



MONITORING REPORT

Project: **Reduction of Greenhouse Gases by Gasification of Sofia Municipality**

Project proponent: **Overgas Inc. AD, 5 Philip Kutev str.; Sofia - 1407, Bulgaria**
Verification period: **1st January 2009 – 31st December 2009**
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ABBREVIATIONS

AAU	Assigned Amount Unit
AGDS	Automated Gas Distribution Station
CRM	Customer Relationship Management
ELM	Equipment Lifecycle Management
ERU	Emission Reduction Unit
FSERF	Fuel Switch Emission Reduction Factor
GDC	Gas Distribution Company
GDCIMS	Gas Distribution Companies Information Management System
GDN	Gas Distribution Network
GIS	Geographic Information System
GMB	Gas Measuring Board
GMS	Gas Measuring Station
GRB	Gas Regulation Board
GRMB	Gas Regulation and Measuring Board
GRMS	Gas Regulation and Measuring Station
GRS	Gas Regulation Station
LHV	Low Heating Value
LHV _{av}	Average Low Heating Value
PDD	Project Design Document
SAMTS	State Agency for Metrology and Technical Surveillance
SCADA	Supervisory Control and Data Acquisition

1. GENERAL INFORMATION FOR THE PROJECT

1.1. General information

The project “Reduction of Greenhouse Gases by Gasification of Sofia Municipality” is implemented under the Joint Implementation (JI) mechanism of the Kyoto Protocol according to the contract ERU 04/01 between the Kingdom of the Netherlands and Overgas Inc. The project has been granted Letters of Approval by the Republic of Bulgaria and the Kingdom of the Netherlands.

This JI project is implemented under the technical scope Fuel Switch and aims at reduction of greenhouse gases by:

- fuel switch from liquid and solid fuels and part of the electricity used by industrial, public and administrative consumers and households to natural gas;
- improvement of the energy efficiency of the combustion installations of the end-users.

The Project design document (PDD) of the project has been subject to Determination by KPMG Sustainability B.V. A Determination report stating that the PDD has been properly prepared on the basis of Article 6 of the Kyoto Protocol and the guidelines for the implementation of Article 6 of the Kyoto Protocol in the Marrakech Accords has been issued in 2004. The project applies a project specific baseline methodology, validated as appropriate for it.

The project has been subject of Initial, First and Second Periodic Verification by TÜV SÜD Industrie Service GmbH. A third periodic verification will take place in the year 2010 based on this Monitoring report encompassing the period 1 January – 31 December 2009.

1.2. Brief description of the project activity

According to the Project Design Document (PDD) the project foresees construction of 583 km steel and polyethylene gas distribution network (GDN) and more than 32 000 relevant facilities in Sofia Municipality.

The project implementation envisages the generation of 728 590 Emission Reduction Units (ERUs) in the period 2008-2012.

The project boundaries cover the combustion installations of the industrial, public and administrative, and residential end users in Sofia Municipality. The production, transportation and distribution of the electricity replaced by natural gas are also included within the project boundaries. Its emission factors are calculated particularly for Bulgaria and are approved and officially published by the Ministry of Environment and Water for use in Joint Implementation projects¹.

Due to the negligible leakages during the transportation and delivery of the solid and liquid fuels, the intermediate storehouses for storage and sale are not included in the project boundaries. The natural gas leakages are also not included in the project boundaries since the constructed GDN is new, with high quality and reliability, and since the anticipated leakages are insignificant.

¹ *Baseline study of Joint Implementation projects in the Bulgarian energy sector. Carbon emission factor, April 2005, http://www.moew.government.bg/recent_doc/climate/Baseline%20CEF%20Summary.pdf*

1.3. Performance of the project activity

The project has been implemented as envisaged. The project boundaries have not been changed after the start of the project. They are described in the PDD (*Annex 1: Block scheme of the fuels' supply after gasification and project boundaries*).

By the end of 2009, 467.2 km GDN of steel and polyethylene gas pipelines with the respective facilities were constructed in Sofia Municipality, which represents 80% of the planned for construction until the end of 2012.

In 2009 the amount of natural gas delivered to the end users reached 81 497.335 thousand sm³. During the monitoring period **89 219 ERUs** have been generated.

