

Seminar and Study Tour on Gas Metering Stations and Data Recording

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Abbreviations List

CH ₄	Methane
CO ₂ e	Carbon dioxide equivalent
DI&M	Directed inspection and maintenance
DN	Normal diameter
EC	European commission
EU	European Union
GIS	Geographic information system
GHG	Greenhouse gas
IPCC	Intergovernmental panel on climate change
IR	Infrared
IRR	Internal rate of return
km	Kilometres
LDAR	Leak detection and repair
LNG	Liquefied natural gas
NO _x	Nitrogen oxides
OVA	Organic vapour analyser
PC	Partner country
PID	Piping and Instrument Diagrams
PIMS	Pipeline integrated management system
ppm	Parts per million
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition
TOC	Total organic compounds
U.S. EPA	U.S. Environmental Protection Agency
UV	Ultraviolet

Executive summary

Description of the seminar and the study tour

The JSC Tajikstransgas company, and the Georgian Gas Transmission company, both monopoly Gas Transmission System Operators (TSOs) of their countries, Tajikistan and Georgia, requested from the INOGATE Technical Secretariat (ITS) a seminar and study tour to one of the EU TSOs regarding the operation of modern gas measuring equipment, data collection, retrieval, process and storage.

ITS organized the event in collaboration with the Gas System Operator of Lithuania, AMBER Grid. This company has recently renovated its network including the measuring and compression stations with new equipment, fully automated and in accordance with the directives and standards of European Union. The communication of their experience on how they have moved from the old system to the new one was considered valuable by the participants of the event, especially as it was delivered in Russian language. Additionally ITS invited SOCAR- Production Association Azerigaz to take advantage of the seminar. SOCAR and GGTC have several border meter stations that take measurements either side of the border to monitor the Cross Border Trading between them.

The technical assistance provided by INOGATE to help establish EU good practice in solutions to the gas metering issues will help minimize commercial gas losses in the Tajikistan, Georgian and Azeri transmission systems the benefits from which will be enhanced as the anticipated transmission volume will increase in the near future between these countries.

The duration of the seminar and study tour was three days, conducted in middle of June 2014. On the first day the representatives of each participant country presented the status of the measuring stations in their country, the problems they face and their plans for renovation of the installations, including improvements in the operation and accuracy of measurement. Then five experienced engineers from Amber Grid described the transmission network of Natural Gas in Lithuania: the metering facilities and equipment; the legislation and standards that apply to the measurement of the gas; the cross border metering stations; and the software that is used for the data management, recording, retrieval, reporting, transfer and storage.

The participants spent the next two days visiting the dispatch centre of the company and four metering stations. On these visits they had the opportunity to meet the operators and discuss in details the operation and maintenance of the units and the accuracy issues between counter parties. In the dispatch centre the SCADA¹ system was presented as an integrated system for the monitoring and control of the Gas Flow in the transmission network and the processing of the measurement data that the system receives in real time.

¹ **SCADA (supervisory control and data acquisition)** is a system operating with coded signals over communication channels to provide control of remote equipment.

Findings

This AHEF assignment increased the capacity of the Gas Transmission System Operators representatives. As a result of participation, they now have the knowledge and references to renovate their measuring stations and to operate and maintain them in accordance with European standards. The participants received all necessary information required to comply with the actual legislation applied to gas measurement in all European countries, along with the procedures for the certification of measuring equipment, which are used to maximize accuracy and to ensure the data collected will be acceptable to counter parties. The application of the techniques learned will, if deployed, result in improvement of the metering stations' performance in the three countries, better communication in cross border gas trading and facilitate the reduction of gas losses.

During the study tour, participants acknowledged the specific achievements of AMBER Grid and sought information to help drive their own organisations in the same direction. Observations were as follows:

- 1) The three participant countries have not yet installed SCADA systems that provide real-time data to the dispatch centre and that enable automatic control of the system operation. The most developed system is in Georgia, however it is quite generic if will be compared with the SCADA systems in operation in all European Countries. The participants have realized the advantages of modern SCADA systems and learned the features that these systems have.
- 2) Full automation of the monitoring and control systems of gas transmission has resulted in unmanned operation of all metering and gas compression stations of AMBER Grid network. This impressed the participants, who discussed the details of the operational procedures with the engineers in the dispatch centre and in the metering stations.
- 3) Cross Border Trading is an important issue for AMBER Grid. The gas supplier is Gazprom, with gas imported through Belarus, which Lithuania then supplies to Kaliningrad-Russia. The metering station of Sakiai is used exclusively for the transfer of gas to Kaliningrad. The participants collected information on the procedures that the two parties apply, which has resulted in a successful, smooth cooperation.
- 4) Connection with the LNG supply in Klaipeda. Construction of the LNG terminal in Klaipeda was being completed. Close to the existing metering station, a second station was under construction, to connect the LNG terminal with the transmission network of AMBER Grid. The participants had the opportunity to see a station under construction and the interconnection between them.

A final result of the study tour was the development of personal relationships between the representatives of the four system operator companies (both trainers and participants). These representatives plan to continue the exchange of information directly between themselves to share experience.

1 Introduction

This Final Report describes the Seminar and Study tour undertaken to support the Tajiktransgas, GGTC and Socar (Gas System Operators of the Tajikistan, Georgia and Azerbaijan Transmission Networks respectively) with training aimed at transferring the necessary skills to: develop procedures for operation and maintenance of the measuring equipment in their stations; certify the accuracy gas flow meters by accredited companies; and to develop internationally acceptable methods of measurement data recording and storage.

