

# RESEARCH & INNOVATION

TRANSMISSION BUSINESS - 2017 REPORT & OUTLOOK

## WHY THIS REPORT?

This document is the second Teréga report on its Research and Innovation (R&I) activities.

It provides an overview of the strategic programmes teams are working on entirely consistent with the new IMPACTS 2025 corporate plan. It exclusively covers regulated transmission programmes and covers the 2017-2019 period, during which the French Energy Regulatory Commission (CRE) is supporting the R&I efforts of gas transporters.



## IN 2018, TIGF BECAME TERÉGA

We have been using our infrastructure for over 70 years to facilitate the transmission and storage of natural gas. Thanks to our wealth of expertise, our passionate and expert teams are able to come up with new solutions to the energy challenges faced by France and Europe.

What can act as a stepping stone between the historical model (centralised and mainly fossil-fuel generated), and the model of the future tending toward a zero-carbon footprint due to a diversified, predominantly renewable energy mix from more decentralised sources?

Our new Teréga brand embodies the spirit of corporate evolution. It also reflects our vision and beliefs: we must take an active part in energy transition acceleration and emphasise the central role of gas in the future energy model.

Our new brand identity symbolises this transformation, to which we are committed via the IMPACTS 2025 corporate plan.

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# ▶ The IMPACTS 2025 INNOVATION Plan

Through Research & Innovation (R&I), Teréga is boosting its dynamic of innovation to address current and future energy challenges.

**Aim: to maintain its position as a reliable gas infrastructure player and to establish itself as an energy transition accelerator.**

The IMPACTS 2025 corporate plan comprises five strategic priorities:

- Guiding the consumer and the market
- Improving efficiency and responsibility
- Increasing our visibility
- Securing and Accelerating
- Reinventing Teréga's DNA

## IMPACTS 2025

The R&I contribution to this new corporate plan is the IMPACTS 2025 INNOVATION Plan focusing on five strategic priorities.

### THE FIVE IMPACTS 2025 INNOVATION PLAN PRIORITIES



INFRASTRUCTURE INTEGRITY



OPERATIONAL PERFORMANCE AND SECURITY



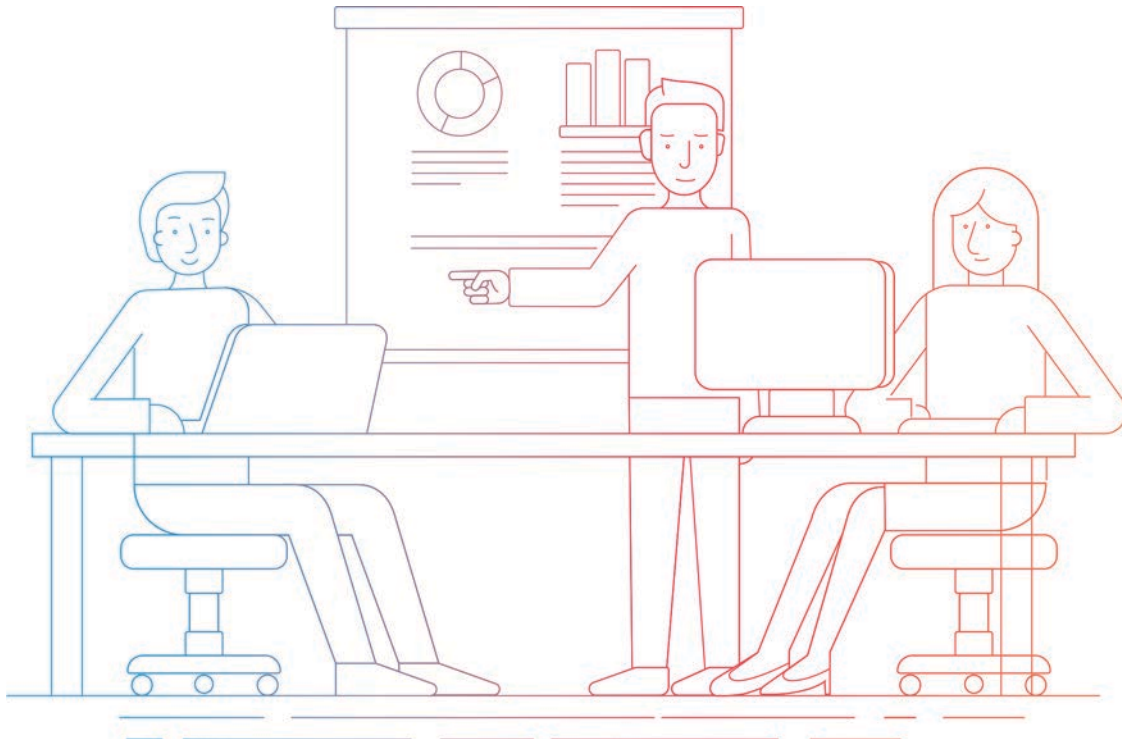
GREENHOUSE GAS EMISSION CONTROL AND ENERGY EFFICIENCY



SMART GRIDS AND NEW GASES



LOCAL INTEGRATION AND ENVIRONMENTAL FOOTPRINT



## ► The role of R&I: to create and predict in line with the energy transition

The main role of R&I is to look into new technologies which could facilitate continuity of supply, operational performance, human safety, structural security and environmental protection. To do this, it tries to optimise working methods and develop client relationships with the help of new digital technologies.

Research is carried out into a range of areas including incorporating gases other than natural gas such as biomethane, hydrogen and synthetic methane. R&I helps the networks prepare to host these new gases by working on different elements such as their quality, acceptance level setting and new flow management.

R&I also aims to position Teréga as a key energy transition player by developing the Smart Grids of the future which will be able to support all energy sources: electricity, methane, heat and hydrogen.

