

EXAMPLES OF C.P. REMOTE MONITORING INSTALLATIONS CARRIED OUT BY A EUROPEAN GAS TRANSMISSION COMPANY

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ABSTRACT

Having daily information about the state of Cathodic Protection systems of the entire transmission network allows to increase the reactivity level and to obtain a better overview of the CP.

Grt Gaz, with the most extended high pressure transmission network in Europe, has been the first gas transmission company to decide to remotely monitor the whole network: this paper describes the key passages which led Grt Gaz in its choice of materials and services associated with the installation of the CP remote monitoring system.

EXEMPLES DE MISE EN PLACE DE LA TELESURVEILLANCE P.C. CHEZ UN TRANSPORTEUR EUROPEEN

RÉSUMÉ

Avoir des informations quotidiennes sur le fonctionnement du système de Protection Cathodique de l'ensemble du réseau de transport permet d'une part d'augmenter le niveau de réactivité d'intervention et de d'obtenir une vue globale de la PC.

GRTgaz, avec le plus long réseau de transport à haute pression d'Europe, a été la première société de transport de gaz à choisir de télésurveiller le système de protection cathodique de la totalité de son réseau. Ce papier décrit les passages clés qui ont orienté GRTgaz dans ses choix de matériel et de services associés sur la mise en place du système de télésurveillance.

1. GRTgaz : the company profile

GRTgaz is the operator of high pressure gas transmission network on the majority of French territory.

GRTgaz network is the longest and one of the best interconnected in Europe. Linked to transmission networks in Norway, Belgium, Germany, Italy via Switzerland and Spain via TIGF, connected to methane terminals in the Atlantic and Mediterranean coasts which receive liquefied natural gas (LNG) from anywhere, it allows the access to different gas sources and facilitates the gas exchanges on the European territory.

Key numbers 2013

- **2 988** employees
- **32 056** km of network, that is to say the first gas transmission network in Europe
- **26** line compression stations (572 MW compression power)
- **4 477** delivery points of which 1 053 related to industrial users
- **110** delivery customers
- **636,6** TWh of gas dispatched in 2013
- **1 807** Millions of € of turnover
- **777** Millions of € of investments in 2013



Figure 1 - Map of GRTgaz Network 2013

2. Operating the CP systems remote monitoring

Following the Decree of 4 August 2006, the regulatory requirements for Cathodic Protection (CP) operations have evolved considerably, including the strengthening of the 3 types of controls: monthly checks on CP equipment (T/R, drainages and earthing systems), general assessment (EG) of Cathodic Protection on the entire network, carried out annually (on potential measures) and three-yearly detailed and comprehensive assessment (ECD) of Cathodic Protection, at all test stations (detailed investigations to prove the effectiveness of CP)

The first actions implemented by GRTgaz regarding remote monitoring of cathodic protection date back to 2006. At that time, GRTgaz launched a European tender aiming to set up a remote monitoring system on its **1000** transformer rectifiers and **80** drainages.

The first installations came to light in 2007.

Three years later, following the placing on the market of new generations of data acquisition stations, able to perform a.c. measurements, not just d.c. ones, GRTgaz extends the installation of the remote monitoring system to its earthing systems (MALT).

The performed measures are :

T/R	Drainages	Earthing systems
U T/R	I drained	I d.c.
I T/R		I a.c.

The measures are automatically recorded by the data acquisition units and are transmitted via SMS / GSM / GPRS to a database and then published on a visualization / management platform accessible via Internet.

Thresholds are applied to the collected data and allow to automatically generate alarms when, for example:

- The transformer rectifier doesn't work
- The drainage doesn't drain
- The earthing system doesn't work properly

After setting up the remote monitoring system (replacing the monthly checks on 1100 devices) and after carrying out pilot projects, GRTgaz decided to extend its choice and remotely control the test posts (PP) also, thanks to the ETOILE PC project.

3. The evolution: the ETOILE PC project

ETOILE PC means:

Extension de la Télémessure Opérationnelle Installée sur les Equipements de Protection Cathodique.

(Extension of Remote Monitoring on Cathodic Protection Installations)

The project is developed as the logical continuation of the remote monitoring implementation on T/R, drainages and earthing systems.

