

Theft Mitigation in the Automotive Market

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Company Name: COMGÁS – Companhia de Gás de São Paulo

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Gas theft
NGV – Natural Gas Vehicular
UFG – Unaccounted for Gas

Background

1- COMGÁS

COMGÁS – Companhia de Gás de São Paulo is a natural gas distribution company based in São Paulo City, Brazil.

The company operates within the most economically important region of Brazil in the southeast part of the country. The map below indicates the location of the concession area.



The concession region involves part of the State of São Paulo, including economical poles such as:

- São Paulo City's metropolitan region,
- Coastal region of Santos City,
- Paraíba River Valley's region, where major towns are located, for example, Jacareí, São José dos Campos, Taubaté, Pindamonhangaba, Caçapava, Guaratinguetá among others,
- Campinas City's area, which includes Piracicaba, Limeira, Rio Claro, Mogi Mirim, Mogi Guaçu among other towns.

The following map shows the location of COMGÁS' concession area within São Paulo State. The table indicates some data about this region.



Population	29,2 million
Area	54,000 km2
Cities	178
Houses	7,7 million
Vehicles	9 million
Brazilian GDP participation	25 % (equivalent to the Argentinean GDP)
Brazilian energy demand participation	35%

The concession is granted by São Paulo State's Government, the contract's term refers to a period of 30 years, as of 1999, and it can be extended for another 20 years after the end of the originally established period.

The company is a joint venture formed by BG Group and Shell, BG being the technical operator.

The main markets served by COMGÁS are the Industrial, Power, Cogeneration, NGV, Commercial and Residential ones.

Since its privatisation in 1999 the company experienced a huge growth, as indicated in the table below:

	1.999	2011
Volume	1,1 billion m³/year	5,0 billion m³/year
Network	2,500 km	8,000 km
Attended Cities	17	72
Total of Clients	290,000	1,200,000
Industrial	650	1,000
Power	-	2
Cogeneration	-	23
NGV	20	360
Commercial	5,200	10,206
Residential	284,000	1,190,000
Investments (1999 to 2011)		US\$ 2,5 billion

2- The Issue

Being a company that distributes about 5 billion m³ per year of natural gas, COMGÁS maintains structured processes to control the purchase and sale of gas; and within this balance it tracks the losses via UFG (Unaccounted for Gas). It is important to mention that COMGÁS' concession contract requires regular monitoring and monthly submission of results to the Regulator.

Since the company was privatized in 1999, when the UFG process was more accurately and structured implemented, the results remained within levels that indicated very small losses. During this period the UFG stayed around 0.5% and, in some occasions, even lower than that. This can be explained by the fact COMGÁS has a small cast iron network, which is being continually renewed. Its distribution networks are new, most of them with polyethylene pipes. The bulk of sold volume is consumed by large industries, where the meters' park was also renewed. In practical terms, COMGÁS has a unique gas supplier, Petrobrás, which also has new meters at the gas taking points.

In 2007 COMGÁS started noting that in a short period of time there was a significant increase in the UFG level, that could not be attributed to distribution system's operating

procedures, leaks in the network, differences in measurement with the carrier, billing errors or even to meter calibration problems.

A process to verify these differences was triggered, starting with the markets which were more significant for COMGÁS in terms of volume. The initial evaluations indicated that the differences were concentrated in the NGV market. It is interesting to note that this market segment experienced a huge growth, with more than 360 NGV stations connected to the distribution network. The daily volume was around 1.6 million m³.

In this market segment there is a big diversity of operators, ranging from major ones such as Petrobrás, Shell, Esso, Ipiranga, etc, to very small ones, the so-called "white flags".

Coincidentally, shortly after this finding about the UFG, an anonymous denounce informed that a NGV Station had assembled a bypass of the COMGÁS meter. The installation of this bypass was pretty rudimentary, representing danger to people who worked at the station, to customers, neighbours and passersby.

This was evidently a case of gas theft. This situation was unacceptable, not only in terms of financial losses, but mainly regarding the risk to assets' integrity, as unauthorized persons were intervening in the natural gas installations of COMGÁS.

However, until then the situation was not clear; there was no information regarding the extension of the problem and who exactly was behind the scenario.

Sadly, during the following months the UFG continued to increase, and its pick indicated an estimated deviation of more or less 200,000 m³ per day. The UFG reached picks nearly 3% in some distribution systems.

Aims

The objective of this paper is to show how COMGÁS acted to substantially reduce the problem of gas theft in NGV stations.

The paper attempts to indicate some key issues in this process, such as, a) the manner in which COMGÁS has been structured to tackle the problem, b) the main types of identified fraud and c) the employed mitigation actions.

This report, on the other hand, also has the intention to show, in a very objective way, the practical actions taken by the company to face the problem.

3- The Extension of the Issue

The first conclusions of the investigations showed that some criminal organizations were using gas stations as a mechanism for money laundering. They were also taking the opportunity to steal gas.

There were also rumours that in the NGV market "skilled professionals" would be selling gas deviation technology, thus triggering various types of fraud, some of them with a reasonable level of technical sophistication.

Around mid 2007, after the Company became aware of the first bypass, some honest NGV operators complained to COMGÁS about the unfair competition in the market; it was

generated by the defraud, as the charged prices practiced by some operators would not be reasonable in a normal condition.

They called for urgent action against this state of affairs. Some of them were very concerned, as ethanol was a strong competitor to natural gas and their business were facing serious difficulties. A few of them even accused COMGÁS of ineffectiveness and incapacity to inhibit this practice within the NGV market. These operators certainly forgot that the biggest loser, so far, was COMGÁS, itself.

If urgent measures were not taken to eliminate the practice of gas theft, there would be the risk of further contamination of the NGV market and of other markets that did not indicate any evidence of fraudulent practices.

Furthermore, some COMGÁS operational employees have been threatened when they performed inspections at the premises of certain gas stations with suspected deviation. This fact confirmed the involvement of criminal organizations in NGV market.

Some actions taken with the Police were unsuccessful to identify stations that were diverting gas; there was a lot of difficulty to materialize any evidence that would prove the practice of gas theft.

Inspections carried out by the COMGÁS field teams were not being effective, as well. It was practically impossible to rely on the element of surprise to identify physical evidence of fraudulent deviation of gas. As a general rule, COMGÁS' employees could not have immediate access to the gas measurement system. They were kept waiting a long time to access the meter.

The concession contract requires that any maintenance or inspection activity at the consumer premises is scheduled in advance. This practice is suitable for honest consumers who need to plan a required stoppage of gas supply in advance. For defrauders, this procedure works as a protection, the inspection notice gives them enough time to eliminate the evidence of gas deviation.

COMGÁS also had some failures in lawsuits against operators who stole gas. Allegations of lack of immediate access to facilities, existence of broken seals, inconsistency of metered data and other evidences gathered by COMGÁS field staff were not enough to convince the judges about the occurrence of gas deviation.

In some cases COMGÁS suspended the gas supply based on provisions of the concession contract, however, the supply had to be restarted by force of judicial measures on behalf of the operators. The judge concluded that there was no proof of crime authorship.