Indeed, because of its flexibility and adaptability, the gas transmission and storage infrastructure looks set to be the natural link between these future Smart Grids. Teréga will use this principle to improve site energy efficiency and reliability, while reducing its environmental impact and maximising the incorporation of renewable energy. Optimised energy conversion systems will be deployed to test and develop the new technologies that will make up the energy system of the future. This will also enable Teréga to fulfil its commitment to achieving a neutral environmental performance by 2020 and a positive performance by 2025 under the BE POSITIVE programme.



# Editorial

## Cécile Boesinger

Head of Research & Innovation

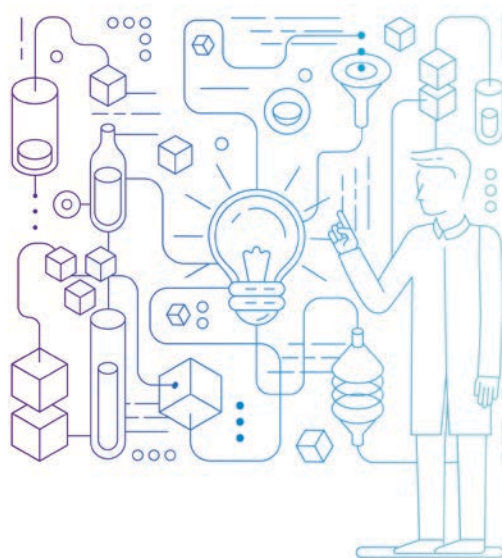
“With the importance of energy transition greater than ever before, Research & Innovation has assimilated the IMPACTS 2025 strategic plan into the intelligence cycle.

This works on two levels:

- Adapting Teréga infrastructure for the arrival of “green” gases;
- Working on projects highlighting the need for real synergy between energy sources and helping us move towards a smart network at the heart of a diversified energy mix.

With these developments, we are aiming to meet the ambitious target of achieving 30% green gases by 2030 supported by gas operators (greater than the 10% required by the French Energy Transition and Green Growth Act).

Of course, our efforts to improve our core business and boost security remain key Teréga priorities.”



### WHAT IS AN R&I PROJECT?

Above all, R&I projects contribute to achieving the ambitions of the IMPACTS 2025 INNOVATION Plan.

As such, although they will present scientific or technical difficulties, Teréga should be able to see them through (with or without assistance from partners). These projects meet new user needs.

R&I projects can therefore be one of three types:

- an improvement to/development of knowledge and practices or any research work required to develop a technological innovation;
- a development to a technology or method involving testing and prototype design;
- a response to a problem with integrating an existing technology or method into the Teréga operational environment which is creating feasibility doubts.

R&I projects tend to take around three and a half years to complete. They then move to a standardisation and deployment stage and go beyond the scope of R&I. At this point, they are then managed by the relevant business teams.

# ▷ A partnership strategy to improve our renown

R&I operates a proactive partnership strategy with three main aims:

- to strengthen and develop the skills of internal teams in key technical areas;
- to support the development of innovative products and services in line with Teréga's activities;
- to feed the dynamic of innovation.

We have a variety of different partners. We collaborate with academic and public entities on early-stage research, with start-ups and SMEs at the development stage, and with other industrial operators to pool efforts at later project stages.

R&I is keen to boost this diversity even further, including with Open Innovation which aims to involve clients, suppliers and partners in a more collaborative way.

Teréga is also supported on its new path by strong and strategic partnerships with other energy players. One example is GRTgaz, with which we run several joint projects. The aim? To enable R&I to establish a beneficial collaborative framework where common issues can be shared and efforts pooled over the long-term. R&I is also a member of various research organisations and associations in France and elsewhere (GERG - European Gas Research Group, EPRG - European Pipeline Research Group, CITEPH - Collaborative Technological Innovation in Energy Domains, ITTECOP - Land Transport Infrastructures, Ecosystems and Landscapes, etc.).



## FIND OUT MORE

**CITEPH (Collaborative Technological Innovation in Energy Domains)** is a programme run by the **EVOLEN Oil and Gas Suppliers' Industry Association** which aims to facilitate relations between start-ups, SMEs and SMIs undertaking innovative projects and industrial sponsors such as Teréga.

This programme allows Teréga to gain contacts in the external R&D ecosystem and run projects with optimum financing.

**50**   
**STAFF WORKING ACROSS A VARIETY OF ROLES AT TERÉGA TO MEET NEEDS IN THE FIELD**

 **Over 30**  
**TRANSMISSION BUSINESS PROJECTS**

 **€13M**  
**BUDGET APPROVED BY THE CRE FOR 2017-2019**

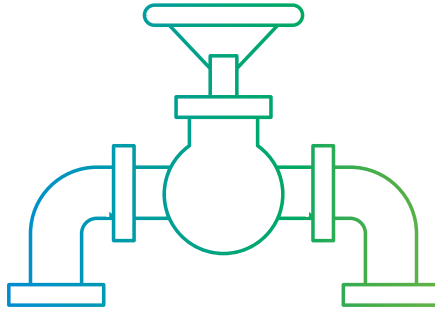
 **Over 40**  
**PARTNERS**

**Infrastructure integrity:**

using the best tools  
and methods to  
protect and inspect  
our pipelines







## Two questions for Rémi Lancien

Head of Inspection Service,  
R&I "Infrastructure Integrity" Programme Manager

### Why is the physical integrity of infrastructure so important?

Teréga is a European gas company. As such, we are responsible for keeping our facilities secure, reliable and available, while also optimising costs and performance. The role of R&I is to improve pipeline protection and inspection techniques because these structures present significant technical challenges. These include: structure accessibility, specific operating conditions, environmental variability, etc.

