership with an **academic player** (university, school, laboratory or institute) are a plus. The integration and links with the unit's manufacturer are clearly exposed (roles and responsibilities, guarantees).
Technical criteria	Projects will be assessed according to the following technical criteria. For sensors: • Autonomy, power supply and energy consumption of sensors • Measurement reliability • Measurement sensitivity • Frequency of calibration and maintenance For software solutions: • Easy to install and use • Connectivity (to external sensors and software)

	• Reliability of predictive models and expected gains for the Producer
Scalability of the solution	This type of innovation will enable the industry to significantly improve biogas production. The criterion of installation complexity will be considered. Applicants will have to prove that the proposed innovation can be installed on as many biogas plants as possible (retrofit and new projects). Solutions based on a business model that benefits as many stakeholders as possible (for example, a collaboratively enriched database) will be highly considered.
Maturity	The **maturity of** the project presented (organisation, budget, objectives, planning) is also a selection criterion.
Innovative character	The **innovative nature of the** proposed project is an asset, in terms of the sensors/instruments used and the methods of analysis. The model for creating and sharing value from data is clearly presented and innovative in its structure.

CONTRACTUAL TERMS AND CONDITIONS

Winner of the CFP

One or more winners will be selected by GRDF.

GRDF's contributions to the project are:

- GRDF's financial contribution to the project, of up to €80,000, at GRDF's discretion;
- Technical support in GRDF's areas of expertise, particularly regulatory aspects;
- Identification of one or two anaerobic digestion sites in France, preferably connected to the GRDF network, for the installation of demonstrator(s).

Considerations for GRDF's involvement in the demonstration project

As a partner in the project, GRDF will have access to at least the following Results:

- Deliverables
- (If case study) Study data collected in the field

Depending on the level of confidentiality of the projects submitted by the applicants, GRDF will agree with the winner(s) on the level of communication and sharing that can be done with the biomethane sector.

The Project Sponsor will retain full ownership of the demonstrator, its previous knowledge and the knowledge acquired.

EXPECTED CONTENT OF THE APPLICATION

Project promoters wishing to apply can do so on the https://innovation.grdf.fr/ platform. A form is to be completed with the information requested and the application file is to be submitted as an attachment.

The application must cover at least the following aspects:

- Introduction of the involved stakeholders;
- Presentation of the project;
- Provisional schedule and main milestones (including expected deliverables);
- Total project budget and GRDF's requested contribution (highlighting the leverage effect for GRDF);
- The ecosystem (players/solutions) into which the project would exist, the collaborative arrangements targeted (in particular, if applicable, the management and future perspective of the databases), and the economic model of the solution;
- The applicant's expectations of GRDF participation.

Pay attention to the banner displayed when your form is validated, as this confirms that GRDF has received your application.