This entire situation brought a very unfavourable environment for COMGÁS. In addition to the financial losses generated by gas theft, there was not an appropriate way to tackle the problem, due to several difficulties presented at that time. On the top of that, there was the risk to asset integrity. Unauthorized persons were acting at gas installations to execute the deviations. There was the risk of gas leaks and even the possibility of explosions.

According to the regulatory model followed by COMGÁS, the company's assets are formed by gas distribution system's elements that include, among others, the odorizing stations in the City Gates, distribution pipes, valves, pressure regulation stations, and every meter installed on each client of the company.

The gas meters are located within the CNG stations in an isolated area with locked doors. The site keys are kept by representatives of the station, which have the right to have visual access to the meter and to the flow computer (PTZ).

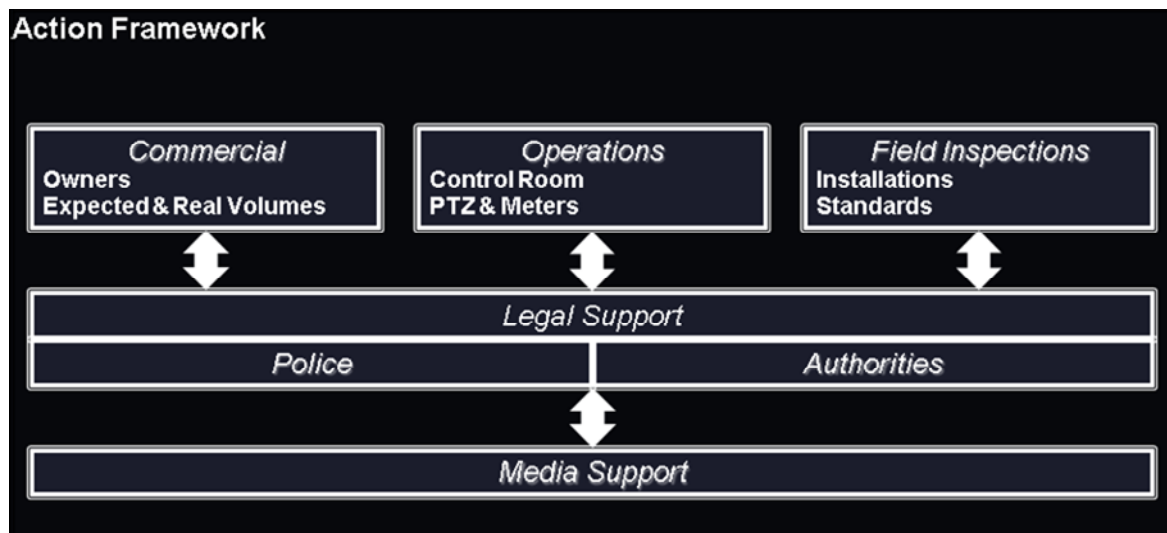
The compression system of the gas to be supplied to the vehicles is owned by the station. The gas distributor company has to check if these facilities meet the technical standards defined by the Brazilian Standards Association (ABNT) regarding these activities. COMGÁS does not have any compression operation or direct sale of gas to the owners of vehicles using natural gas.

Considering all the complexities involved, it became clear to COMGÁS' Board that the solution to this problem required another kind of action, which should be developed in a very structured manner. That would be the only way to find a successful solution to this serious problem. The conventional method practiced by the company was not enough to stop the theft of gas in the NGV market.

These actions would have to go beyond the simple field inspections carried out by the Company's operations team. They required a holistic and integrated view of the situation. Regulatory, commercial, legal, operational, communication aspects, among others, had to be analysed in an integrated way in order to act with one single goal: the elimination of gas theft in NGV stations.

4- Action Framework

An "Action Framework" was set out to integrate all these elements, as shown in the chart below,



Each area had specific responsibilities, which are briefly listed below,

Commercial:

- Obtain all relevant information about the NGV market,
- Maintain an updated list of COMGÁS client NGV stations and monitor the changes in ownership,

- Identify the owners of each NGV station, its background, time in the market, its reputation, its origins, etc.
- Compare the expectations of volumes to be sold to the volume of gas effectively sold,
- Report any suspicious situation.

Operations:

- Obtain operational information concerning the distribution network, mainly the data handled by the Control Room, such as volume, pressure, temperature, etc.,
- Monitor the performance of meters and PTZ's,
- Develop actions involving meter manufacturers,
- Get technical support from other gas companies and other technical institutions in order to identify the technologies used to prevent gas theft.

Field Inspections:

- Check the facilities in the field,
- Ensure compliance with the regulations and standards required,
- Ensure the physical security of the people involved in field activities.

Legal:

- Evaluate legal alternatives and regulatory requirements,
- Make contact with relevant authorities, particularly with the Regulator, Police, Public Prosecutor and Tax Authorities.

Media Support:

- Build a communication plan regarding the problem,
- Identify the communication channels to be used,
- "Sell" the importance of eliminating deviations, "sell" the concept of "Zero Tolerance", do not give the impression that this is a large international company chasing undefended small operators,
- Show that COMGÁS is the "good guy" and gas operators who are deviating gas are the "bad guys",
- Do not create panic over the installations' safety issue.

COMGÁS hired external support, provided by:

- IPT - Instituto de Pesquisas Tecnológicas (Technological Research Institute) of USP - University of Sao Paulo, which is a public entity with great credibility in Brazil, in order to run tests on meters and PTZ's with suspected tampering, and to support technological developments to be applied,
- Manufacturers of meters; in an attempt to eliminate the weak points that could lead to equipment fraud,
- A highly regarded criminal law firm, to support COMGÁS in any criminal lawsuit and to maintain the interface with the public authorities, particularly the Police and Public Prosecutor,

- A law firm specialized in public and administrative law, to provide support involving administrative, regulatory and civil issues,
- A media company to provide support in relation to communication issues,
- A security intelligence company, to help in every aspect involving security, mainly to avoid personal risks to COMGÁS' employees.

It is important to mention that the highlight of the Action Framework was the adoption of a "Zero Tolerance Policy". In case of fraud, COMGÁS had to go to the ultimate consequences, demanding regulatory penalties and possible legal sanctions. More important than the reimbursement of any amount diverted is, firstly, eliminating any condition that could represent an asset integrity risk and, secondly, terminating the gas supply contract with the defrauder.

From the regulatory point of view when a fraud is identified, or when the intervention of a customer puts at risk the integrity of the asset, the gas distribution company should stop supplying gas to that customer. Therefore, in case of deviation or any action which indicates that an unauthorized person had access to the gas facilities, the supply can be immediately cut off. COMGÁS adopted this strategy as its main line of action in cases of gas theft.

In case of NGV stations, the strategy of stopping the gas supply really means ceasing their activities. This may also represent significant losses for these operators, as they invested money in the compression system and without gas supply, in theory, this investment would not be amortized.

The idea was didactically showing to the market that COMGÁS would not tolerate any fraud.