### What is the aim of R&I in this area?

The programme launched aims to develop and implement innovative technologies to inspect inaccessible structures, such as those encased or buried, without the need to excavate. It also involves being up-to-date with the latest passive protection techniques and methods for new buried structures (pipeline coating) and active protection (cathodic protection).

# ▶ Pipeline inspection and protection: two R&I projects

With over 5000 km of pipelines in its network, one of Teréga's major challenges is ensuring that its structures stay safe and operational.

## 1 - Pipeline defect detection using tomography and cathodic protection (CP) optimisation

### AIMS

Through this project, R&I is hoping to develop direct inspection technology for unpiggable low-diameter pipelines (< 200 mm) which avoids them having to be dug up. The project also aims to better understand corrosion phenomena and therefore improve the effectiveness of pipeline cathodic protection.

### Approach

- Developing and testing a new non-destructive magnetic pipeline inspection technology in partnership with Skipper.
- Pairing this technology with other inspection methods already in use.
- Pooling resources with GRTgaz.
- Looking at cathodic protection (CP) in a volatile environment (sandy soil).
- Studying the properties of epoxy coatings in comparison with traditional coatings.

### Progress

- Analysis and first series of excavations undertaken to pre-validate the method.
- Work continued and partnership established with GRTgaz to carry out joint testing on the same 10-km stretch with two different providers developing the same technology.
- Study carried out into influence of key parameters on buried steel structure polarisation (coupon geometry, soil composition).
- Bibliographic and laboratory study run on the effects of coating screen.

### Client benefits

- Gas network integrity improved and inspection costs optimised.
- Network infrastructure longevity.

### Future developments

- Joint inspections and testing with GRTgaz.
- Continued excavation to validate the method.
- Teréga construction and inspection standards to be updated and corrosion risk identification tools to be improved.

### WHAT TYPES OF INSPECTION ARE THERE?

Teréga uses four specific inspection techniques.

- Surface magnetic inspection, which detects possible metal loss and/or tube deformation.
- Surface electrical measurement inspection, which detects defects in the pipeline coating.
- Instrumented pig inspection, which allows for precise mapping of metal irregularities on the structure.
- Inspection via excavation and visual inspection.



Instrumented pig

## 2 - Innovation in duct inspection

### AIM

Pipeline defect protection and defect detection are essential across the network for gas transmission security and performance reasons. R&I is working on creating a powerful method to inspect the 10,000 ducts in the Teréga network in the most effective way.

### WHAT IS A DUCT?

The word “duct” means a steel or concrete case which protects buried pipelines from mechanical stress created by the external environment such as railway tracks, motorways and rivers. Although ducts help keep structures secure and protect their integrity, inspecting them is an onerous task because they are difficult to access and excavations are expensive (road closures, river crossings, etc. may be required).



Gas pipeline before being lowered into the trench

### Approach

- Making sure duct excavations are only carried out where necessary by developing a model for analysis and sampling (of Teréga's 5000 unpiggable ducts, 224 have been identified as requiring priority inspection via excavation).
- Participating in national and European working groups to identify innovative and non-destructive duct inspection methods.

### Progress

- Threat tree drawn up.
- Duct inspection traceability consolidated and first inspection results considered to improve and confirm the model.
- Inspections undertaken on identified ducts (20 ducts per year).

- MOBIZEN technology identified and in-laboratory testing begun to determine how it could be used.

### Client benefits

- Efficiency improved and costs optimised by adjusting inspection frequency according to structure integrity risk.
- Better duct integrity management.

### Future developments

- MOBIZEN technique testing to be implemented to decide whether it is appropriate for use on encased pipelines.
- If technique approved, it will be deployed for duct inspection.
- Research into other duct inspection techniques to continue including through Teréga's involvement in the GRTgaz Open Innovation Challenge.



### WHY DOES TERÉGA PARTICIPATE IN THE EPRG AND JIP?


Teréga constantly monitors ongoing sector developments, including by participating in the European Pipeline Research Group (EPRG) and Joint Industry Program (JIP) for pipeline transporters.

The EPRG is a European association which addresses issues of common interest concerning the technical integrity of gas transmission pipelines in the areas of pipe manufacture, design, construction, operation and maintenance.

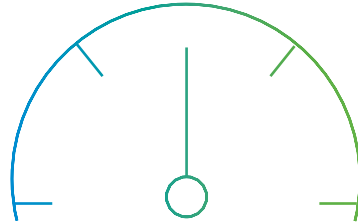
The JIP was formed in 2015 as a collaborative research programme supported by the French Ministry for the Ecological and Inclusive Transition. The 13 different transporter members are able to capitalise on technological progress in structure security, maintenance and monitoring. The JIP also offers the opportunity to undertake specific research.



A pipeline being inserted into its duct under a road



Operational performance and security:  
making use of  
digital technology  
to improve network  
monitoring and  
maintenance



## Two questions for...



### David Carrere

Electricity, Instrumentation and Automated Systems Technician,  
Interim R&I "Operational Performance and Security" Programme Manager



### Jean-Marc Jouanine

Head of Architecture and Technology Department,  
R&I/Digital Consistency Manager

#### How can R&I help with the challenges involved in improving operational performance and security?

**D.C.:** Through the programme, R&I is showing its ambition to develop new monitoring, maintenance and operational systems. First, we would like to deploy at least one automatic network monitoring system. A variety of such technologies are being researched at the moment and the end solution will combine the potential of every solution. We also hope to make new digital predictive maintenance and augmented reality tools available to help operators on the ground work more efficiently. Monitoring and prediction are the watchwords.

#### How can new digital technologies help achieve these goals?

**J.-M. J.:** Nothing is impossible any more.

Indeed, we have not yet fully exploited all the potential of existing technologies. The cloud provides access to almost infinite data storage and processing capacity. Thanks to progress in telecommunications and the exponential development of connected devices, we will be able to know the exact state of our assets in real-time.