As a consequence of external factors beyond the control of Overgas Inc. (the warm winter seasons in the last years, the deepening financial crisis and the gas crisis in the beginning of 2009) certain slow-down in the growth trends of the connection of new users to the GDN and of the natural gas consumption has been noticed. As the GHG emission reductions depend in direct proportion on the gas deliveries a slow down in ERUs generation also takes place.

2. MAIN PRINCIPLES OF THE MONITORING PLAN

The Monitoring Plan described in the PDD is based on the following principles:

- The total annual natural gas consumption by the end users by sectors is used as an activity indicator to control and determine the greenhouse gas emissions during the project implementation;
- The fuel switch emission reduction factor (FSERF) is used for converting the amount of delivered natural gas to the end users into ERUs for each sector;
- The FSERFs take into account the fuel switch effect and the reduced energy consumption due to the increase of the efficiency of the combustion installations;
- The natural gas amounts delivered to the end users in the three sectors are taken into account for the calculation of the total amount emission reductions generated by the project;
- The fulfilment of the contractual amount of ERUs is determined on the basis on the realized emission reductions;
- At constant low heating value, the change in the natural gas composition does not lead to change in the carbon dioxide emission factor. On an energy base the carbon dioxide emission factor is identical for all kinds of natural gas independently of its quality;
- In case of a change in the low heating value of the delivered natural gas, a recalculation of natural gas amounts is made according to the low heating value used for the calculations in the PDD.

The monitoring of the “Reduction of Greenhouse Gases by Gasification of Sofia Municipality” project is performed by the personnel of the *Ecology and Sustainable Development Dept.* The employees have a high educational qualification and have participated in additional specialized trainings in the field of the greenhouse gas emissions trading, environmental impact assessments, environmental management systems, quality management systems, etc.

3. REPORTING AND MANAGEMENT SYSTEMS

The Gas Distribution Companies Information Management System (GDCIMS) includes the modules *Customer Relationship Management (CRM)*, *Billing*, *Equipment Lifecycle Management (ELM)*, *Reports* and *Informations*.

The **CRM** module manages the database of all clients, including data for the combustion installation. The module serves also for tracking the customer's status – it displays the stage of

customer's connection. The **CRM** module allows automatic issuing, generation and printing of documents and contracts. It contains statistic and marketing data for the users – site type, gas pressure data, mode of use, level of continuity, agreed and consumed amounts of natural gas, etc. In the module data for the appliances which use natural gas – type of the gas appliances and their main technical parameters are entered.

The **Billing** module uses a database for the consumption of natural gas by clients, generates invoices and allows remote control of the activities of natural gas delivery to the end users. The module works with data base which contains the main information necessary for the GDC's financial relations with the customer. The **Billing** module allows automatic invoice generation, which is made after conclusion of series of reports in the **Reports** module and printing letters of notification and bills for invoices. The payments are also indicated in it.

ELM is an information module for maintenance of the networks and the devices. It allows generation of information about the equipments in the GDN. The information contains data about the address and the factory number of each equipment, maximum hourly consumption, input and output pressure, date of exploitation initiation, manufacturer and type of gas meter, etc. The module tracks the elements for electric and chemical protection and the status of the odorizing system. The module also generates information about exploitation status of the GDN, inspection and setting, as well as determined revision with disassembling of the equipment of the GDN.

The **Reports** module serves for preparation of various informations. The readings of the gas meters of the end users are input in this module for the calculation of their monthly consumption of natural gas.

The **Informations** module generates generates various informations using the data managed by the other modules. This module is used for the generation of the data for the natural gas consumption by sectors, used for the calculation of the ERUs generated by the project.

All information modules use unified geographic information system (GIS) and data base.

The Automated System for Dispatch Control Overcomm 2.0 of the **SCADA (Supervisory Control and Data Acquisition)** system contributes for the high reliability of the measurements and accuracy of the data of controlled variables: pressure, temperature and consumption. It reports occurrence of deviations from the technological parameters in the value of measured parameter and deviations in the operation of the measuring devices. The dispatch management is centralized; it is based in Sofia and it services all the GDCs affiliates of Overgas Inc. AD.

4. QUALITY MANAGEMENT AND ASSURANCE SYSTEM

The Quality Management System developed in Overgas Inc. AD allows for the activities done in the company and GDCs to be duly documented and managed. The personnel is acquainted with and trained to implement and follow the approved procedures, instructions and work documents in the scope of their activity.