With the ETOILE PC project, GRTGaz decides to go further, in order to remotely monitor its entire network.

In summary:

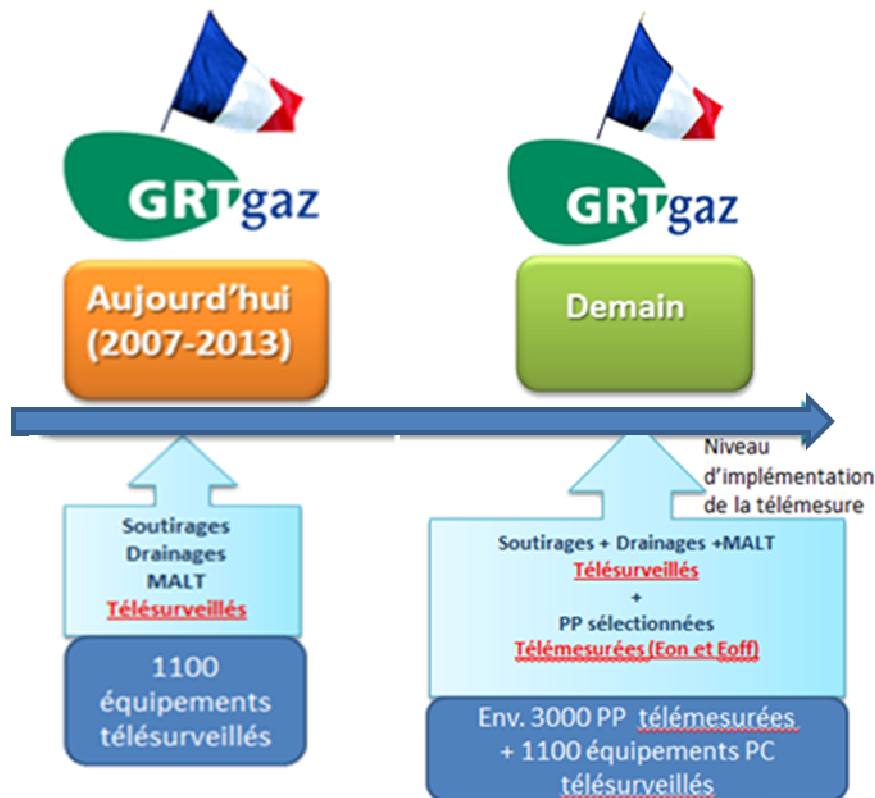


Figure 2 - Today and tomorrow

4. The regulatory context

Cathodic Protection controls (from EN 12954 standard)

Without remote monitoring (10.03.3.2 – Cathodic protection measurements)

- 1) For **general assessment** of cathodic protection, Eon potential measurement is usual, **carried out annually**.
- 2) For **detailed and comprehensive assessment of the effectiveness** of cathodic protection, the measurement methods adopted shall be appropriate to the structure. For structures not significantly affected by stray current, possible measurement methods include E_{off} potentials and test probe or coupon potentials, carried out typically every 3 years, preferably at all test stations

With remote monitoring (10.3.3.3 - Remote control)

General assessment:

If the cathodic protection system is monitored by remote control, such that equipment malfunctions can be immediately detected, then the frequency of functional checks laid out in Table 2 does not apply.

Detailed and comprehensive assessment of the effectiveness:

It is possible to have a better overview of the cathodic protection system if the effectiveness of cathodic protection is monitored by remote control. In this case potential and current measurements may be performed on demand, automatically at preset intervals, or when an alarm condition exists.

Table 2 — Frequency of functional checks

Functional check	Frequency
Galvanic anode stations	Annually or more frequently if required by operational conditions
Impressed current station	Every 3 months or more frequently if required by operational conditions
Drainage stations	Every month or more frequently if stray current is severe
Connections to foreign structures	Annually or more frequently if required by operational conditions
d.c. decoupling devices and earthing systems	Annually or more frequently if required by operational conditions
Safety and protection devices	Annually or more frequently if required by operational conditions
Test stations	Annually at selected locations and every three years at all locations (see 10.3.3.2)

EN 12954 – Table 2 – Frequency of functional check

The EN 12954 specifies that the implementation of remote monitoring on test posts (PP) allows to vary the frequency of the measurement campaigns, thanks to a better mastering of the CP control level.