Teréga R&I is therefore making use of new opportunities created by big data digital architecture and machine learning - the field of study for artificial intelligence.

Areas covered by the programme target data processing and analysis to create advantages for both the client and the business.

# ▶ New digital technologies serving the network: three R&I projects

For an infrastructure manager like Teréga, network reliability and guaranteed continuity of supply are key priorities. The aim is to constantly improve the service provided by becoming more agile and predicting any network security issues ahead of time.

## 1 - New technologies used in aerial surveillance



### AIM

To better monitor the network and avoid any environmental hazards (e.g. unregistered third-party works), Teréga is looking at innovative ways to improve and automate its network aerial surveillance programme which is currently undertaken by plane or helicopter.

#### Approach

- Experimenting with different aerial surveillance techniques (vertical photography by plane, drone, satellite).
- Pairing vertical photographs with artificial intelligence image processing techniques.

#### Progress

- Drone surveillance excluded for the moment.
- Onboard automatic shape recognition software developed that can instantly compare images with the previous flight.

#### Client benefits

- Surveillance security and reliability optimised.
- Anomaly traceability (auditable system).

#### Future developments

- Vertical photography technique to be developed with EarthCube.
- Whole image capture and automatic processing chain to be deployed in-flight.
- Economic appropriateness of enhanced surveillance using satellite images to be evaluated.



Urrugne switching station

## FIND OUT MORE

Teréga is looking into the possibility of developing an enhanced pipeline network monitoring tool that uses satellite imaging. Research is being undertaken to develop a working pilot. With this technology, the challenge lies in detecting changes in a context of limits imposed by resolution, detection methodology, specific signal processing and associated costs.

## 2 -A “new-generation” fibre optic technology to detect leaks, unregistered works and land movement

### AIM

As well as the potential of fibre optics in telecommunications, an initial R&I project assessed their properties when it came to transmitting data about the state of gas pipelines and their immediate environment. Teréga is currently trying to develop a new and more efficient fibre optic technology that better meets the monitoring needs and specifications of its infrastructure.

#### Approach

- Developing and testing a 3-in-1 fibre optic technology (measuring temperature, stress and vibrations).
- Detecting external pipeline aggressors and potential leaks.

#### Progress

- CITEPH collaborative project launched with Febus Optics start-up and two other partners, TOTAL and SAIPEM.
- Specifications drawn up for controlled-environment ground testing.

#### Client benefits

- Method developed at optimum cost to ensure better remote detection of network activity.
- Network integrity boosted to guarantee continuity of supply.
- Quicker intervention.

#### Future developments

- Test platform to be built and technology to be validated.
- Optimum fibre optic position to be identified and theoretically validated.
- Initial operational system to be implemented by 2020.



Fibre optic drawer



Fibre optics being laid before pipework is lowered in

## 3 -New technologies to improve equipment maintenance and service life

### AIM

Teréga constantly focuses on facilitating and securing maintenance operations on the ground, as it does on facility security. R&I's approach aims to target these priorities by developing predictive maintenance and augmented reality concepts.

#### Approach

- Improving data collection and overall storage.
- Taking advantage of progress in machine learning to interrogate data and gain new knowledge.
- Improving and preparing for on-site work using augmented reality.
- Experimenting over time with pilot augmented reality applications across different business lines.

#### Progress

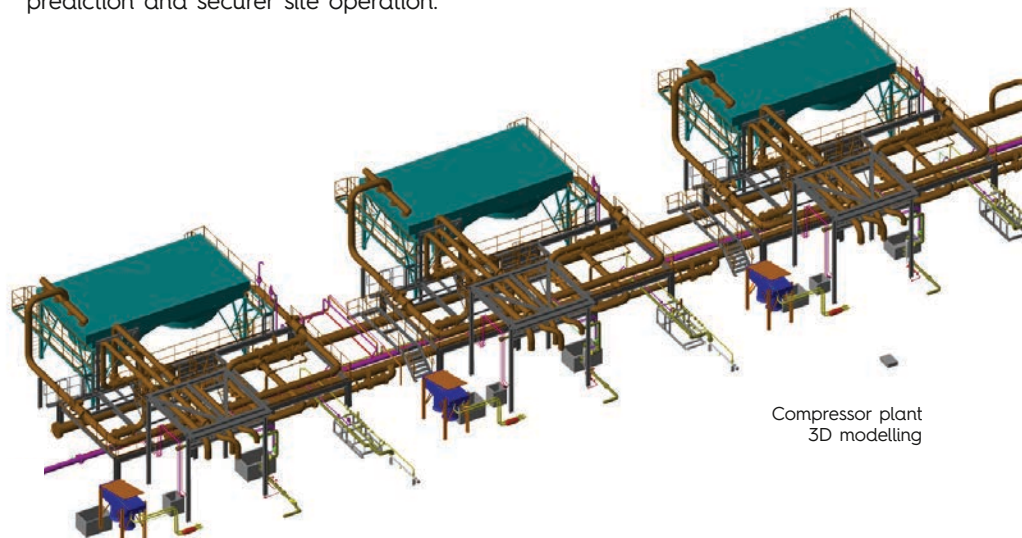
- Maintenance data retrieved from two critical maintenance compressors.
- Predictive model updated; data and anomaly analysis up to five days in advance (pilot phase).
- Augmented reality case studies completed.

#### Client benefits

- Continuity of supply thanks to productivity gains, better breakdown prediction and securer site operation.

#### Future developments

- Compressor predictive model to be refined and extended to other equipment types (valves, release mechanisms, etc.).
- Tool to be standardised in 2019 and deployed to operators.
- First buried network viewer pilot application.
- Teréga 3D data management to be reorganised.