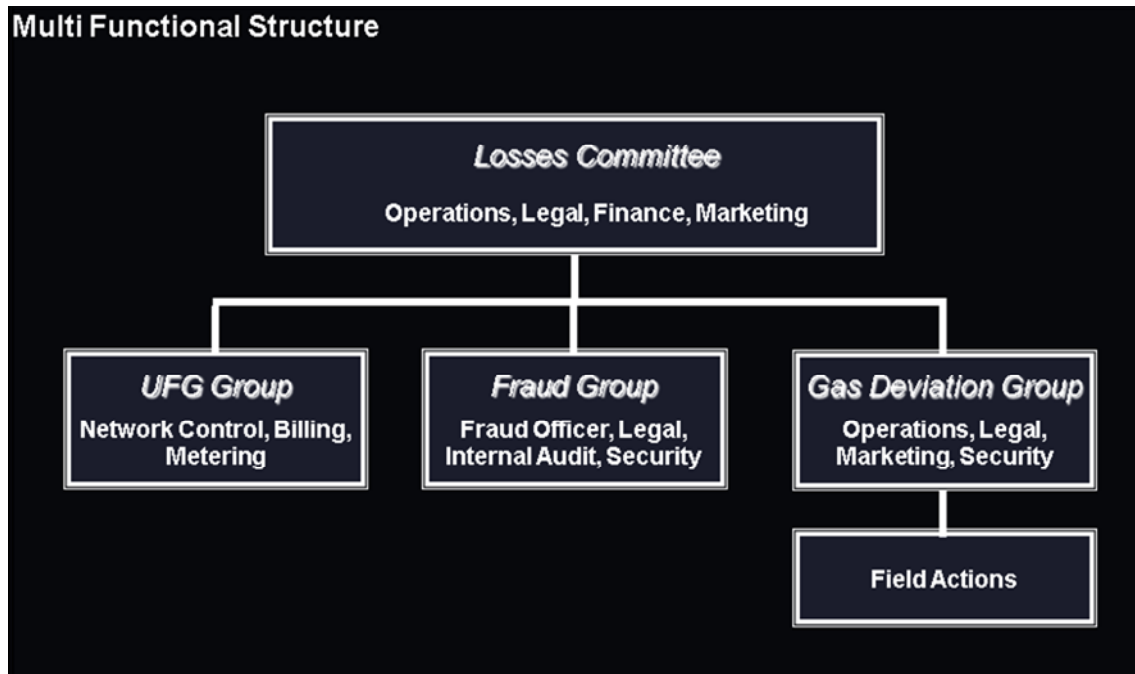
Another fundamental premise for COMGÁS in this process was to ensure that all actions should be developed within the strictest limits of Brazilian legislation and also accordingly to the principles of ethics of the company and its shareholders.

A key objective of this phase was identifying deviation methods and providing a strategy to mitigate these deviations.

5- Multi Functional Structure

In order to put the Action Framework into practice, a multi-functional organizational structure was developed, ensuring that the different areas were in the same wavelength and remained focused on the same goal.

It is important to emphasize that this group has the direct involvement of COMGÁS' top management. The chart below identifies this structure:



Losses Committee: is formed by the directors of Operations, Legal, Finance and Market, and is led by the Operations Director. Three groups with distinct goals report to this committee:

UFG Group: focused on the detailed study of the company's UFG, it is a continuous work where the UFG results are obtained every month, system by system, city gate by city gate, etc. Formed by representatives of the Network Control, Billing and Metering areas

Fraud Group: operates in the prevention and investigation of fraud against the company. Group formed by the Fraud Officer, the Legal Director, the Head of Internal Audit and the Security Manager.

Gas Deviation Group: focused on the identification of gas deviation. Group formed by the Network Operations Manager, the Legal Manager, the Market Manager and the Security Manager.

Initially, the intelligence group, which actually had a full view of all the actions in progress, was limited to a small number of participants, as no one could inform the extent of the problem, or confirm the existence of internal connections to execute the frauds.

This group was formed by eight people. Participants by the Operations area: Operations Director, Operations Superintendent, Security Superintendent, and Control Room Manager. Participants of the Marketing area: Marketing Director and NGV Manager. Participants of the Legal area: Legal Director and Legal Superintendent.

All these participants signed a letter of confidentiality, committing themselves to treat all the discussions and actions to be carried out as highly confidential issues. The same non-disclosure agreement was required in relation to the third parties involved in the process.

It is important to mention that to the present date there is no evidence of participation of any COMGÁS' employee in the identified actions involving gas deviation.

Methods

6- Facing the Issue

After the first identified case of gas theft the main concern was to develop a data analysis intelligence process. The aim was generating more effective inspections to look for evidences that could identify and indicate other cases of gas deviation.

The first step was to create reports to analyze consumption data obtained from flow computers installed at customers.

The analysis produced some consumption patterns that indicated a possibility of gas deviation, such as:

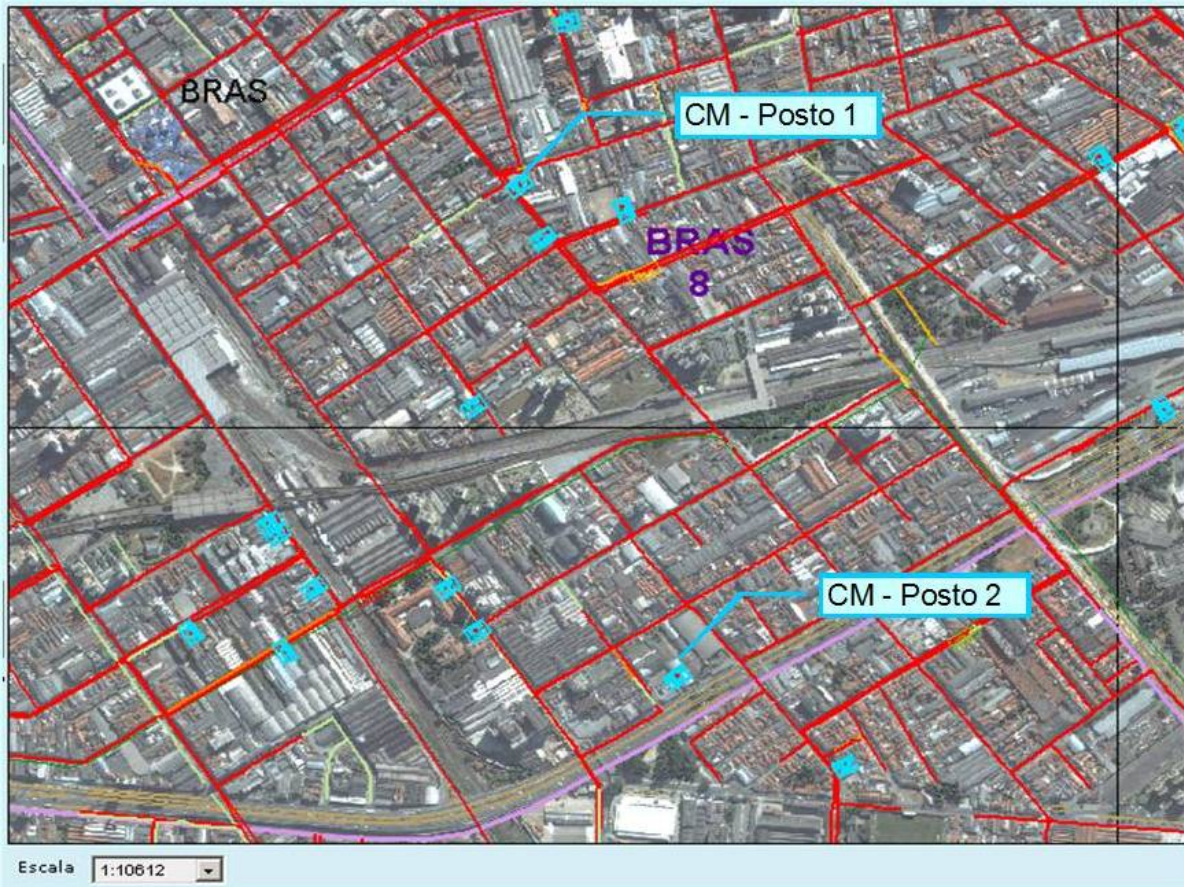
- Large amount of hours without consumption,
- Variations in temperature,
- Inconsistencies between flow and pressure,
- Low level of consumption during the night period, despite the market indications regarding a higher volume of sales,
- Inconsistencies in the comparison between the working pressure of NGV Stations, the gas supply network's pressure, and the pressure of other stations located in the same region,
- Inconsistencies in the comparison between the working pressure and the consumption volume,
- Comparative data billing.