As illustrated by prior INOGATE projects, such as "Technologies and methodologies for reducing gas losses of the Central Asian Gas Transit System" and "Safety and security of main gas transit infrastructure in Eastern Europe", the issue of gas losses (technical and commercial) in natural gas networks remains a relevant and

significant problem. Commercial losses occur due to metering errors and operational failures at cross-border gas metering stations are significant and need to be tackled.

INOGATE has supported development of a number of modern cross-border gas stations in the region (Georgia, Azerbaijan, Armenia, Uzbekistan), however their operation & maintenance has been challenging to the national gas companies due to a lack of training in appropriate maintenance techniques. For example, experience at Gweletti metering station (on the Georgia- Russia border) has identified amongst other problems the lack of training of GGTC personnel responsible for operation.

The technical support provided by INOGATE to help establish EU good practice in solutions to gas metering issues will help to minimize commercial gas losses in the Tajikistan and Georgian transmission systems, the benefits of which will be enhanced as the anticipated transmission volume will increase in the near future between both countries.

The Azeri organisation SOCAR was invited, because they have common cross border pipelines with Georgia and both companies should solve problems using the same procedures and standards. New pipelines are under construction to transfer gas from Baku to Central Europe. The mitigation of commercial and technical losses along the pipeline is to the benefit of EU consumers.

The seminar and study tour focused on the development of operation and maintenance procedures for metering stations, as well as the certification procedures that EU TSOs follow in order to have reliable measurements of gas quantities accepted by their counterparts and the methods of recording and storing the data. The adaptation of European methodologies will give the opportunity to Georgian, Azeri and Tajik System Operators to produce data in forms that can be compared with others and especially with European partners and organisations.

The Lithuanian System Operator (Amber-Grid) was selected as host for the seminar and study tour because it's company technological level was similar to that in Georgia, Azerbaijan and Tajikistan before joining the EU. However joining EU and following the instructions and requirements of the Energy Community, resulted in transformation of the operation and maintenance procedures to match European standards, leading to organizational upgraded and renovated gas transmission system.

On the first day, the representatives of each participant country presented the status of the metering stations in their country, the problems and their plans for renovation of the installations, and improvements in the operation and accuracy of measurement. Then five experienced engineers from Amber Grid described the transmission network of Natural Gas in Lithuania, the facilities and equipment in the metering plans, the legislation and standards that apply to the measurement of the gas, the cross border metering stations and the software that is used for the data management, recording and transferring.

On the next two days, the participants visited the dispatch centre of the company and four metering stations, where they had the opportunity to meet the operators and discuss in detail the operation and maintenance of the meters and the accuracy issues between counter parties (Lithuania imports gas from Russia and supplies to Kaliningrad).

2 Preparation of the seminars/study tour

The preparation of the seminar/study tour consisted of the following tasks:

- Development of the concept note, thematic agenda and selection of the European System Operator to implement the one day seminar and show in two days the main metering stations of its network, how they operate, maintain and certify the accuracy of the metering equipment.
- Based on the agenda of the seminar, selection of trainers from the organization AMBER GRID organisation to prepare the seminar material.
- Preparation of a contract for the engagement of AMBER GRID and the specific trainers in the event.
- Preparation of the invitation letters for the participants. Participants were two persons from each partner country: Tajikistan, Georgia and Azerbaijan.
- Selection of the metering stations in Lithuania to be visited by participants.
- Logistics of flights, conference venue and hotels for participants and ITS speakers and staff.
- Development of ex-ante and ex-post questionnaires.
- Preparation of presentation by participants of the status of metering stations in their home countries.
- Organise the translation of the seminar and study tour material.
- Development and updating of the seminar agenda.
- Development and editing of the seminar materials.
- Distribution of ex-ante and ex-post evaluation questionnaires.
- Preparation of the evaluation reports and review of the conclusion of the seminar.

The specific objectives of the seminar and the study tour were to support all three participant organisations Tajiktransgas, GGTC, and SOCAR respectively Gas System Operators of the Tajikistan and Georgia Transmission Networks:

- To develop methodological procedures for operation and maintenance of the measuring equipment in their metering stations.
- To certify the accuracy of the equipment for the measurements of gas flow by accredited companies.
- To develop internationally acceptable methods of recording and storage of the measurement data.

3 Seminars and study tour

3.1 Combined Event/Study Tour Overview

Location: One Day Seminar in Vilnius Lithuania, two Days to Metering Stations around Lithuania.

Date : 17-18-19 June 2014

The objective of the seminar was to increase the capacity of participants in the design of metering stations in accordance with European Standards, which cover the operation and maintenance of the equipment. This would help to achieve accurate measurements and periodically to certify equipment so that data would be mutually acceptable for counter parties and therefore avoid potential disagreements and decrease non-technical losses.

The seminar started with the presentation of the status of the metering stations in the three participating partner countries :

- Tajikistan
- Georgia
- Azerbaijan

The main topics presented by the members of Amber Grid were:

- Company organisation and how they have transformed operations to comply with the European 3rd Energy Package.
- A description of the Lithuanian natural gas sector, gas transmission, distribution and supply companies in Lithuania, gas consumers and consumption figures.
- A description of the Lithuanian natural gas transmission system, covering the pipeline network, gas-metering stations, gas distribution stations, compressor stations, along with a description of how renovation affected gas metering.
- A description of the legislation for regulating gas metering and metrology in Lithuania and Europe, including the requirements of the Metering Instruments Directive (MID).
- A description of gas metering equipment, certification, inspection, standards and accredited laboratories.
- A description of gas flows in the transmission system, gas losses and gas consumption for calculation of technological requirements.
- A description of the measuring equipment which Amber Grid are using in border metering stations (at Kotlovka, Šakiai and Kiemėnai).
- A description of the gas measurement systems in AMBER Grid, including operation, accuracy and maintenance.
- A description of the hardware and software that Amber-Grid uses for data management: SCADA, SCALA (GDAP) DOVAS etc. covering data recording, transfer, process and storage.