Procedure II 08.00.00-1 for employees' selection, which is applied in the Overgas system of companies, allows the appointment of experts, who fulfil at a maximum degree the requirements for occupying a particular position regarding education, professional experience, knowledge and skills. Further increase of staff's qualification is achieved through motivation trainings and seminars, conference participations, work meetings for experience exchange, etc. following the **Procedure II 6.2 – 005 for Organizing and Conducting of Training for the company's employees**.

The maintenance of **GDCIMS** and Overcomm 2.0 systems, as well as the activities relevant to the exploitation, technical maintenance and servicing of the GDN and to the control over the deliveries of natural gas are performed in accordance with the unified quality management system of Overgas Inc. and the GDCs. The procedures from the QMS are in compliance with the existing national legislation regulating the activities of Sofiagas EAD. All activities are implemented by the appropriate staff in the company, which is selected and trained in accordance with the above mentioned procedures.

A list of the procedures and instructions of Overgas Inc.’s quality management system that are related to the monitoring of the “Reduction of Greenhouse Gases by Gasification of Sofia Municipality” project is presented in *Annex 2: List of the applicable procedures and instructions from the Quality management system*.

Brief information about the quality control and quality assurance procedures relevant to the exploitation, technical maintenance and servicing of the GDN and to the control over the deliveries of natural gas is presented below in the respective sections of the monitoring report.

5. PARAMETERS MEASURED AND MONITORED

For the preparation of the Monitoring report data were used from the monitoring and the measurement results of:

- Amounts of natural gas entered into the GDN – measured monthly at the Automated Gas Distribution Stations;
- Average low heating value of the natural gas – measured monthly by a licensed laboratory;
- Amounts of natural gas transmitted and delivered to the end users by sectors – measured monthly at each user’s gas measuring station or board.

5.1.Data archiving

The data about the amount of natural gas delivered to the end users, as well as other data, necessary for the elaboration of the Monitoring report, are entered, stored and archived in the GDCIMS by authorized employees of Overgas.

This information system contains all the information relevant to the technical maintenance and the consumption of natural gas by each client of the GDC from the stage of preliminary survey.

All the information entered in the modules of the ISMGDC is stored on a back-up hard drive at Sofiagas EAD. The data are subsequently recorded on servers and a back-up copy is made on a back-up server every day. The servicing of the ISMGDC is performed by Information Technologies Dept. at Overgas Holding AD.

Paper and digital copies of the Monthly acts for delivery and Certificates of Natural gas from Bulgargas EAD are archived and stored at Sofiagas EAD and at Overgas Inc.’s headquarters. Paper copies of the monthly invoices and acts for delivery to every user are stored at Sofiagas EAD, while digital copies can be generated by the ISMGDC.

All the documentation regarding the II project “Reduction of Greenhouse Gases by Gasification of Sofia Municipality”, relevant to the determination, monitoring, reporting and verification of the project is archived and kept on paper and digital copies at the *Ecology and Sustainable Development Dept.* This information will be submitted to the company’s Archive after the project implementation.

5.2. Measurements of the monthly amounts of natural gas that enters into to GDN and the gas’ low heating value

The measurement of the natural gas delivered by Bulgargas EAD is performed monthly on the basis of a contract for delivery signed with Sofiagas EAD by gas meters and electronic volume correctors, which are property of Bulgargas EAD.

A general block scheme of the natural gas supply to the GDN of Sofiagas is presented in *Annex 5*. To improve the management of the process of distribution and delivery of natural gas to the end users at part of the sites for measurement of the monthly amounts of natural gas incoming in the GDN electronic volume correctors, property of Sofiagas EAD are also installed. The devices are of the same type as the ones of Bulgargas EAD. They are connected to GPRS modems which transmit in real time to the Central Dispatch Management via the GSM network data for gas consumption, temperature and pressure. The devices store archives with hourly, daily and monthly data for the amounts of natural gas and the technological parameters of the gas.

With regard to the amounts of natural gas that enters into the GDN, a **Delivery Statement** is prepared and signed by both parties (*Annex 3: Monthly statements for delivery of natural gas by Bulgargas EAD to Sofiagas EAD in 2009*). The Delivery Statement includes information about the natural gas amount preliminarily ordered by the GDC and the actual amount invoiced and received.