Some of the various performed analyzes:

1- GIS data.

The use of GIS system information allows a more accurate evaluation in relation to the geographical location of the NGV stations in the same region, as well as the parameters concerning gas consumption in different stations.

The graphs below present examples of these evaluations. The first one indicates NGV's stations located at the same region and the networks that feed the area. The second shows the distances between the NGV stations and the PRS's – pressure reduction stations that supply gas to them.



Distance from PRS 26 to GNV Station 1: 2,337 m

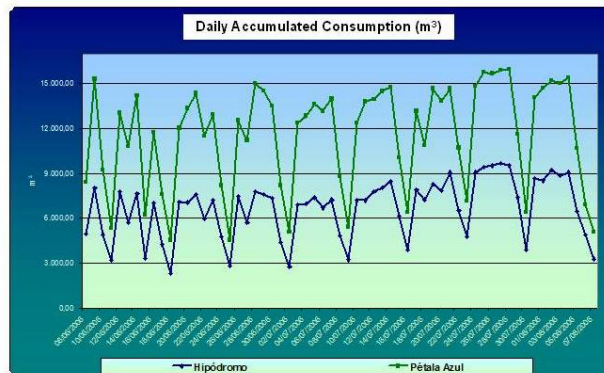
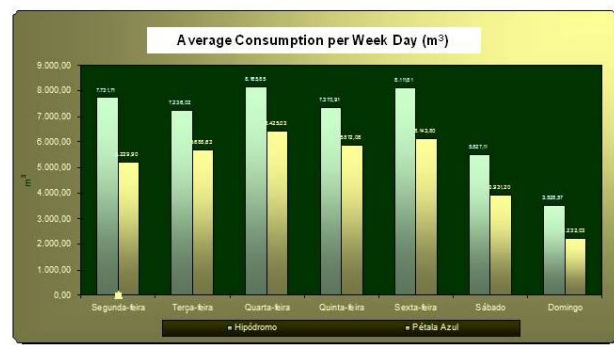
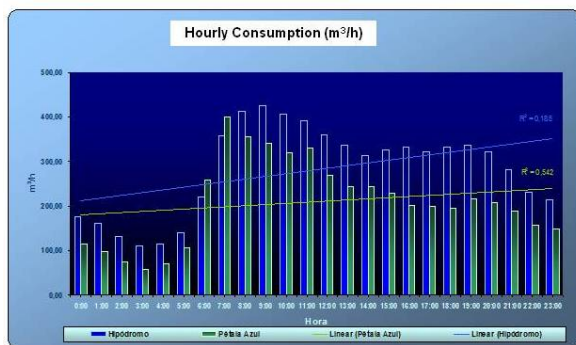
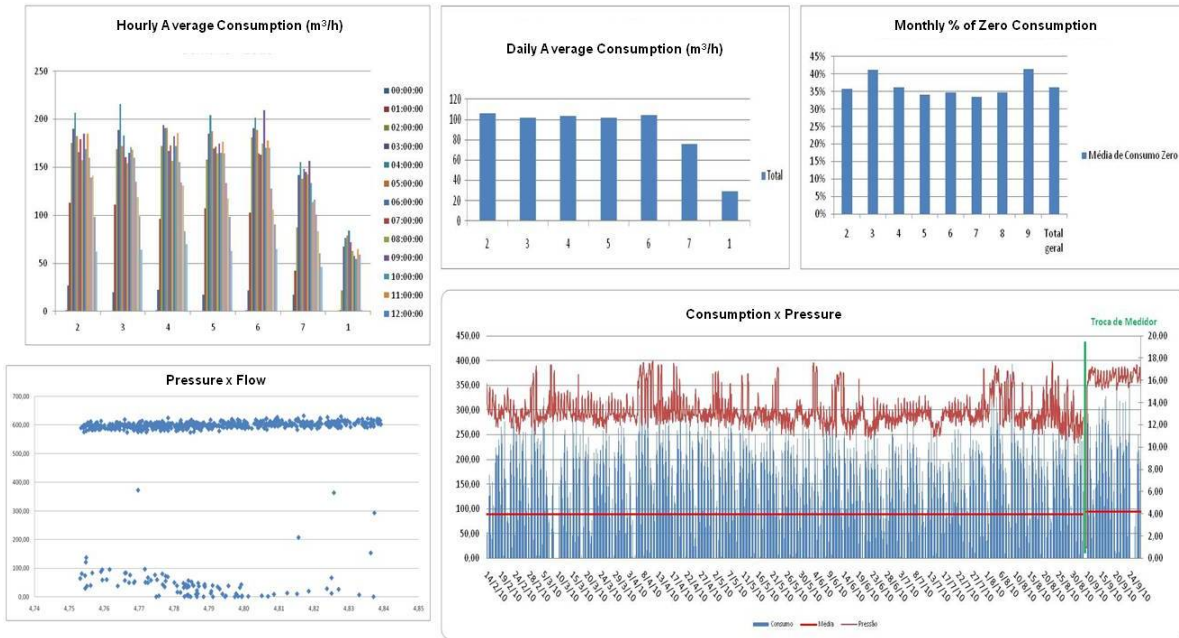