Compressor plant 3D modelling

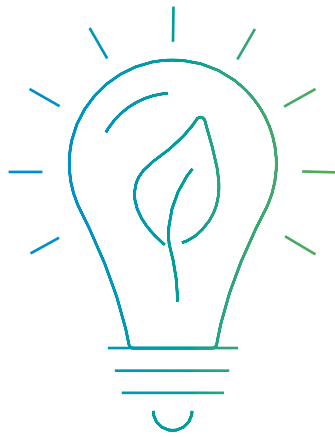
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Controlling our greenhouse gas emissions  
and energy efficiency:

innovations to  
achieve a positive  
environmental  
performance







## Two questions for Éric Bouley

Head of process service,  
R&I "Controlling our Greenhouse Gas Emissions and Energy Efficiency"  
Programme Manager

### What is behind the Teréga approach?

It started with a desire to respond to the French Energy Transition Act of August 2015 alongside an ambition of reducing greenhouse gas emissions by 40% between 1990 and 2030. Teréga has also been ISO 50001-certified since 2014 and energy efficiency is one of our main focuses.

For several years, R&I has been exploring and adapting technologies to contribute to these aims. The company BE POSITIVE programme has also consolidated and strengthened this approach.

### What does R&I hope to achieve in the field of energy efficiency?

The R&I programme covers three main areas. First, it aims to develop a tool to optimise compressor fleet functioning and thereby reduce energy consumption.

Second, it hopes to come up with innovative solutions to contribute towards the goal of reducing the CO<sub>2</sub> equivalent tonnes emitted by Teréga activities.

Third, it aims to work on energy wastage and on producing clean, renewable energy for auto-consumption. Needless to say, all these developments are being carried out without disrupting service provision.

## ▶ Energy efficiency at Teréga: two R&I projects

When it comes to its industrial resources, Teréga takes particular care to limit its environmental footprint. Indeed, R&I are working on innovative technologies to improve facility energy efficiency and recover waste energy while always providing the same level of service.

### 1 - Solutions to reduce emissions generated by transmission decompression



#### AIM

In order to carry out work or maintenance on pipelines, Teréga has to undertake greenhouse-gas-emitting decompression. This project aims to test out different techniques to limit and reduce these emissions.

#### Approach

- Testing different decompression techniques (classic venting method, reducing pressure through local consumption; using temporary connections, gas combustion or recompression for reuse).
- Developing a decision-making tool for operators to help them decide on the most appropriate method in each situation.

#### Progress

- Decision-making tool deployed for work carried out since 2017.
- Engineering study undertaken for a mobile recompression unit installed on a lorry and investment decision approved by Teréga.

#### Client benefits

- Can rely on a responsible operator that is considerably reducing its environmental footprint.
- Can contract an operator that respects and goes beyond regulatory requirements in the field of greenhouse gas emissions.

#### Future developments

- Recompression lorry to be built in the light of technical reassessment due to operating conditions.
- Delivery planned for second half of 2019 for use on future decompression work.

#### FIND OUT MORE

To reduce its greenhouse gas emissions even further, Teréga is also working on new types of gas analysers. The aim is to come up with innovative solutions to assess gas quality quickly and accurately while limiting gas sampling and eliminating post-analysis emissions. We have received several prizes for this work in the GRTgaz Open Innovation Challenge. The current goal is to develop this new analyser before initially deploying it at biomethane injection stations.



Gas being sampled for analysis

## 2 - Solutions to optimise compressor station functioning

### AIM

Teréga's compressor fleet has high operating costs. Gas compressor stations also represent 30% of Teréga's CO<sub>2</sub> equivalent emissions. Because each compressor has its own characteristics, the project aims to suggest the best usage scenarios so that the compressor fleet can function more effectively (with reduced wastage and emissions). There is currently no tool on the market that can do this.

### Approach

- Using an integrated simulation tool to optimise compressor fleet functioning in line with transmission flow blueprints.
- Simulating future situations and predicting changes to the network.

### Progress

- Specifications revised to develop a specific solution and technical specifications drawn up for the tool.
- Proposed solution adapted by DCBrain start-up and tested.

### Client benefits

- Compressor fleet performance improved leading to optimised energy performance and reduced operating costs.

### Future developments

- Tool deployment to be approved at the end of 2018.
- Teréga IS integration in 2019.
- Tool to be automated and improved using machine learning if benefits thought to be relevant.



Sauveterre compressor plant

### FIND OUT MORE



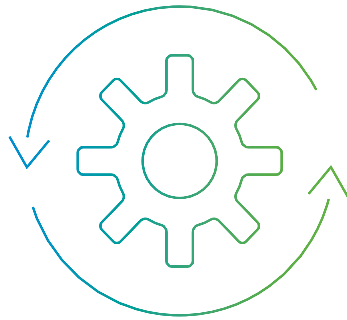
Since 2017, Teréga has been working under the company BE POSITIVE company programme which aims to achieve a zero-carbon footprint across all activities by 2020. There have been many developments (including some lead by R&I since 2016) in a bid to preserve the quality of air, water resources, biodiversity, soil, acoustics and landscapes and engage with stakeholders in a more global approach to societal

responsibility.

However, the BE POSITIVE programme can take us even further by enabling us to generate environmental value by 2025. We need to ensure that gas has a positive impact on the environment, such as by reconstructing ecosystems affected by our work sites and implementing an ambitious emission offsetting policy. The aim: to make Teréga an example to others in the field.

The background image shows an industrial site, likely a gas processing or storage facility. In the foreground, there is a blue metal container with a door. To its right, a wooden pallet holds a large white IBC (Intermediate Bulk Container) and a red fire hose. In the mid-ground, there are several large, cylindrical storage tanks, some with walkways and railings. The sky is a clear, bright blue. The overall scene is well-lit, suggesting a sunny day.