The monthly Delivery Statements are obligatorily accompanied by monthly **Average certificate of the natural gas** issued by Bulgargas EAD. This certificate includes information about the composition of the natural gas and its low heating value (LHV). Copies of the certificates are presented in *Annex 4: Certificates of natural gas delivered by Bulgargas EAD to Sofiagas EAD in 2009*.

For taking into account the influence of the low heating value of the natural gas delivered by Bulgargas EAD over the greenhouse gas emission reductions realized, the annual weighted average of the natural gas low heating value is calculated on the basis of the monthly certificates and the monthly statements for natural gas delivery.

5.3. Measurement of the monthly amount of transported and delivered natural gas to the end users

The conditions and the order for reporting the delivered by each GDC natural gas amounts are regulated by **Rules for working with the users, General terms and conditions for selling natural gas to users for residential needs, Contract for distribution and delivery of natural gas, and Contract for transportation**.

The natural gas amounts are measured in cubic meters at standard conditions. “Cubic meter at standard conditions” means the amount of natural gas in a volume of one cubic meter at a temperature of 293.15 K and absolute pressure of 0.101325 MPa.

According to the **Rules for working with the users** and **Instruction H10-6.3-102 for correction of the readings of natural gas consumption-measuring systems** from Overgas Inc. AD’s quality management system, two methods are applied to transform the measured amounts of natural gas into standard conditions:

- Use of special devices called volume correctors;
- Use of a fixed factor, based on the meteorological characteristics of the respective geographic area.

The transformation of the measured natural gas amounts into standard conditions for the industrial users is done using volume correctors within the measuring devices. The measurement of the amounts of natural gas delivered to the residential and “small” industrial users (at 100 mbar pressure and maximum hourly consumption less than 25 m³/h) is done with the fixed factor, whose definition is described in the **Rules for working with the users** and in the **PDD**.

In the presence of a volume corrector within the measuring device, the volume of the gas consumed V_{st} is read directly from the electronic corrector or from the counter of the gas meter if it is equipped with a built-in temperature mechanical corrector.

In the absence of a volume corrector within the measuring device, the volume of the natural gas consumed is calculated by the formula:

$$V_{st}=V_p*K_{tp} \quad (I),$$

where:

V_p the natural gas amount read on the gas meter;

K_{tp} the product of the temperature (K_t) and pressure (K_p) correction factors.

The natural gas consumption of the users in the industrial, public and administrative, and residential sectors is read manually every month by employees of Sofiagas EAD. In case of an industrial or institutional client the reading of the metering device is done in the presence of a representative of the client, who confirms the accuracy of the reading. These users receive a monthly statement about the amount of natural gas delivered which is signed by the client and a representative of Sofiagas EAD.

The readings of the gas meters are recorded in a protocol, which also contains the ID of the gas meter of the respective user and the gas meter’s readings of the previous month. The consumption data for each user are typed manually in the **Reports** module of the GDCIMS by authorized employee of the GDC. The **Billing** module of this system serves for generation of monthly invoices for all users in the three sectors.

5.4. Accuracy of the measurement data and measurement reliability

The high accuracy of the measurements of different parameters and data is guaranteed by the reliable and precise work of the gas meters, manometers, temperature converters, electronic correctors and pressure converters at the Gas Regulation Stations (GRS), Gas Regulation Boards (GRB), Gas Measuring Stations (GMS), Gas Measuring Boards (GMB), Gas Regulation and Measuring Stations (GRMS) and Gas Regulation and Measuring Boards (GRMB).

The delivered amounts of natural gas to the end users are measured on the user’s property borderline with measurement devices (gas meters), which are subject to a type approval, to an initial control and to a subsequent periodic control in a defined time interval according to the legislation of the Republic of Bulgaria.

The devices for natural gas measurement (gas meters) are subject to check-up by the State Agency for Metrology and Technical Surveillance (SAMTS) or an authorized person as per art. 43, par. 4 of the **Law on Measurements** in the terms, defined with an Order of the chairman of SAMTS.

As per Order № A-412 of 16 Aug. 2004 of the chairman of SAMTS the regularity for check-ups of the volume gas meters with deformable chambers (diaphragm) or with roots bodies (pistons) and of turbine gas meters for gas and additional devices for them is two years.