For the next two days participants and trainers visited the dispatch centre of AMBER GRID and four metering stations:

- Dispatch Centre, located in a Vilnius suburb, where the Scada system is installed and from where Amber Grid monitors and controls all metering stations, distribution stations, compressor stations and records the flows and gas balances.
- The Vilnius Metering Station that is located nearby the dispatch centre and controls the gas flow to the residential and industrial area of Vilnius.
- The Sakiai gas Metering Station, that measures and controls the gas flow to Kaliningrad.
- The Kaunas Gas Distribution station, which manages gas distribution to Kaunas, the second city of Lithuania.
- The Klaipėda Gas Distribution Station, which is located on the coast of the Baltic Sea, and controls the distribution to a rural area. This is connected with the LNG terminal that was under completion and from December 2014 will import LNG to the Lithuania transmission network.

3.2 The participants

A list of the participants attending the Seminar may be found in Appendix 6.3

3.3 The results from the seminar and the study tour

- The seminar and the study tour increased the capacity of the Tajiktransgas, GGTC/GOGC and SOCAR personnel concerning issues related to the metering stations: Organisation of the company, Design concept of each station, Equipment for the measuring and all other tasks of a station: pressure control, odorization², filtering, calibration and certification of measuring equipment.
- JSC Tajiktransgas estimates its commercial losses to be up to 7%. Implementing better measuring and recording practices has the potential to reduce these losses.
- GGTC believes that improving the accuracy of cross border metering stations will increase their efficiency and decrease disputes concerning imports from Russia and Azerbaijan and exports to Armenia and Turkey.
- The presence of Azerbaijan (SOCAR) engineers jointly with their Georgian colleagues gave them the opportunity to discuss with AMBER Grid engineers the methods that they are using for metering the cross border gas and how they solve any discrepancies with their counter parties (Russians, Belarusians and Latvians).
- Participants visiting the dispatch centre, realized the importance of the operation of SCADA system. The real time connection of all metering and controlling equipment and the continuous processing of the recorded data prevents any gas leakage and allows the operator to balance the quantities within the network and keep gas losses at a minimum level.

4 Evaluation of the Event

The evaluation of the event and its impact has been assessed using the questionnaires (see appendix 6.4) which were completed by the participants before and after the event. The evaluation was aimed at:

- The assessment of the overall organisation of the event (presentations, logistics, hotel, etc.) and the utility and quality of each session.
- A self-assessment on the knowledge gained and an evaluation on covering the priority needs of the participants by the contributions delivered in the event.

² Natural gas odorization is a process whereby odorant is added to the gas so that it can be smelt to aid leak detection.

Additionally in the second part of this chapter specific comments, remarks and conclusions are included as have been presented by the trainers and the participants. Finally a brief reference is given to the presentations of each country representative. The status of metering stations in each country and the effort that they have already spend to improve the operation conditions and the accuracy of measurements show that the event achieved the objectives of the application and was very useful to the needs of the organizations

4.1 Overall organisation evaluation

An evaluation of the overall organisation of the event included the following components:

- 1) Organisational Aspects
 - Overall organisation
 - Travel and visa support
 - On-site organisation
 - Quality of the hotel
 - Selection of the topics and presentations

- 2) Quality of Sessions (selection of topics)

- 3) Achievement of the INOGATE seminar’s objectives

The summary of the evaluation results for all above mentioned components is presented in Appendix 6.5

The tables below show an example of the difference of the level of understanding of a set of questions that participants have answered before and after the event:

4.1.1 Overall evaluation

As it can be seen on the evaluation tables the participants have recorded the highest scores for the organisation part of the event

Figure 1: Overall Organisation

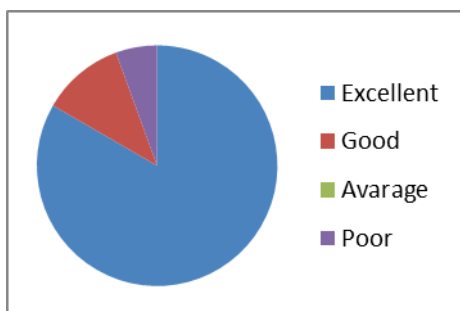


Figure 2: INOGATE Seminar Sessions

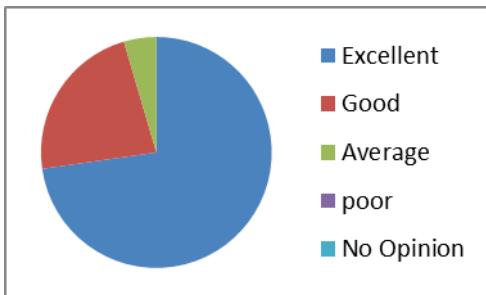
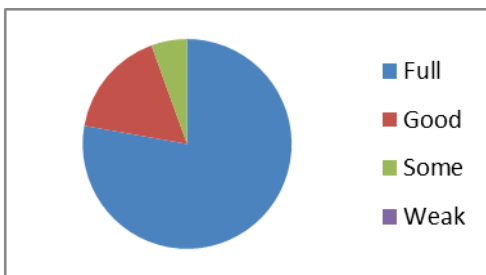


Figure 3: Achievements of INOGATE Seminar's Objectives



4.1.2 Evaluation results tables

The following comparative tables show the difference in level of understanding of participants before and after the event, on the main objectives of the seminar. The tables of all answers to the questionnaires are in the Attachment 6.5 :

General and specific knowledge gained and priority needs evaluation

Table 1: How would you rate your knowledge and understanding of European Procedures and Standards applicable to the operation and maintenance of the Gas Metering Stations?