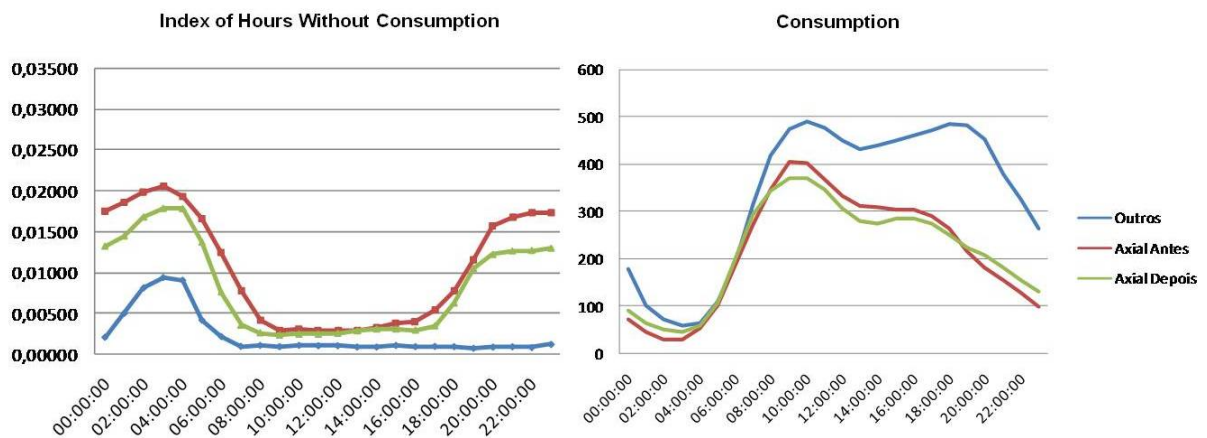
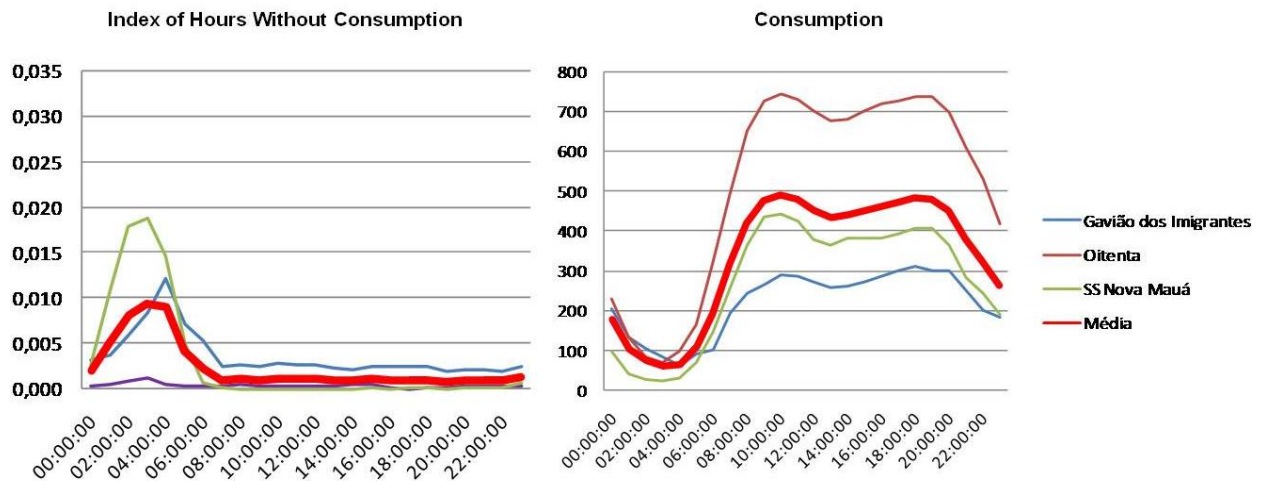
Distance from PRS 2 to GNV Station 2: 1,446 m



2- Operational Parameters Evaluation (Volumes, Flow, Pressure, Time, etc.)

Data on volume, flow, pressure, and day time can be worked in different combinations to assess operational proceeding of gas consumption indicating gas misuse, as indicated in the graphs following.





7- What was found

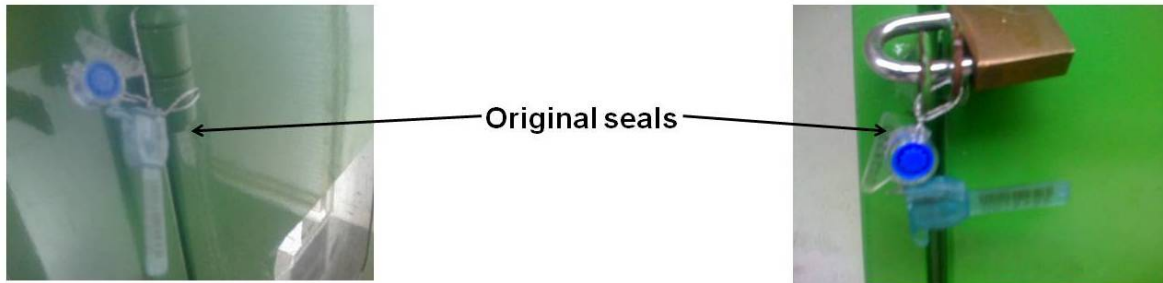
As a consequence of a better understanding of the problem, the assertiveness of field inspections has become much higher. The group of Repression to Organized Crime of the Public Prosecutor began to fully support the actions. Besides that, Brazilian media was also interested in the subject and gave a major coverage to the actions of fraud detection in NGV stations.

Due to the big visibility in the press, the Judges were also more sensible to the risks that these criminal actions could pose to society, as a whole. From this moment on the results of lawsuits against the NGV stations that stole gas became almost entirely favourable to COMGÁS.

Various types of irregularities were found, among which are:

1- Seals Violation

The seals may be broken by actions that are not necessarily linked to the theft of gas. However, the exchange of original seals by non original seals and the violation of the original seals are clear indications of actions aimed at gas theft.