For measurement of the users’ natural gas consumption, Sofiagas EAD is using diaphragm, roots and turbine gas meters. The company has a certificate for gas meters type approval, as well as a passport with ID for each device. Sofiagas EAD prepares annual schedules for subsequent metrological control of the measurement devices. For 2009 the metrological check-ups of 2 132 diaphragm and 98 roots and turbine gas meters, as well as of 187 electronic volume correctors have been scheduled.

In 2009 metrological check-ups of 2 541 diaphragm and 76 roots and turbine gas meters for natural gas, as well as of 139 electronic volume correctors have been performed. In case of necessity the devices have been replaced with new ones. All gas meters and volume correctors used by Sofiagas EAD for the measurement of the end users’ consumption of natural gas are fully calibrated.

The metering devices of Bulgargas EAD measuring the amount of natural gas entering into the GDN, which is used as cross-check parameter for the plausibility of the total consumption, are also calibrated.

If a metering device or a volume corrector without correct calibration is identified, the device is disassembled and sent to a licensed laboratory for metrological check. Such devices are replaced by calibrated devices at the moment they are disassembled.

In case of failure of a metering device or a volume corrector, an average correction factor is applied for the determination of the consumption by the user. This factor is calculated using the consumption by similar users with similar metering devices in the same area or the consumption by the same user in the same month the previous year. A bilateral protocol stating the agreed consumption of natural gas is issued and signed by the consumer and a representative of the GDC. There aren’t any events of this type occurred in 2009.

The reliability of the measured parameters is guaranteed by the implementation of ***Instruction H9-6.3-102 for technical maintenance and servicing of GRS, GRB, GRMS and GRMB*** of Overgas Inc. AD. According to this instruction, the technical service and repair of the GRSs, GRBs, GRMSs and GRMBs should be requested by the GDCs. The regularity, scope and responsibilities for servicing and maintenance of the technical devices for measurement of natural gas amounts are described in the instruction.

In conformity with this instruction, revision with disassembling the equipment is performed with regard to the integrated system for centralized repair by the service company Overgas Service AD on the basis of contracts with Sofiagas EAD and annual ***Schedules for revision with disassembling the equipment in the GDN devices (working document F1-H9-6.3-102)***, co-coordinated and approved by Sofiagas EAD. For each revision with disassembling a bilateral ***Act for performed revision with disassembling and setting the equipment in GDN devices (working document F2-H9-6.3-102)*** is prepared. In 2009 a total number of 98 revisions including disassembling and setting the equipment in devices in the GDN of Sofiagas EAD were performed and the respective acts have been issued.

In accordance with ***Instruction H9-6.3-102***, the Head of Exploitation and Service Department of Sofiagas EAD records in the ***Exploitation register of the equipment (working document F1-H8-6.3-102)*** information for every technical servicing of the equipment performed. This information includes the name of the person who performed the works or the person who is liable for the work, the fulfilled works, and the results obtained.

In 2009, preventive maintenance of part of the equipment on the GDN was performed (GRSs, GRBs, GRMSs, GRMBs, GMSs and GMBs) in order to ensure the continuity of the gas supply and the reliability of the equipment operations in the GDN. During this preventive maintenance taps, filters, valves and gaskets of the equipments were checked and in case of necessity were replaced.

5.5. Balance of the amount of natural gas which entered into the GDN and delivered to the end users

According to **Procedure II 8.1-011 for Control of Natural Gas Retail Sales** the amount of natural gas delivered to the clients and the amount of natural gas that entered into the GDN are compared. The data are collected from the GDCIMS and from the monthly statements of Bulgargas EAD, and the reasons for the deviations are analyzed. The main reason is the different time of reporting. The monthly amounts of natural gas delivered to the GDCs are compared also to the data for the weekly amounts, which are received by the SCADA dispatch system in order to serve for the preparation of weekly operation reports.

The annual balance of the amount of natural gas input into the GDN and delivered to the end users of Sofiagas EAD in 2009 is presented in *Table 2*. The balance is prepared on the basis of the registered data for the natural gas amounts at the entrance and at the exit of the GDN.