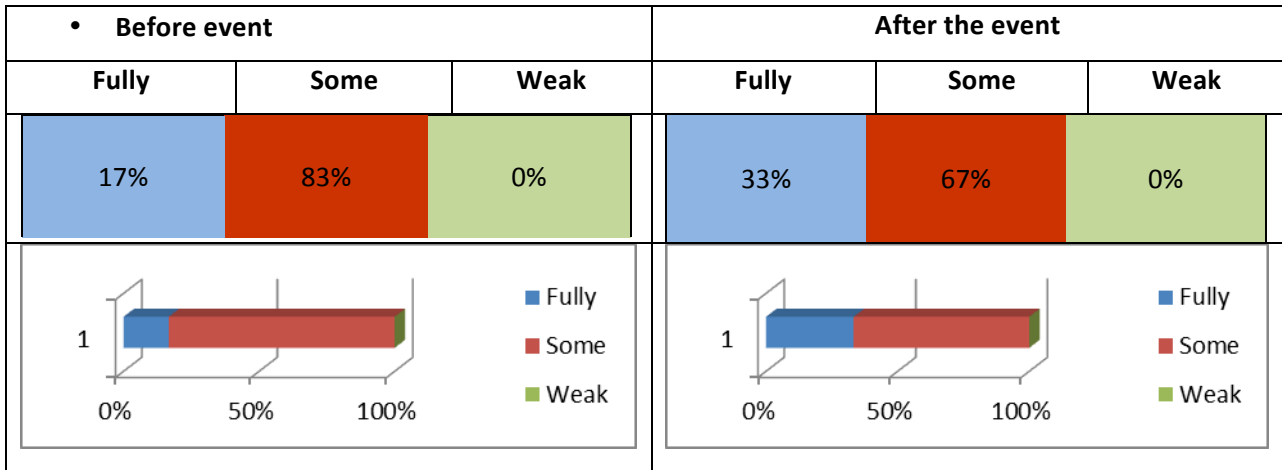


Table2: How would you rate your knowledge on the SCADA systems and their subsystems that European TSOs (Transmission System Operators) are using?

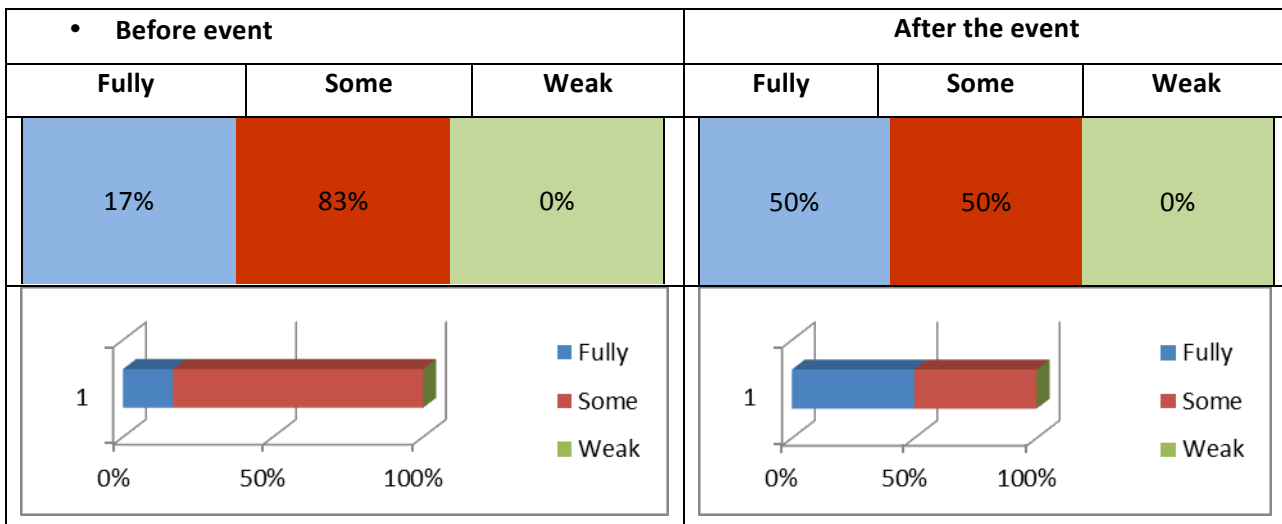


Table 3: How would you rate your personal potential to undertake responsibility for the operation and maintenance of the metering stations of your company/organization?