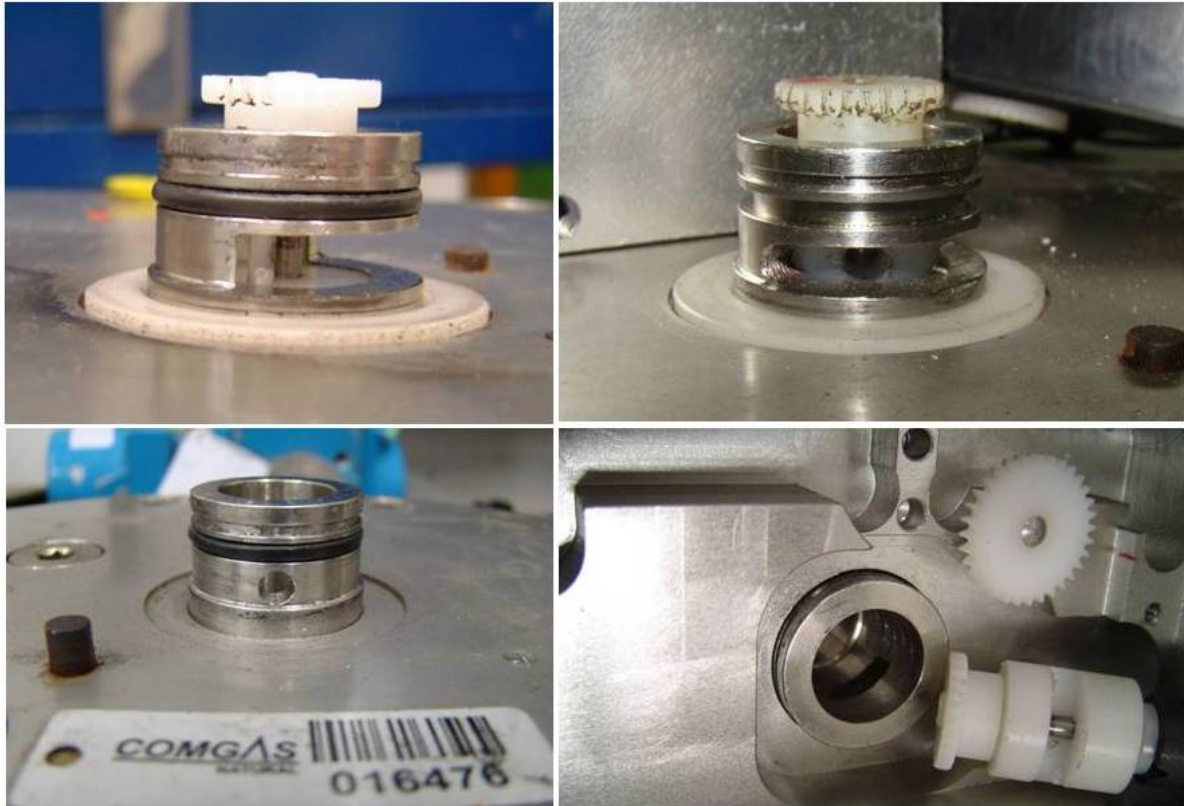
2- Meters Opened

The meters are owned by COMGÁS and according to the supply contract the customers are forbidden to manipulate these equipments. The attempt to open the meter is a clear indication that there was the intention to deviate gas.

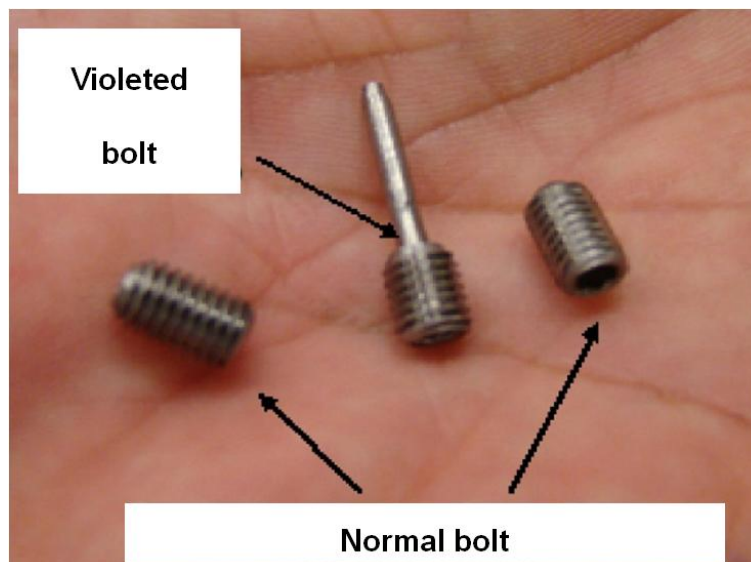


3- Holes in the Axis of the Meter & Screw Violation

This is a clear case of fraud: a hole in the axis that drives the record system of the gas flow metering. Through this hole the defrauders prevent the axis to rotate and do the correct record of the consumed gas.

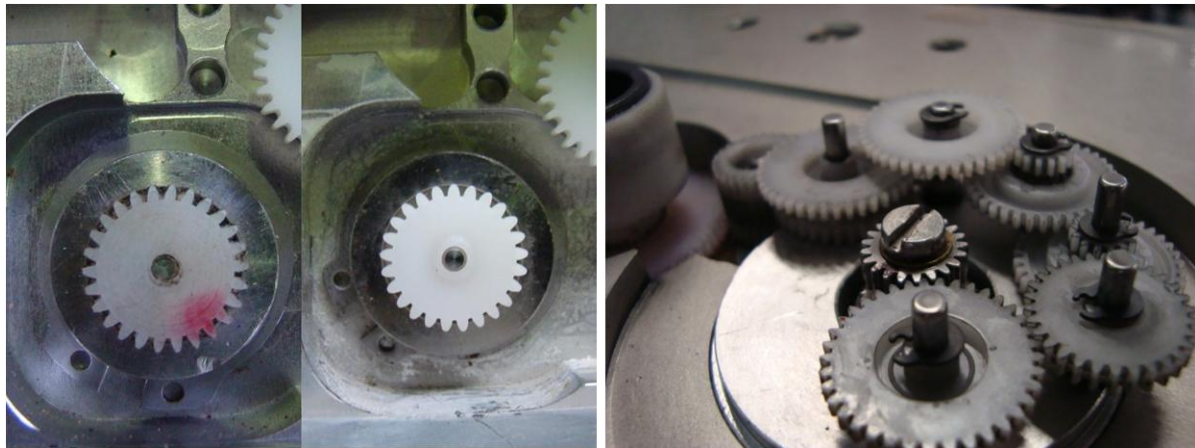


The photo below shows a violated screw. Through the extension welded on the original screw the defrauders prevented the right turn of the logging mechanism of the gas flow through the meter.



4- Gear Meter Violation

Gears with different number of teeth to adulterate the correct volume of consumed gas. This is a fairly complex meter tampering, because the defrauder has to know the functioning of the meter flow register.



In the photo below on can see that the adulterated gears (left side) are quite similar to the normal gears (right side). This type of fraud could only be identified after a bench testing of tampered meters in IPT's meter calibration laboratories.



5- Meter Dial Violation

In these cases the defrauders accessed the meter dial and performed different types of actions to prevent the correct measurement of consumed gas. Commonly, the dials are physical damaged in order not to rotate properly. This type of action is easily noted. The second most common form of fraud with the dials is to disconnect them from the axis to impede consumption recording. This situation is more difficult to be perceived, as the dial can be reassembled before the inspection.



6- Meter By-Pass

This is a “classical” manner of deviating gas. There are many ways of bypassing the meters.

The most complex case: the defrauder welded a connection in the inlet gas service of his real estate, between the block valve on the footpath and the metering station. A parallel gas line (bypass) was built, going from this service connection point to the compressor, behind the meter. This parallel gas line entered into the station office, where the defrauder kept a manual shut-off valve, inside a closet. This valve could be promptly operated in case the COMGÁS team arrived at the station. This office was located on the second floor, offering a broad view of the entire site. It also had a reinforced door that was permanently closed. The

bypass was found with the help of a micro camera that was inserted into the service pipe through the footpath block valve.

It was also found by-pass at the points of pressure outlet in measurement system. In some cases the bypass was done by sticking the figure eight installed in the reserve stream of the meter set.

The photos below show a case where the bypass was done with flexible hoses from the filter pressure gauges point up to the connections welded at the compressor inlet. The by-pass was dismantled every time the COMGÁS team arrived at the station. The access to the compression area was made by the employees of the NGV station using a secondary hidden door. Usually the COMGÁS employees had to wait long periods to have access to the meter, the main entrance was locked and the key keeper was never at the station. "He had to be called to open the door".