Smart Grids and new gases:  
accelerating  
the energy transition  
and preparing for  
future business lines



## Two questions for...



### William Rahain

Business Opportunities Study Manager,  
R&I "Smart Grids" Programme Manager



### Guilhem Caumette

Environment Engineer, Energy Research,  
R&I "New Gases" Programme Manager

#### What are the main principles of this innovative new gas programme?

**G. C.:** It's part of our strategic ambitions under the IMPACTS 2025 company project which aims to adapt and secure transmission infrastructure so new gases can be incorporated. In this context, R&I is intending to continue its work analysing the impact of new gases on facilities. We need to be able to deal with all biomethane types (generated by methanisation - 1G or pyrogasification - 2G) and determine acceptable transmission network H<sub>2</sub> content. Finally, we want to be proactive when it comes to developing new technologies in collaboration with hydrogen, methanisation and methanation channels.

#### Does the programme have any specific goals in relation to Smart Grids?

**W. R.:** Yes. Network integration and multi-energy systems are two cross-functional issues in the energy transition on which R&I is already working. We will further develop this work with IMPACTS 2025. Gas cannot be considered separately. It must be integrated into multi-energy offers and will help make use of surplus electricity generated by intermittent renewable energy sources. Teréga's involvement in the Jupiter 1000 project and power-to-gas knowledge could be extended via a wider smart multi-energy systems project.

# ▷ Future gas challenges: two R&I projects

The energy transition should lead to more new gases being incorporated into gas networks and greater synergy between different energies. Teréga is determined to affirm its commitment to being an energy transition accelerator and is carrying out various initiatives to make gas an energy of the future.

## 1 - JUPITER 1000, a power-to-gas demonstrator and HYREADY, a European consortium studying the impact of hydrogen fuel injection

### AIM

Gas infrastructure is already able to provide a balancing service to electricity networks via power-to-gas. By participating in the JUPITER 1000 project and studying the effects of hydrogen on pipelines, Teréga is hoping to prepare for developments linked to injecting new gases.

### Approach

- Acquiring skills in all technical and operational areas associated with power-to-gas, green hydrogen fuel injection and synthetic methane via the JUPITER 1000 project.
- Studying the viability of the power-to-gas economic model and establishing the regulatory context.
- Implementing smart unit management.
- Validating hydrogen fuel injection technologies, studying their impact on gas infrastructure (security, integrity,

performance) and looking at downstream use of this unconventional gas.

### Progress

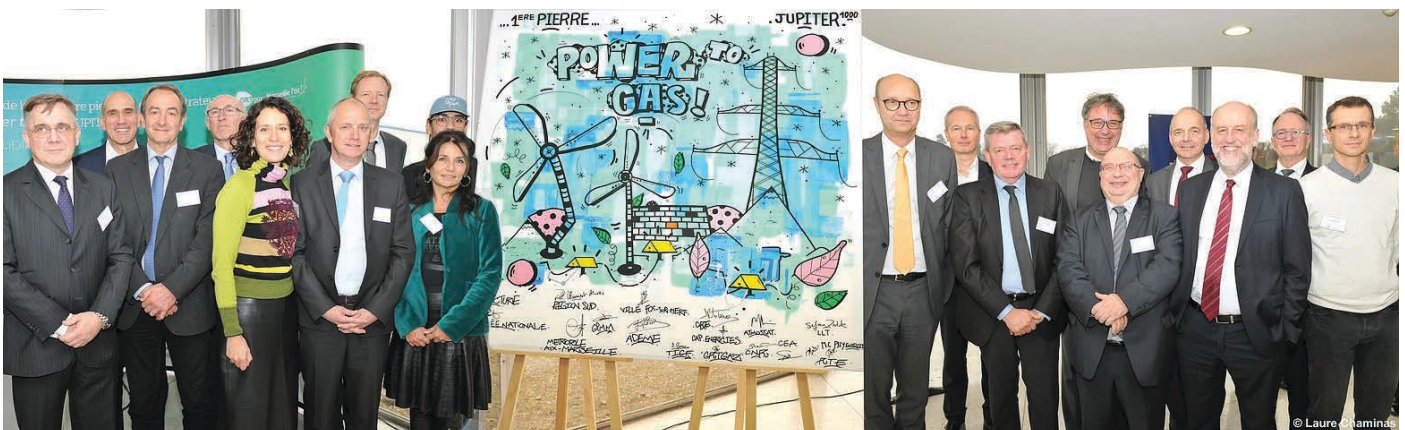
- Participated in engineering studies and Fos-sur-Mer platform constructed.
- Supplied Teréga gas analysers and CO<sub>2</sub> compression.
- Looked into implementing a smart system to run the facility in the best possible way.
- HYREADY studies begun to consider the impact of hydrogen fuel injection on different mixing rates with natural gas.

### Client benefits

- Renewable energy incorporation maximised and surplus electricity reused.
- Energy security, quality and continuity of supply.
- Preparation for future client requests.

### Future developments

- Demonstration to be done.
- Electrolysers to begin operating at the start of 2019 and hydrogen fuel injection.
- Methanation injection unit and synthetic methane injection to be launched in 2019.
- Different technologies and functioning to be adopted; testing and analysis to happen.
- HYREADY bibliographic studies to end: maximum acceptable network hydrogen content to be determined.
- Efforts to be pooled with GRTgaz to confirm maximum acceptable network hydrogen content with laboratory testing done by CEA Tech (HY'NJECTION project).