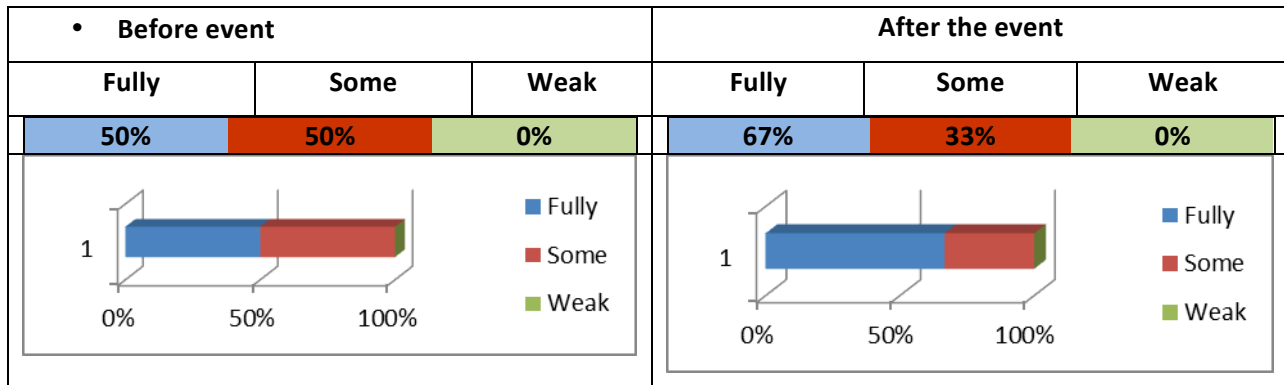
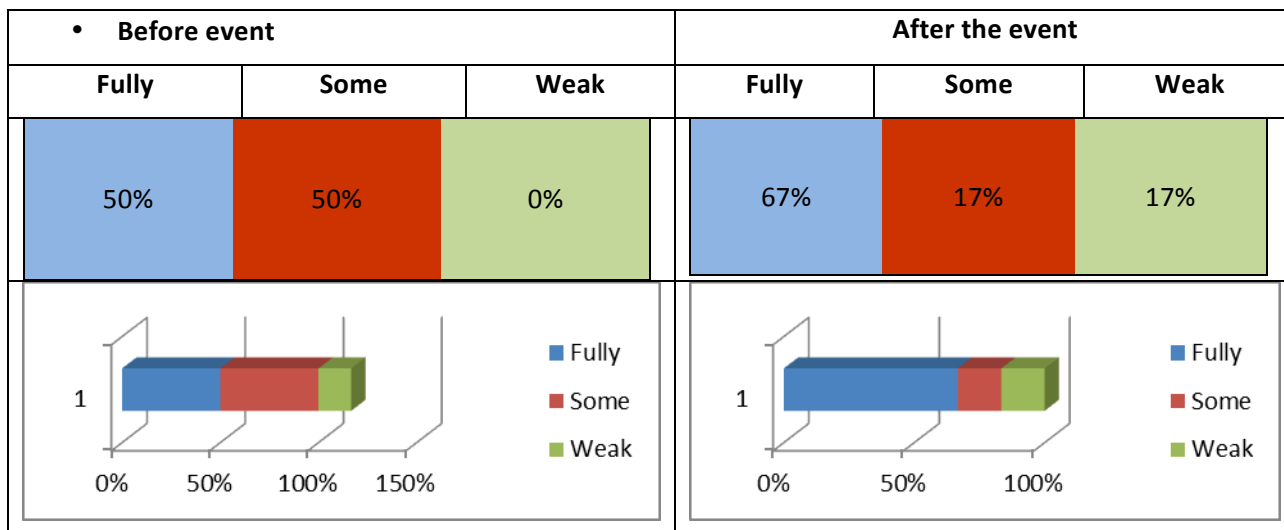


Table 4: How would you rate your skills in the designing and supervising the implementation the Metering Data Management System of your organization for recording, transferring, processing and storage?



The answers on the questions concerning the main objectives of the seminar show that the seminar material, the sites visited were sufficient to provide knowledge of the European standards and norms on metering stations to participants. However that was not enough for all of them to feel self-confident to design, construct, operate and maintain similar plants. It is suggested beneficiary organizations should spent more effort to build up the capacity of their people on the norms, standards, equipment specification related to the design, procurement, installation, operation and maintenance of modern metering stations that will comply with European and International standards.

4.2 Specific Comments and Main issues addressed

4.2.1 Trainers Comments and Feedback

During the one day seminar, upon completion of each presentation, the participants and trainer discussed the main issues of the section. In Annex 6.7 there are brief reports from each trainer pointing out the main issues discussed.

The general conclusions of these comments are:

- The exchange of the experience between trainers and seminar delegates was useful to all parties
- The acquaintance between organisations created relationships that will continue further and without the need of direct involvement by INOGATE.
- Technical and commercial losses remains a major issue for Partner Countries. Trainers made the following suggestions:
 - When identifying gas losses (leakage, unauthorised connections, inaccurate metering) it is necessary to determine the site, region or time of day as accurately as possible. For this purpose, the system balance should preferably be calculated as frequently as possible. The usual frequency is every hour or even every half hour. Naturally, for this purpose almost all metering systems must be connected to the remote control system. The transfer of data to the dispatch centre should be continuous and the network to operate on line. In order to identify approximately the location of the losses, the system should be divided into separate sections for which gas reserved quantities are precisely calculated at the time of calculation of the balance.
 - Pipeline routes should be inspected periodically using methane leak detection equipment.
 - During repairs, the use of gas-pumping and pressure tapping equipment are absolutely necessary to reduce gas emissions into the atmosphere.
 - Efficient use of gas compressor stations, i.e. selection of optimal modes, reduces gas costs.
 - To identify leaks due to poor tightness of the trunk pipeline, organise fly-overs of the pipeline to detect gas leaks with a laser (CHARM)
 - To decrease gas losses due to instrumentation errors, backup gas metering data (sequential work of gas metering systems) and use metering equipment of higher accuracy (the higher cost will be more than compensated by reducing losses and disputes with counter parties). Metering equipment must be certified by an accredited organisation on a regular basis.