	<i>Natural gas, thousand sm³</i>	<i>%</i>
Entered into the GDN	80 890.2	100.0 %
Delivered to the users	81 714.6	101.0 %
Difference	-824.4	-1.0 %

Table 2: Balance of natural gas amounts, entered into the GDN and delivered to the end users of Sofiagas EAD in 2009

The differences between the amounts of natural gas at the entrance and at the exit of GDN of Sofiagas EAD are insignificant and due to the different time of reporting. The simultaneous reporting of the readings for all end users is impossible, since the users' gas regulation and measuring stations and boards do not have remote reading. The natural gas amount needed for initial filling when commissioning large GDN sections also leads to deviations in the parameters.

The balance of the amounts of natural gas at the entrance and at the exit of GDN confirms plausibility of the total gas consumption of the users.

5.6. Insignificance of the leakages, procedures for prevention and accidents' elimination

According to **Procedure II6.3-102 for the service of GDN** and the relevant instructions, annual and monthly plans for the GDN exploitation activities were elaborated; walk-through checks for breaking the integrity of the gas pipelines and for gas leakages and check-ups of the equipment status, etc. were performed. At the end of each month, the results from the walk-through checks and the control were summarized in monthly **Information for the exploitation status of the GDN (working document F3-II1-6.3-102)**.

The quality parameters of the natural gas (pressure, temperature, admixtures content, amount of the odorant added etc.) were checked monthly. No malpractices have been found in the gas pipelines including in the stations for cathode protection. The monthly **Informations for the exploitation status of the GDN** are kept at Sofiagas EAD.

The deviations from the normal operation of the measuring devices and the telecommunications reported by the **SCADA** system are registered in ***Form for the current status of the equipment or a part of the GDN (working document F5-II-6.3-012)*** and ***Register for failure of the telecommunication devices and the automated system for dispatch management (working document F6-II-6.3-012)***.

According to the information in these documents, any deviations in the functioning of the equipment and sections of the GDN, as well as of the telecommunications are eliminated duly and their normal operation is restored.

Sofiagas EAD organizes systematic and periodical checks for natural gas leakages. The periodical checks are performed by preliminarily coordinated with Overgas Service AD annual schedules. For the performed activities a bilateral ***Acts for performed control of GDN for natural gas leakages (working document F1-II-6.3-102)*** is signed.

In 2009 by schedule totally 76 211 m underground gas pipeline networks were investigated for natural gas leakages. According to the elaborated Statements, no breaks or leakages have been found during the investigations.

The natural gas leakages along the GDN are due to accident leakages after breaking a distribution pipeline and to the scavenging before repairs and connections. The accidents are registered by Sofiagas EAD in Statements of ascertainment.

According to the information for accidents in 2009 from the Statements of ascertainment for the accidents occurred, the amounts of natural gas leaked are minimal. There are 123 cases of accidents in the GDN for 2009. 100 of them are related to natural gas accidental leakage.

Information for the natural gas leakages during the accidents in 2009 is presented in *Table 3*.

	2009
Amount of natural gas leaked, thousand sm ³	100.14
Amount of natural gas entered into the GDN, thousand sm ³	80 890.2
<i>Share of the natural gas, %</i>	0.124%

*Table 3: Data for the amount of natural gas leaked during accidents
in the GDN in 2009*

6. PROCEDURES FOR EMERGENCIES

The actions in case of occurrence of large-scale accidents are planned in compliance with the document ***Д7.05.02.13 - Action plan in occurrence of substantial production accident in the gas distribution network on the territory of a municipality***. The plan includes preventive actions for non-admission of accidents' occurrence, forecasting the type and the consequences of accidents in the GDN, defining the actions and the obligations of the operational personnel.

In accordance with the legislation the activities in Sofiagas EAD in time of accidents and emergency situations are implemented following specific ***Rules for work in accidents and emergency situations***. These rules are part of the company's quality management system. In case of accident or emergency situation, information for the implemented changes and the reasons for them are elaborated, as well as protocols after investigating the reasons for the accidents occurred.

In case of accident or emergency situation Sofiagas EAD cooperates also with the users, the public supplier Bulgargas EAD and the state and municipal bodies.

The emergency readiness of Sofiagas EAD is ensured by the development of an Emergency plan. This Emergency plan is agreed following the respective order with the Regional Service for Fire and Emergency Safety and with Civil Protection. Sofiagas EAD provides for the emergency technical equipment and instrumentation, as well as an emergency reserve of technological materials – elements of the GDN and implements control over the emergency readiness – over the status of the technical equipment, the reserve and the efficiency of actions on the emergency plan. The emergency readiness in the GDC is regulated also by the state legislation and is subject of periodical planned and sudden control.