JUPITER 1000 foundation stone ceremony

Project supported by:



Project partners



## 2 - Accelerating the development of the methanation channel

### AIM

To contribute to the development of "green gas" channels, Teréga is actively participating in two collaborative methanation projects. These will focus on producing synthetic methane using different methanation processes, last three years and be run in partnership with start-ups, public R&D laboratories, universities and other industry players. By making use of CO<sub>2</sub> generated by other processes (such as methanisation), these two projects will improve the production yield of the renewable gas channel and make it a more attractive option.

### Approach

- Increasing expertise and experience regarding the control and quality of injected and injectable gases used in the network.

- Facilitating innovative new gas projects to contribute to Smart Grids.
- Developing a biological methanation biogas enrichment pilot in an operational environment (DEMETHA project).
- Developing and proving the technical feasibility of electrolytic hydrogenation for synthetic methane production (SOLARVI project).

### Progress

- Prepared the DEMETHA submission for the Occitania READYNOV 2018 call for proposals.
- Drew up specifications for the architectural invitation to tender for construction of the SOLIDIA 2 experimental platform which will host the DEMETHA pilot.
- Obtained funding from the Occitania region for SOLARVI as part of the READYNOV call for proposals.

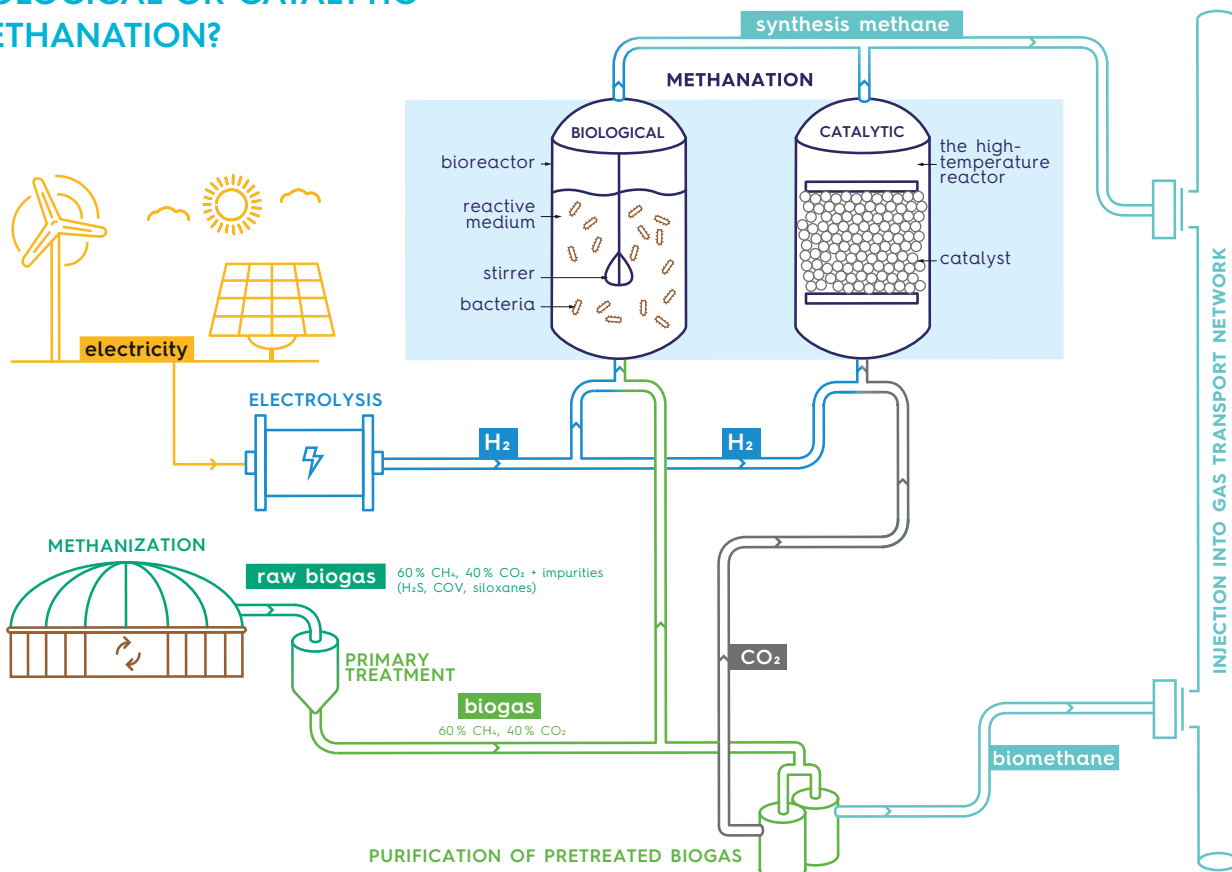
### Client benefits

- Connection and injection of biomethane and synthetic methane into the gas transmission network.
- Value added to biomethane production by optimising methanation yield.
- Solutions developed to make use of waste products (including CO<sub>2</sub>).

### Future developments

- SOLARVI pilot to be developed and testing to be undertaken between 2019 and 2021.
- SOLIDIA 2 experimental platform to be built.
- DEMETHA pilot to be designed in 2019 and testing to be carried out to assess the performance of this process.
- Laboratory testing to be undertaken to assess the performance of biological methanation in landfill gas and syngas enrichment.
- Techno-economic and regulatory study to be run on biogas enrichment industrial unit.