4.2.2 Comments and Issues by the participant countries

In the beginning of the one day seminar, presentations were made by the three participating partner countries showcasing their gas transmission systems. These presentations enabled a useful exchange of experience between PC members and Amber Grid engineers. Each presentation was followed by fruitful discussions which, together with the presentations of Amber Grid and the visits to the metering stations, provided the participants with immediate explanations to their queries and contributed to improved understanding of the material and therefore to the successful achievement of the objectives of this seminar and study visit.

The main points presented by each country were as follows:

1) Presentation of Tajikistan

OJSC “Tajiktransgaz” is the only company coordinating transportation of natural gas to the Republic of Tajikistan.

The total length of main gas pipelines located in Tajikistan is 1030 km, including 421 km in the Southern part and 609 km in the Northern part. The diameter of the gas pipelines varies from 325 mm to 1020 mm. The Company also services three gas measuring stations and over 35 gas distribution stations (GDS).

Due to the sharp rise of prices for the natural gas imported from the Republic of Uzbekistan, the consumption had fallen to 200 mln. m³/ year in June 2014; A large part of Tajik industrial enterprises were not being used due to the price level for the natural gas.

Three types of gas flow meters were installed and functioning at the metering points of the OJSC “Tajiktransgaz”, namely: ultrasonic gas flow meters, AUTOPILOT flow meters with orifice plates, and turbine gas meters with electronic calculator, manufactured by Chinese companies.

Commercial metering points of the large gas consumers and technological metering points have ultrasonic gas flow meters manufactured by the Chinese instrument company WEISI (accuracy class 0,5%) with a diameter of 100 – 300 mm. This type of flow meters with the diameter of 100 mm is also installed at the metering points of automobile gas refilling stations for commercial gas metering.

AUTOPILOT flow computers together with the orifice plates are installed at the commercial metering points with the gas pipelines diameter of 100 – 300 mm.

Turbine gas meters with calculators are installed at the commercial and technological metering points, namely: metering points of automobile gas refilling stations, utility enterprises, and collective gas metering in the private sector.

Calibration (multifunction calibrator MC-5R - pressure and difference and temperature calibrator by Fluke company) of commercial gas meters is carried out once per year in the presence of the state verification body – Tajikstandard Agency.

Membrane and rotary gas meters manufactured by the Russian, Chinese, Belarusian and Ukrainian (rotary ones) gas fittings plants were installed for private consumers.

For minimising gas losses, certain methods have been applied and specific projects implemented:

- Odourisation systems have been installed in metering stations on main pipelines. This has resulted in tangible savings due to the reduction of technological losses, i.e. emissions.
- A safety walkthrough along the sections of the gas pipeline route is carried out on a monthly basis by authorised persons and managers.
- Polymer Coated Steel Pipes were purchased through the World Bank project and in 2009 more than 4000 m of the most deteriorated sections of main gas pipelines were replaced in the most swamped areas.

2) Presentation of Georgia

LLP “Georgian Gas Transportation Company” was founded in 1999 and 100% of shares with managing rights belong to the Georgian Ministry of Energy and Natural Resources. The company is the single Licensed Operator of High-Pressure Gas Pipeline Network in Georgia.

The length of the Transmission network is 1922 Km with a rated capacity of 20 billion cubic metres per year. The company maintains 350 metering sites which are located at 241 gas distribution stations.

In 2007 the renovation of the measuring, monitoring and controlling system of the Transmission Network was started, with the following results:

- Replacement of old gas meters to modern ones.
- Connection of all the measuring devices on the pipeline to the GSM network for data collection.
- Development of software for collecting data from the gas meters including information on the internal configuration of gas meters.
- Development of the common electronic database for all the measuring devices installed on the main gas pipeline.
- Building the electronic system for the Dispatch Centre to monitor the pipeline. Electronic equipment were installed on the network to get on line information. On the main pipeline, a few control valves were installed and are monitoring through the centralised system.
- Data are retrieved with in house developed algorithms and relevant reports are generated. Reports are shown on an hourly and daily basis information on gas flow for each consumer (Industrial plants and distributors). On a daily basis, the system calculates the balance of supply and demand and estimates the gas losses.
- Inspectors walk along the pipe network periodically, reporting to the dispatch centre any accident. Walkers are equipped with GSM/GPRS trackers.
- Establishment of Calibration Bench for Gas Meters.
- Modernisation of the Chemistry Laboratory.

3) Presentation of Azerbaijan

Production Association Azerigaz is a subdivision of the State Oil Company of Azerbaijan Republic (SOCAR).

Production Association Azerigaz operates in these main directions:

- Gas receipt at gas distribution and gas metering stations.
- Gas transportation within the Republic in the distribution network of gas pipelines.
- Operation of gas pipeline distribution network.
- Sale of natural gas to local consumers.

At gas distribution and gas measuring stations the gas intake is measured by ROC-107, ROC-407 flow meters manufactured in Canada and using differential pressure method, as well as industrial gas mechanical gas meters and gas meters with electronic corrector.

Currently there are 227 gas measuring units in operation, including 53 domestic gas measuring units of PA Azerigaz.

Metrological service and maintenance of gas flow meters at gas measuring units is scheduled at least once a month by a joint team of representatives of PA Azerigazm, Gazexport Administration, Gazservisavtomatika Department, Administration of Information Technology and Communications at SOCAR.

Gas flow meters – once a year, industrial gas meters – once every 3 years undergo the state verification, by results of which a verification certificate is issued.

Flow meters ROC-107, ROC-407 are calibrated based on three parameters: pressure, differential pressure and temperature at 5 points (minimum, maximum, and three intermediate points).

In the Republic of Azerbaijan accreditation and certification are carried out by the State Committee for Standardization, Metrology and Patent. The practice in June 2014 was for measuring equipment and instruments to be calibrated by the accredited central laboratory of the Office of Information Technology and Communications at SOCAR.