7. PROCESSING OF INITIAL DATA

The data on the amount of natural gas delivered to the end users as well as the data on the number of new users are received in Overgas Inc. AD monthly according to the ***Procedure II 8.1-011 for Control of Natural Gas Retail Sales***. They are entered into the GDCIMS by authorized employee of Sofiagas EAD. The data about the amount of consumed natural gas in each sector, used for the calculation of the generated greenhouse gases emission reductions of the project, are taken from the ***Information*** module of the GDCIMS.

To report the influence of the low heating value of the natural gas delivered, the amount of the consumed natural gas had to be corrected as it is envisaged in the Monitoring plan of the PDD. Toward that goal, a correction factor is used.

The data on the amount of the delivered natural gas by Bulgargas EAD in the Monthly Statements on delivery and the average low heating value of the natural gas in the Certificates of the natural gas are used for calculation of the correction factor. The correction factor calculation is made according to ***Formula 2*** and ***Formula 3***.

The average weighted value of natural gas’s low heating value ***LHVav*** is calculated on the basis of the monthly certificates and the monthly statements on delivery of natural gas to Sofiagas EAD by Bulgargas EAD.

$$LHVav = \Sigma Q_{NG\ m} * LHV_{NG\ m} / Q_{NG\ y} \quad (2),$$

where:

$Q_{NG\ m}$ is the amount of natural gas delivered for the month ***m*** in 1000 sm³;
 $LHV_{NG\ m}$ is the low heating value of the natural gas during the month ***m*** in GJ/1000m³;
 $Q_{NG\ y}$ is the amount of natural gas delivered for the year ***y*** in 1000 sm³;

The correction factor for taking into account the influence of the low heating value of the delivered natural gas ***K*** is calculated according the formula:

$$K = LHVav / LHV_{NG} \quad (3)$$

where:

LHV_{NG} is the low heating value of the natural gas, used in the calculations in the PDD in GJ/1000m³.

Information about the amounts entered into the GDN and its low heating value by months from the monthly statements and the certificates of the natural gas is presented in Table 4. The calculated annual weighted average for 2009 is also presented in the table.

<i>Month</i>	<i>Purchased natural gas, thousand sm³</i>	<i>LHV, kcal/m³</i>
January	12 207	8 050
February	12 576	8 049
March	11 019	8 064
April	3 617	8 083
May	3 211	8 090
June	2 635	8 089
July	2 673	8 083
August	2 344	8 071
September	2 853	8 077
October	5 681	8 049
November	9 011	8 084
December	13 064	8 054
Total	80 890	-
LHVav	-	8 063

Table 4: Amounts of natural gas entered into the GDN and low heating value of the gas in 2009

The data for calculation of the correction factor **K** for 2009 are presented in Table 5.

Average low heating value of the delivered natural gas, kcal/m ³	8 063
Average low heating value of the delivered natural gas, GJ/1000 sm ³	33.758
Low heating value of the natural gas used in PDD, GJ/1000 sm ³	34.000
Correction factor for taking into account the influence of the low heating value of the natural gas	0.9929

Table 5: Correction factor for taking into account the influence of the natural gas low heating value in 2009

To increase the calculation accuracy and to use more actual input data and following a Correction Action Request from the Second Periodic Verification, the FSERF calculated in the PDD has been recalculated. The recalculation has been made using the official electricity emission factors for Bulgaria, approved and published by the Ministry of Environment and Waters (MOEW) for use in Joint Implementation projects under the Kyoto Protocol.

The updated FSERF values by years for the three sectors are presented in Table 6.

<i>Sector</i>	<i>2008 г.</i>	<i>2009 г.</i>	<i>2010 г.</i>	<i>2011 г.</i>	<i>2012 г.</i>
Industrial	0.96	0.96	0.96	0.96	0.96
Public and administrative	0.70	0.69	0.70	0.70	0.70
Residential	2.02	1.71	1.64	1.62	1.50

Table 6: Recalculated FSERF values by years and sectors, tCO₂e/1000sm³

8. CALCULATION OF THE EMISSION REDUCTIONS

According to the approved monitoring plan, the amount of greenhouse gas emission reductions is calculated by multiplying the annual consumption of natural gas in each sector by the FSERF for the respective sector for the reported year. For reporting, the amounts of natural gas delivered to the end users in every sector are corrected by a factor taking into account the low heating value of the gas. The calculation of the factor is made as described in *it. 7 – Processing of Initial Data* of the Monitoring report.