## BIOLOGICAL OR CATALYTIC METHANATION?

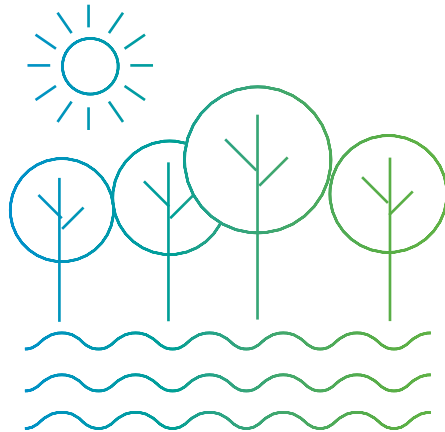


Local integration  
and environmental footprint:

working for biodiversity  
and to preserve  
water and landscape  
quality







## Two questions for Laëtitia Mahenc

Head of Environment and CSR Department,  
R&I “Local Integration and Environmental Footprint” Programme Manager,  
“BE POSITIVE” Company Programme Manager

### What is the aim of the programme?

R&I has two main aims with this programme. First, we want to improve the integration of Teréga infrastructure and activities in their locations and see them better accepted by society. Second, we hope to limit their environmental impact on local biodiversity and their surroundings.

As such, the programme includes several projects in line with BE POSITIVE.

### What does R&I hope to achieve?

With this programme, R&I has four key ambitions. First, we want to develop ways to reduce the impact of our work sites. Second, we hope to position Teréga as a leader in managing the environmental impact of its activities and in carbon offsetting. Third, we want to make our easements centres of biodiversity. Fourth, we hope to implement effective and innovative measures to encourage people to accept our new activities and projects by incorporating energy transition issues and new activities that result.

# ▷ Protecting locations and the environment: two R&I projects

Because of its desire to be a leader in the field, Teréga's commitment to the environment can be seen at all levels. In developing this programme, R&I has two main aims: to improve local integration of its infrastructure and to limit the local environmental impact on biodiversity and the surroundings.



## FIND OUT MORE

The ITTECOP programme was created by the French Ministry for the Ecological and Inclusive Transition and the French Environment and Energy Management Agency.

Since 2014, Teréga has been working with the Foundation for Research on Biodiversity and members of the CIL&B (Linear Infrastructure and Biodiversity Club) on calls for proposals led by ITTECOP. Subjects covered include linear infrastructure compensation strategy, the potential of easements in pollination and the mutual impact of green areas around sites on biodiversity. The results of the 2014-2017 programme have now been consolidated and projects for the 2017-2020 programme have been selected. Teréga hopes to use these results to determine the routes of future projects and improve its easement management practices.

## 1 - Boosting biodiversity for better awareness of linear infrastructure contributions

### AIM

Teréga is working on organising all its work sites to avoid impacting local biodiversity, or even to enhance it. In this context, Teréga is making its industrial resources available and is co-financing the ITTECOP programme as well as undertaking research using the MERCle method to quickly assess environmental compensation.

### Approach

- Understanding how linear infrastructure and easements contribute to biodiversity, how to restore environments and how to encourage the reintroduction of species after works.
- Testing the MERCle method developed by the University of Montpellier.
- Assessing environmental loss caused by a development project and benefits associated with compensation.

### Progress

- Environmental compensation evaluation method consolidated.
- MERCle method tested on the RGM (Gascogne-Midi Reinforcement) site.

### Client benefits

- Responsible purchasing with Teréga as a gas transmission operator committed to conserving biodiversity.
- More responsible (and therefore more "acceptable") projects developed by standardising compensation measure ascertainment.

### Future developments

- Holistic view of Teréga project impact management to be given through a brainstorming day.
- MERCle method testing to be extended to other major infrastructure projects.



Gold-ringed dragonfly



Marsh fritillary butterfly

## 2 - Adapting and implementing measuring devices to reduce impact during works and/or operations

### AIM

To meet this challenge, R&I is currently working on several sub-projects all with a common aim: to improve Teréga work site practices to conserve the environment and biodiversity and to reduce waste generation.

### FIND OUT MORE

Key compensation figures for Teréga work sites

20 %

TARGET RATIO\* FOR COMPENSATION AREA TO WORK SITE CONSTRUCTION AREA

4 %

RATIO ACHIEVED FOR LAST TERÉGA GASCOGNE-MIDI REINFORCEMENT WORK SITE\*\*

\*The lower this figure, the better Teréga will have succeeded in preventing and reducing the impact of its activity.

\*\*62 km of pipelines 900 mm in diameter buried at least 1.2 m down.

### Approach

- Developing and looking into new technologies for work site water filtering.
- Developing methods to monitor compensation measure effectiveness.
- Identifying the best techniques to use as an alternative to paint coating removal by sanding.

### Progress

- Suppliers selected to provide innovative solutions to the specific need to filter work site water.
- Testing and comparison of new coating removal techniques at a delivery station (lasering, magnetic induction, capper with suction head).

### Client benefits

- Responsible purchasing with Teréga as an expert in biodiversity conservation, water management and environmental footprint reduction.
- Continuity of supply achieved with improvements to reliability thanks to regulatory monitoring.

### Future developments

- Benchmark to be analysed internally; new water filtering technique to be implemented and assessed.
- Technique to be deployed from 2019 across all Teréga work sites if test conclusive. If not, alternative techniques to be researched and evaluated.
- New paint coating removal technologies to be identified and integrated into Teréga specifications.

### WORK SITE PRACTICES TO CONSERVE THE ENVIRONMENT


Besides R&I projects, Teréga's approach at work sites is guided by three principles: Avoid-Reduce-Compensate. The first stage is to avoid environmentally important areas. This means that before work begins a route is devised to cause the least possible impact and avoid any sensitive locations. Secondly,

during the works particular technical solutions are used to reduce residual impact (fish exclusion, substrate recovery, soil sorting, by-pass creation).

Finally, if the first two stages have not been sufficient, environmental compensation is used to avoid any net biodiversity loss.



Photos showing before (restoration in 2013) and after (2018) - ABE Project - Vallée du Lourden in Duhort-Bachen (64 - Pyrénées-Atlantiques)

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