The information on the delivered and received gas is gathered at the end of each reporting month through modem network and ROC WEB software, with the findings of the report printed in hardcopy form. A report on the delivered and received gas is prepared as a joint act between the supplier and the recipient.

5 Conclusions

5.1 Conclusions of the seminars

This AHEF assignment increased the capacity of the representatives of the Gas Transmission System Operators, of Tajikistan, Georgia and Azerbaijan to renovate their measuring stations, and to operate and maintain them in accordance with European standards. Participants received all necessary information for the actual legislation applied to the subject in all European countries and the procedures for the certification of measuring equipment in order to maximise accuracy and data acceptance by counter parties. This will result in the improvement of the measuring stations in the three countries, better communication in cross border gas trading and the reduction of gas losses.

5.2 Specific outcome from the seminars

- 1) The three participant countries have not yet installed SCADA systems and so their dispatch centres do not receive real time data and do not provide automatic control of the system operation. The most developed system is the one of Georgia, however it is quite generic if compared with the SCADA systems in operation in all European Countries. The participants have realised the advantages of modern SCADA systems and they have become aware of the features that these systems have.
- 2) The full automation of the monitoring and control of the transmission system has resulted in an unmanned system for all measuring and compression stations of the AMBER Grid network. That

impressed the participants and was discussed in detail with the engineers in the dispatch centre and in the metering stations.

- 3) Cross Border Trading is a very important issue for AMBER Grid. The gas supplier is Gazprom, The gas is imported through Belarus and then Lithuania exports gas to Kaliningrad. The metering station of Sakiai is exclusively used for the transfer of gas to Kaliningrad. The participants collected information on the procedures the two parties apply, which has allowed a successful and smooth cooperation.
- 4) Connection with the LNG supply in Klaipeda. Construction was being completed of the LNG terminal in Klaipeda during the study tour. Close to the existing measuring station, a second station was under construction in order to connect the LNG terminal with the transmission network of AMBER Grid. The participants had the opportunity to see a station under construction and the interconnection between them.

6 Annexes

6.1 Agenda

1. The Agenda of the seminars/study tour can be found at the following link of the INOGATE web portal)

<http://www.inogate.org/activities/373?lang=en>

6.2 List of participants

1. The List of Participants of the seminars/study tour can be seen in the following link of the INOGATE web portal

<http://www.inogate.org/activities/373?lang=en>

6.3 Presentations

The main presentations of the seminars/study tour can be seen in the following link of the INOGATE web portal

<http://www.inogate.org/activities/373?lang=en>

6.4 Questionnaires

See Attachment 1 Questionnaires (before and after)

6.5 Evaluation results

See Attachment 2 Evaluations

6.6 Photos & media material

<http://www.inogate.org/activities/373?lang=en>

6.7 Trainers Feed Back

1. Gediminas Nakas- Senior Engineer of Gas Metering and Metrology Department of Amber Grid

The following subjects were presented by Gediminas:

- AB „Amber Grid“. The Company's shareholders, board, organisation.
- Gas Flows in the transmission system, gas losses, gas consumption for technological requirements calculation
- Measuring equipment which AB „Amber Grid“ are using in Border metering stations (Kotlovka, Šakiai, Kiemėnai)

“On 17 June 2014 Vilnius hosted a seminar on measuring stations and data recording. It was attended by representatives from Tajikistan (JSC Tajiktransgas), Georgia (GGTC), Azerbaijan (CJSC Azerigaz) and

Lithuania (JSC Amber Grid). Mr. Irakli Orkoshidze (GGTC) made an impressive presentation, describing measuring devices used for gas metering and systems used for automatic control. I was impressed to see what vehicles are used to detect gas leaks. It was also surprising that the Georgian company GGTC had a mobile laboratory for natural gas analysis and a stand for calibration of gas meters.

Mr. Orzuzhon Karimov (OJSC "Tajiktransgas") and Mr. Kamran Dvafarov (CJSC "Azerigaz") prepared exciting presentations describing their companies, measuring devices used at gas metering stations, as well as systems used to record data in Tajikistan and Azerbaijan.

The main problems discussed at the seminar were gas losses in gas transportation system. Two factors contribute to biggest gas losses:

- Problem 1. Leaks due poor tightness of trunk pipelines. Suggestions: fly over the pipeline to detect gas leaks with a laser (CHARM).
- Problem 2. Gas losses due to instrumentation errors. Suggestions: backup gas metering (sequential work of gas metering systems); measuring instruments with higher accuracy."

2. Jurijus Lubinskis – Operating Engineer of Engineering Department of Amber Grid

The following subjects were presented by Jurijus:

- Lithuanian natural gas sector. Gas transmission, distribution and supply companies in Lithuania. Gas consumers and consumption figures
- Lithuanian natural gas transmission system. Pipeline network, gas-metering stations, gas distribution stations, compressor stations. How renovation affected the Gas Metering.

"After communicating with colleagues from Azerbaijan, Georgia and Tajikistan, I have the impression that the gas industry of these countries is serviced to a good standard, and employs qualified personnel. The number of natural gas consumers is rapidly increasing in Azerbaijan, and prepaid smart meters are used for gas metering in the residential sector. There is active gas production with prospect of increase. Georgia has made a major step to replace meters with more modern ones, and to develop protocols for the connection with correctors. Work was done on the automation of data collection and remote control of remote objects, and automation of dispatch functions. It is also impressive how Georgia managed to reduce gas losses to 0.4%. Tajikistan is actively working on the revision of operating rules of gas facilities. I was impressed that at some point 95% of vehicles were converted to gas fuel. Currently Tajikistan is experiencing difficult times due to termination of gas supplies from Uzbekistan, but has good prospects in connection to plans to build transit pipelines to China through its territory.