8.1. ERUs generated by the project

The amount of the emission reductions generated in the year is calculated by the formula:

$$ERU_{z,y} = FSERF_{z,y} * Q_{NG\ z,y} * K (4),$$

where:

$ERU_{z,y}$ is the amount of emission reduction units for the year y in the sector z , tCO_2e ;
 $FSERF_{z,y}$ is the fuel switch emission reduction factor for sector z , for the year y , $tCO_2e/1000sm^3$;
 $Q_{NG\ z,y}$ is the amount of natural gas delivered to sector z , in the year y , $1000\ sm^3$;
 K is the correction factor for taking into account the change of the low heating value of the delivered natural gas.

The amount of natural gas delivered to the end users by Sofiagas EAD in 2009 is 81 497.335 thousand sm^3 . The calculations of the greenhouse gas emission reductions for 2009 are presented in *Table 7*.

Sector	Natural gas consumption, thousand sm^3	Correction factor for 2009	Corrected natural gas consumption, thousand sm^3	FSERF, $tCO_2/$ thousand sm^3	Greenhouse gas emission reductions, tCO_2e
Industrial sector	45 324.445	0.9929	45 001.868	0.96	43 200
Public and administrative sector	15 600.260	0.9929	15 489.232	0.69	10 763
Residential sector	20 789.845	0.9929	20 641.882	1.71	35 256
Total	81 714.550		81 132.982		89 219

Table 7: ERUs realized in 2009, tCO_2e

The realized emission reduction units in 2009 are **89 219 tCO_2e** . The amount of ERUs estimated in the PDD for 2009 was 138 477 (36% lower than the estimated). This is due to the lower than expected natural gas consumption. As described in *it.1* of the Monitoring report the main reasons for this are the warm winter seasons in the last years, the deepening financial crisis and the gas crisis in the beginning of 2009. These reasons are beyond the control of Overgas Inc.

8.2. Results of the conducted monitoring

In the period reported, from 1st January 2009 to 31st December 2009, the implementation of “Reduction of the greenhouse gases by the Gasification of Sofia Municipality” project lead to generation **89 219 ERUs** (*it. 8.1*).

The monitoring shows that the project boundaries, determined in the PDD, have not been changed (it. 1.3).

The reporting of the amounts of natural gas, which enters into the GDN, is implemented at high degree of accuracy and is controlled by Bulgargas EAD and Sofiagas EAD (it. 5.2).

The data used for the calculation of the ERUs generated with the project implementation are accurate and reliable (it. 5.4).

The leakages from the natural gas distribution are insignificant and have no impact on the final results (it. 5.6).

In 2009 the low heating value of the delivered natural gas has been in the range of 8000 ± 100 kcal/nm³ (Table 4).

The calculation of the greenhouse gas emission reductions are performed in accordance with the Monitoring plan of the determined PDD of the ***“Reduction of Greenhouse Gases by Gasification of Sofia Municipality”*** project and the ***Instruction for elaboration of monitoring reports on the Joint Implementation projects of Overgas Inc. AD.***

The Excel worksheet file *Monitoring_Sofia.xls* containing the detailed calculations of the amount of the realized greenhouse gases emission reductions is integral part of the present Monitoring report.

9. ENVIRONMENTAL IMPACT

The amounts of the emission reductions of pollutants and greenhouse gases resulted the replacement of the traditional fuels with natural gas are calculated annually. The information is submitted to the Public Communication Dept. of Overgas Inc. AD and to the GDCs.

The switch from the traditional energy carriers to natural gas leads to a reduction of the overall amount of the emissions and to an enhancement of the natural and urban environments. In 2009 as a result of this switch the emission of more than 7 480 tones of pollutants has been avoided including 3 300 tones of sulphur oxides, 100 tones of nitrous oxides, 3 200 tones of carbon monoxide and more than 450 tones of dust.

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