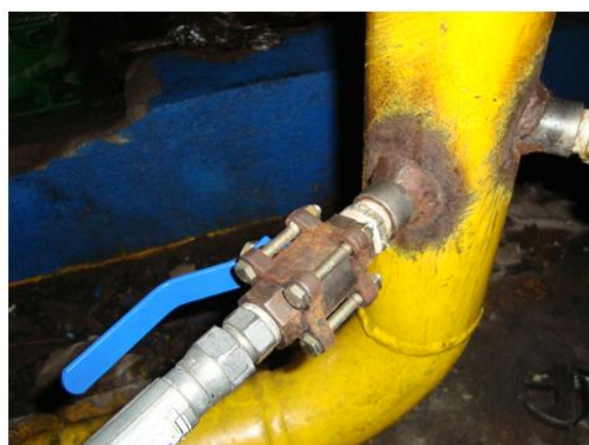
The immediate access to the compression area was made with the support of the Public Prosecutor, who obtained legal authorization to do it. The by-pass was operating.



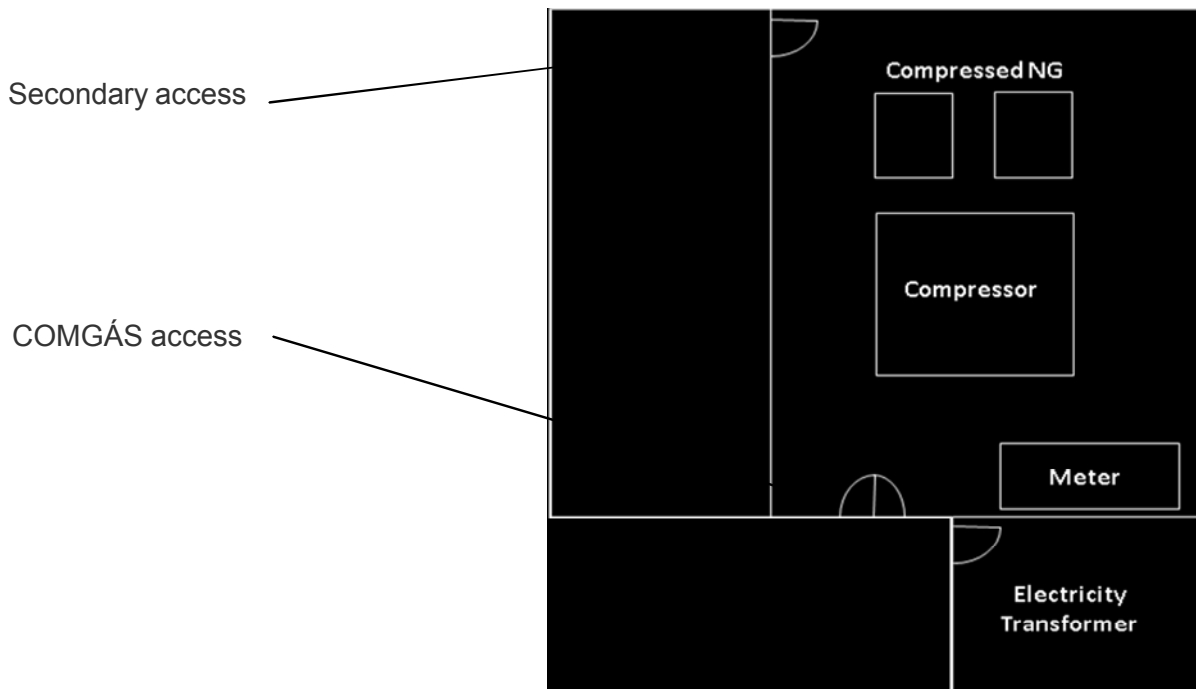
By pass at the filter pressure gauges positions



Compressor Entrance



Lay out of the compressor and meter system area



Photos of the local



Secondary Access



COMGAS Access

Results

8- Mitigation Actions

After identifying the main ways of executing frauds to deviate gas, COMGÁS has implemented a set of different actions to minimize and refrain this kind of problem.

These actions can be classified in two groups, Organizational & Procedures and Technical & Field Actions.

Organizational & Procedures

- 1- Review the inspection procedures of installations, with more specific and detailed guidelines for maintenance personnel and meter readers. The objective was to facilitate the identification and report of typical situations involving gas deviation. Besides that, it is important to ensure that the evidence collected can be used in future legal proceedings. This procedure also intended to ensure the physical integrity of these professionals in contact with situations that characterize the existence of anomalies. Implementation of an anti-fraud and loss prevention culture in the company.
- 2- Revision of the installation standards for the premises where the metering system is assembled. Improve safety conditions and provide better external visibility, avoiding hidden places that facilitate the assembly of bypass or adulteration of meters.
- 3- To obtain the Regulator's approval concerning the reviewed installation standards.
- 4- Communicate and request the customers to provide the adaptation to the new installation standards within 120 days. Failure to comply with these requirements would imply in closing the gas supply to the NGV station until the situation is normalized.
- 5- Revision of the Crisis Management and Emergencies Plan of the company, taking into account the situations related to gas deviation risk.
- 6- Be more rigorous regarding the management of loss risk, especially with new clients and during the renegotiation of the gas supply contracts. The strategy will prevent potential defrauders being accepted as gas consumers.
- 7- Developing a new software to support the data analysis process in a quicker and more accurate manner.

Technical & Field Actions

- 1- Training the field teams and meter readers to identify gas theft.
- 2- Changing the layout of the meter set which previously had two streams, the main one with the meter and a reserve one normally flanged. The reserve stream was eliminated just to avoid the assembling of by-passes.

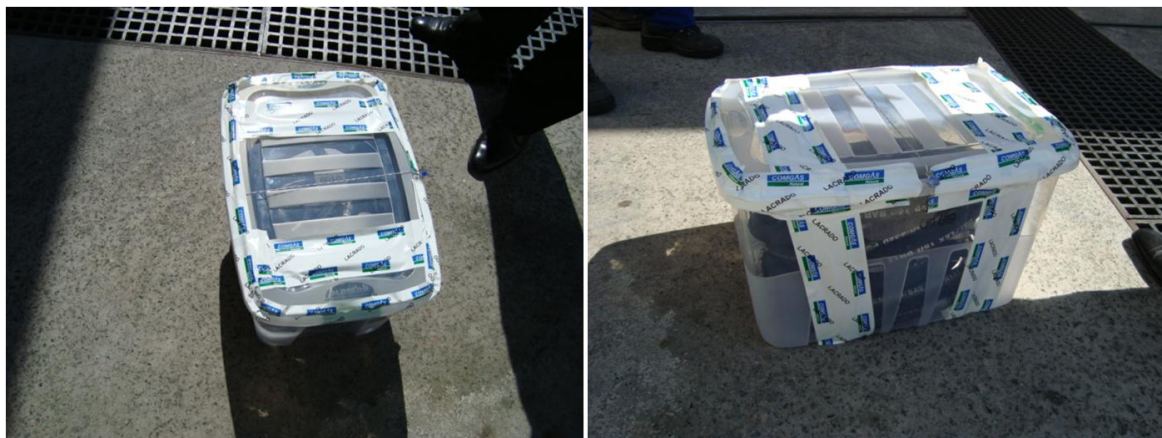
The photo below indicates the old design of a meter set for NGV station with two streams. As can be seeing the reserve stream could be an "invitation" for by-passes.