Possible measures to reduce gas losses.

- When identifying gas losses (leakage, unauthorised connections, inaccurate metering) it is necessary to determine the site, region or time of day as accurately as possible. For this purpose the system balance should preferably be calculated as frequently as possible, once an hour or even a constant moment system balance. Naturally, for this purpose almost all metering systems must be

connected to the remote control system, the problem with the transfer of data to the dispatch office should be fixed, work of software should be adjusted, and forecast program must be available. To approximately locate the losses, the system should be divided into separate sections for which gas reserve is precisely calculated at the time of calculation of the balance.

- Pipeline routes inspections using methane leaks detection equipment.
- During repairs, the use of gas-pumping and pressure tapping equipment to reduce gas emissions into the atmosphere.
- Efficient use of gas compressor stations, i.e. selection of optimal modes to reduce fuel gas costs.”

3. Edmas Arbačiauskas- Head of Gas Monitoring and Metrology Department of Amber Grid

The following subjects were presented by Edmas:

- Legislation for the regulating gas metering and metrology. Lithuania and Europe. Metering Instruments Directive (MID)- Requirements
- Gas Metering equipment. Certification, inspection, standards, accredited laboratories

“Most of the seminar participants from Azerbaijan, Georgia and Tajikistan were managers holding senior posts in their companies. On this basis we can say that there has been interest in the current state and development of the gas industry in the former Soviet republics and in the European Union.

The guests took interest in the organisation of the gas facilities, new technical gas transportation facilities, operation of gas systems and data recording. The guests were also interested in the economic development of the Republic of Lithuania during independence years, i.e. after 1991.

We have gained the general understanding of gas facilities in the above countries and established the contact information to support closer ties.

The workshop made us work fruitfully while preparing for it, prompted a more thorough review of national legal regulations and directives of the European Parliament and the Council relating to gas metering. It was necessary to get into more detail on the documents related to metrological provision of natural gas transportation. This resulted in gaining deeper knowledge in these areas.

Summing up we can say that such workshops facilitate the exchange of experience and knowledge in the gas industry, with a positive impact on the organisation and on gas facilities - from a technical point of view, they also provide a great opportunity for staff capacity building.”

4. Vladas Paplauskas- Operating Engineer of Operating Department of Amber Grid

The following subjects were presented by Vladas:

- Gas measurement systems in AMBER Grid. Operation, accuracy and maintenance

“For me personally the conducted meeting and experience exchange with the colleagues working in the gas sector of the Caspian Sea region countries was very useful and productive. It was helpful to share the experience in gas sector management and operation, particularly in the aspect of the gas metering.

It was a surprise for me to learn that my colleagues used informal software in their systems. I would propose that my colleagues start using licensed software and try to formalise management systems of gas

dispatch centres. One way or another they should establish direct professional contacts with the manufacturers of gas system equipment in Eastern and Western Europe and should not hesitate to ask for help regarding any questions or issues in the gas sector”.

5. Marius Kaklauskas- Senior Computer System Engineer of Information Technology and Telecom Division of Amber Grid

The following subjects were presented by Marius:

- -Hardware and Software that Amber-Grid uses for the data management: SCADA, SCALA (GDAP) DOVAS etc, Date Recording, Transfer, Process and Storage

“On June 17 a seminar was held in Vilnius, attended by representatives from Georgia, Azerbaijan and Tajikistan. The seminar offered necessary and useful information for us and for our guests. The seminar was also very helpful from the professional perspective, because it was interesting to learn how the gas sector is operated in other post-Soviet countries. We could compare and discuss existing systems, their features, drawbacks and qualities. I think that the meeting brought benefits because it provided us with the opportunity to learn some useful things, such as current situation of the gas industry in other countries, to establish new contacts which would allow to continue cooperation and to exchange useful and good experience. For me as an administrator of information systems in the first place it was useful to learn which technologies and solutions are used in other countries that were represented at the seminar. Of course, myself shared useful and good practices, presented the systems used in Lithuania and could compare them with other systems. The system used in some countries participating in the seminar (e.g. Georgia) had much in common with our functioning systems. I had a few professional observations which can be adapted in their operations, i.e. to switch from GSM to much more efficient and fast GPRS or TCP / IP for data collection from facilities. More frequent collection of data will allow more efficient and thorough evaluation of deviations or detection of possible changes in the real time.

I hope that this will not be the last seminar, and in the future it will be possible to continue to cooperate and exchange information about gas industry with these or maybe with new countries also.

6. Raimondas Buckus- Seminar and Study Tour Administrator

“The study tour started in the dispatching centre where AmberGrid collects and processes the data. Participants were interested in hardware and software that AmberGrid uses for the data management. As well the presentation about dispatching centre brought a lot of questions like: what methods AmberGrid use to transfer and agree the data with gas supplier, gas distribution companies and industrial user. Later we went to Vilnius metering station, to a border meter station (Šakiai), Kaunas metering station and to

the newest metering station of Klaipėda. Participants were very interested in equipment that AmberGrid Uses, principles of operation, accuracy, skill of operators and maintenance. As well our company's people gave to participants other items which we considered will be useful for the Tajiktransgas, GGTC and Azerigas personnel.

In my opinion the study tour was really very successful. And the scope according introduction and exchange of experience regarding the operation of modern gas metering devices, as well as their maintenance and metrological support was totally implemented.”