The purpose of the project ETOILE PC for GRTgaz is to continue on its way, allowing the replacement of the annual onsite controls for general assessment (EG) by equipping some test posts (PP), indicated as 'selected', of a remote monitoring system for carrying out the control of CP presence and, as for the controls for detailed and comprehensive assessment of Cathodic Protection (ECD) to be carried out every 3 years, by the setup of an evolved and more performing tool to automatically and continuously monitor the presence of PC on the network, better controlling the risks of corrosion and optimizing maintenance actions.

After a test phase checking different technologies, which lasted one year on pilot sites, GRTgaz launched in 2013 a tender to select the data acquisition units, as well as the associated services, to be evaluated as the best for the project realization.

The project key points :

- Remote monitoring of approximately 10% of the test posts (PP)
- Deployment from 2013 to 2018

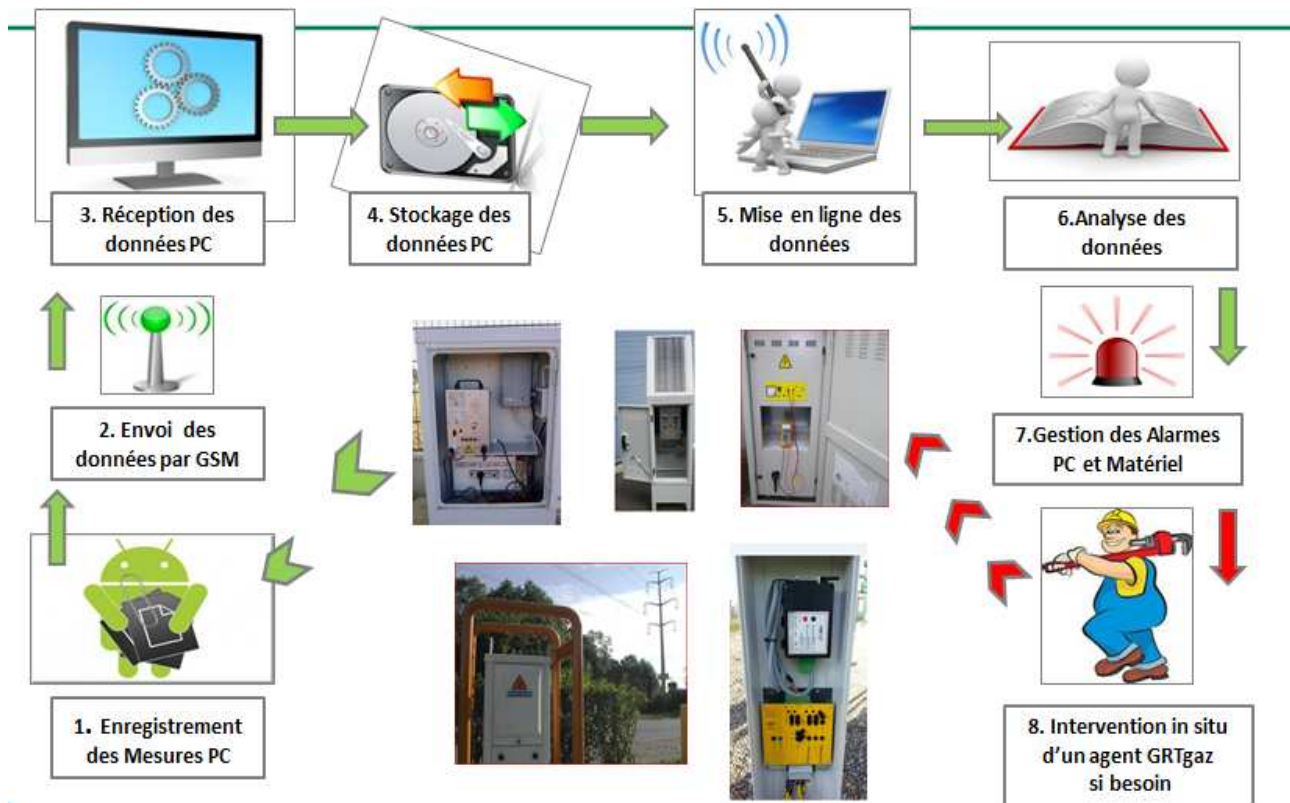
The progress of the project:

- Tender award: June 2013
- First commissioning: December 2013
- 350 test posts equipped of remote monitoring units as of today

Measures performed on the different installations

T/R	Drainages	Earthing systems	Test posts (PP)
U T/R	I drained	I d.c.	Eon
I T/R		I a.c.	Eoff
			Uac
			I dc (coupon)
Alarm if T/R does not work	Alarm if drainage does not work	Alarm if earthing system does not work	Alarm if threshold criteria (Eoff, I _{tm} or Uac) are met

5. Operation and control of remote monitoring



Action N°	Explication
1	The data acquisition units records the CP measures on the 24 hours of the day
2	The data acquisition unit transmits the data by GSM
3	Data are received by a server
4	Data are archived
5	Data are put on line on a web application, a secure access to which is guaranteed
6	Data analysis is carried out by the application with reference to the pre-defined thresholds
7	The data acquisition unit and / or the internet application generate 2 types of alarm, which are sent to the CP operators. The alarms are related to: <ul style="list-style-type: none"> - CP alarms (CP installations out of order, thresholds criteria are met) - Equipment alarms (data acquisition unit defective, low battery)
8	After analyzing the alarm GRTgaz agent intervenes onsite to troubleshoot, in case of a 'material alarm', or to perform additional measures and refine the diagnosis in order to "solve the CP problem ", in case it is a CP alarm

6. Equipment choice : technical features

Requirements :

- Product polyvalence (T/R, drainage, earthing systems, test posts)
- Easy-to-go cabling, startup and commissioning,
- Long term battery operation (at least 5 years) or 220V powered if needed
- Reliability and efficiency (low failure rate)
- Remote modification of working parameters
- Reading channels adaptability and flexibility, in relation to the various measures to be carried out
- Metrological followup
- GPRS / GSM / Satellite transmission

Equipements	Paramètres retenus						
Calibres des voies	+/- 60 V d.c (continu)	+/- 10 V d.c (continu)	60 V a.c. (alternatif)	100 mV d.c (continu)	60 V d.c (continu)	100 mV d.c (continu)	100 mV a.c. (alternatif)
MALT (Mise à la Terre)						I dc	I ac
Soutirage					Us (I soutirage)	I s (I soutirage)	
Drainage				I _{tm} (dc) (I Témoin)		I drainée	
PP	E _{on} (potentiel ON)	E _{off} (potentiel OFF)	U _{ac}	I _{tm} (dc) (I Témoin)			
PP + liaison PC	E _{on} (potentiel ON)	E _{off} (potentiel OFF)	U _{ac}	I _{tm} (dc) (I Témoin)		I liaison	
Shunt				Interne* autocalibrable		Externe **	

Table of required parameters for each type of installation

Daily measurement of Eoff potential

GRTgaz chose to take the Eoff measure on a daily basis because this is easily accessible with the remote monitoring system. The daily measured value is an indicative one, because it's the value measured every 3 years in situ by a CP agent that is taken into account for the control of the comprehensive assessment of the CP

7. Data management

Requirements :

- To check the data and the registrations sent by the data acquisition units
- To modify the different working parameters of the data acquisition units (alarm thresholds)
- To search and manage all the details concerning the data acquisition units
- To remotely program the data acquisition units
- To import or export data and / or files in different formats,
- To remotely release data registrations
- To be aware of measures and anomalies
- To archive and exchange information between operators,
- To set up (remotely) parameters for OFF potential measure

At company level GRTgaz has chosen a unique supervision tool (secure website) accessible to all CP teams that provides the access to the values transmitted every day by all the data acquisition units installed on the whole network.

8. CONCLUSIONS

The continuous monitoring of the CP presence on the network allows a better control of the corrosion risks and a better optimization of maintenance actions.

Having a daily measure of the Eoff potential, which is usually taken once every 3 years in situ by a CP agent, allows a more comprehensive CP daily assessment for a better reactivity.