Reserve Stream (eliminated)

- 3- Perform all exchanges of meters and PTZ's with the presence of IPT technicians, to seal the removed equipment and issue a replacement monitoring report. The removed meters will be inspected in the IPT test bench. Any suspicion regarding unauthorized action involving the equipment will generate a technical report stating the type of suspected fraud. This report will support future claims against the defrauder.

The photos below show a sealed box containing a removed meter that is being sent to the IPT meter laboratory for inspection



- 4- IPT did a qualitative risk study based on the found adulterations. This study shows the high risks brought by the gas equipment that is exposed to unauthorized actions. The public authorities generally become very impressed with this kind of study.
- 5- Internal inspection of the pipe services using a special camera (endoscope type) that checks the existence of physical deviations at buried points. This method is particularly applicable in case it is not possible to run a check excavating the area. The method allows checking up to 40 m of pipes without excavating or using any destructive method within NGV station premises.

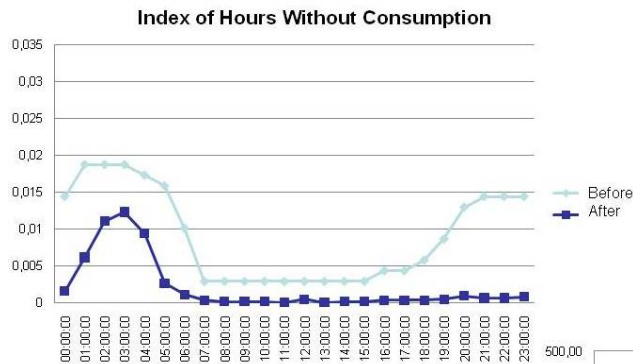
- 6- Use of video cameras inside the COMGÁS equipment to try to identify if any action was performed by unauthorized persons in the area where the metering system is installed.
- 7- Develop a partnership with the Police and with the Public Prosecutor to perform several actions in NGV stations where there were indications of gas misuse. In two of those actions, in a short period of time, it could already be identified 12 stations with adulterations. The gas supply to all of them was immediately stopped.
- 8- Development of a new Seal that uses a strong adhesive, which is resistant to chemical solvents. The serial numbers of the seals are controlled by SAP and they are easy to adhere to any surface

The photos below show the Seal and some of its application



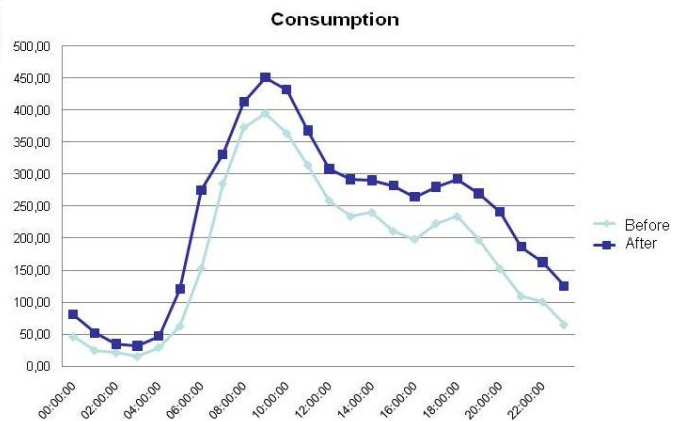
The example below indicates the differences of volume in one particular NGV station where the new Seal was installed.

Station "A" (after the new seal)



77,3% of reduction of the hours without consumption

28,6% of increase in the consumption



- 9- Installation of GPRS communication system between the flow computers installed in the meter set at the NGV station and COMGÁS Control Room. This allows the consumption monitoring in real time at every station where a potential risk of gas theft exists.
- 10-Development of special polyurethane coating involving the casting of the rotation meter, including the dial. This coating prevents any direct access to the meter. A glass plate was installed in front of the dial and on the polyurethane to avoid small holes that would lock the meter.

The photos below show the polyurethane coating applied to the meter



11- Replacement of meters installed in the field for new meters already with the polyurethane protection. In addition, all meters have been opened and checked by IPT before the installation of the polyurethane protection. This procedure is intended to protect COMGÁS in case of the identification of a future fraud in these replaced meters.

12- Development of special steel box to protect the meter set, which happened in different stages. At each stage the gained experience was incorporated to the box design.

Phase 1:

The box was originally designed to protect the meter and the flow computer (PTZ).



Phase 2:

The box also protected the sensors (pressure and temperature) of the meter set and the locker of the door was improved.



Phase 3:

The box included: a) mechanical locks similar to the ones used in safes, b) alarms to detect unauthorized opening of the box's door, c) remote opening of the doors via Control Room, using passwords, and d) all the components of the meter set were installed within the steel box (in order to eliminate all points subject to gas deviation, from where by-passes could be assembled).

NGV Station A: before (meter with PU, without the box)



NGV Station A: after (meter with PU and with the box)



Phase 4:

It was included a remote control block valve, operated by the Control Room.



Summary / Conclusions

The effort described in the previous chapters demanded many hours of hard work from the COMGÁS teams and also from the contractors who supported the company in this enterprise. After nearly four years of continuous action focused on the elimination of gas theft in the NGV market, the results are significantly positive. The current situation can be considered under control, although it doesn't mean that this kind of issue is really overcome.

Some figures about this journey deserve attention:

Actions

Metallic Box & PU Meters Installed	171
Metallic "Safe Box" Installed	46
Field Inspections since 2008	2,703
Data Analysis per year	400
Points monitored by GPRS System	60

Until the end of 2011 the following main results were achieved:

Results

NGV Stations Closed	27
Investment	U\$ 1,5 million
Potential Losses Avoided	U\$ 80,000 /day
UFG at the end of 2011	0,20%

The learning experiences for COMGÁS in this process were enormous. They can be identified in several areas, such as,

a) Organizational: indicated by how the company prepared itself to tackle a very critical issue.

b) Technical: represented by the various technical developments achieved and by the solutions reached at different process stages. Some of them are unique in the gas industry.

c) Legal and Institutional Relationships: shown by the way a positive relationship was maintained with the competent authorities. Furthermore, the society was protected against the risks posed by illegal practices in the gas distribution networks.

d) Media Relationship: as it was a critical subject, if it had not been handled properly with the media it would have created a crisis environment, without control.

e) Asset Integrity: despite finding several critical problems it was possible to maintain the operating conditions within safe levels, keeping the risks under control.

Last but not least it is worth highlighting some key learning experiences for COMGÁS:

a) The Zero Tolerance Policy was very effective to help the reduction of gas theft.

b) Even acting against defrauders without any respect to the ethics and to the law, it was essential to the COMGÁS success in this journey to strictly observe the business principles of the company and mainly the applicable legislation,

c) The issue involved every area of the company. It did not refer only to the technical areas or to the security area. The proper solution required the involvement of the entire company, especially the involvement of its top management.

d) The concern with the issue has to be permanent. The fact of having achieved some success to date does not mean that other forms of deviation of gas in the NGV segment or in other market segments may not arise. For sure, right now, a defrauder somewhere is trying to find ways to illegally deviate gas. There is, therefore, a need to be constantly alert regarding the risk of gas theft.

e) The UFG was an important indicator for the initial identification of the problem and also to monitor its evolution. This indicator, being well managed, represents a powerful tool to control gas losses in a gas distribution company.