

International Gas Union Research Conference 2011

**Technology of Electronic GHG Emission Inventory
for Gas-Producing Companies**

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ABSTRACT

The main principle of Gazprom's activity is sustainable development, which means dynamic economic growth at maximum reasonable use of natural resources and preservation of favourable environment for future generations. The establishment of a GHG emissions control, accounting and management system is an integral part of the environmental policy and the corporate liability of the Company.

The relevance of this system is caused by the need for collection and submission of detailed information on greenhouse gas emissions in line with undertaken by the RF liabilities under Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UN FCCC) and Articles 3, 5 and 7 of the Kyoto Protocol to UN FCCC.

The paper is devoted to the experience of Gazprom in development of the Corporate GHG Emission Inventory and the respective Software on the example of the major subsidiary gas-producing company – Gazprom dobycha Yamburg.

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1. INTRODUCTION

Natural gas is the most environment-friendly hydrocarbon fuel, carbon dioxide emissions from its combustion are minimal compared to other types of fossil energy carriers. Natural gas is an ideal basis for introduction of integrated power stations using renewable energy sources.

However, increasing GHG volumes are discharged into the atmosphere in compliance with current technologies at all stages of production chain - from natural gas production to supply to end-consumers.

Therefore, companies of many countries put in considerable efforts to improve these technologies, including the development of GHG emission reduction projects. But without knowledge of objective GHG emission assessments, trends and forecasts it is impossible to evaluate projects for carbon-component and emission reduction costs. Reliable and quite precise GHG emission metering system is a key to taking corporate decisions on necessary measures on stabilization and GHG emission reduction.

Main GHG gases that are discharged into the atmosphere during operation of process equipment at Gazprom's production facilities are methane and carbon dioxide. Let us consider this issue on the example of Gazprom's major gas-producing subsidiary – Gazprom dobycha Yamburg. It is located in the Arctic zone of West Siberia, where the nature is very sensible to all man-caused impacts. Due to the large-scale operations, the company pays much attention to environmental issues, including GHG emission.

2. OBJECTIVES

Gazprom dobycha Yamburg together with Gazprom VNIIGAZ carries out regular works on assessment of carbon dioxide and methane emissions from operated process facilities. As a result an Electronic GHG Emission Inventory (EEI) for a gas-producing company was developed.

The purpose of EEI development is stock-taking inventory, metering and control of GHG emission as well as online data processing and selection of cost effective ways of GHG emission management.

3. METHODS

EEI development applied analytical, statistical, instrumental and software methods.

The inventory was designed in compliance with recommendations of corporate and international guidelines for stock-taking inventory and drafting corporate GHG inventories – IPCC Guidelines 1996, 2000 and 2006, GOST R ISO 14 064-2007, STO Gazprom 3-2005 .

EEI was developed in compliance with the following current international and Russia requirements:

- transparency (clear statement of made assumptions and methodology);
- coordination (application of the same coordinated data and methodologies for the basic year and the following years);
- comprehensiveness (coverage of all available data on GHG sources);

- precision (assessment of uncertainties and reliability of data).

4. RESULTS

Functionally EEI consists of three parts:

Emission inventory;

Emission calculation module;

Reporting module.

Emission inventory includes materials with corporate dynamic statistical data of the gas-producing company.

GHG emissions were calculated for operational and fugitive emission sources - flares, exhaust pipes of gas compressor units, smoke stacks of boilers, heaters and captive power plants, blow-off stands in "open" position of valves, surface shut-off and control valves.

GHG emission caused by waste disposal and the use of purchased heat and power energy for own process needs of the company has been assessed.

GHG emission from motor fuel combustion by operating vehicles and carbon dioxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO₂) and non-methane volatile organic compounds (NMVOC) emission with indirect greenhouse effect have been estimated.

Total uncertainty of the inventory amounts to not more than 6,6 %.

EEI as a software system consists of the following parts:

Data base

Calculation module

User interface, including:

Windows interface

Web interface

The data base is the basis of the inventory as informational set of data on GHG emissions and their sources in Gazprom dobycha Yamburg.

The software system allows to collect primary data on GHG emissions via ecologist terminals, automatically calculate total emissions and save results in the electronic data base. At the output the software produces a final report.

Web-application is intended for organization of remote access of users with different rights to the software system to enter, edit and analyze data as well as perform calculation tasks. Web-architecture means new regulations on data entering and new responsibility matrix for provided information. Access right policy allows to change the data flow from merely centrifugal to a more complicated scheme of exchange, analysis and collective data handling (Figures 1a, 1b). Web-application properly works in all modern browsers: MS Internet Explorer 7.0+, Mozilla Firefox 2.0+, Opera 9.5+, Apple Safari 3.0+, Google Chrome 1.0+.

The software system was developed using new information technologies and namely:

- Independence from used Data Base Management System (DBMS);

- Application of development framework with the possibility of creating web-interface and desktop interface from one code;
- Application of sleeping record technology.

In this software system the data base of electronic inventory can be managed by all SQL data base management systems, for example: PostgreSQL, MS SQLServer, Oracle. It allows to integrate the system into general IT-infrastructure of the enterprise without its significant change.

The possibility to choose the user interface type allows to optimize the use of the system in case of remote facilities without fixed communication means. Web-interface ensures remote access, unified relevant data centre and no need for changing the working environment on the user computer.

The framework technology includes the possibility to form user diagram sets choosing the data source and diagram type on the screen (Figure 2). Thus, the system has online analytical processing mechanisms (OLAP). Moreover, the system has more possibilities for drawing up final reporting by the principle “what you see is what you get” (WYSIWYG).

The sleep record technology allows to set future time of recording. It will be placed among drafts before change of status to “published” and then it will be automatically published. It provides the flexibility of operation with calculations and final reports (Figure 3).

EEl widely uses access rights. First of all, it is used for convenience of data logging by certain subdivisions and for providing only the data that is needed by a certain subdivision or for a certain purpose.

Open code technology together with development tools that enable to produce software systems without obligations to pay license fees to third parties allow unlimited distribution of the Electronic Emission Inventory.

The calculation-analytical system allows to make report in various formats for review, analysis and editing: PDF, Excel, RTF, HTML, CSV, set of slides.

5. CONCLUSION

Electronic GHG Emission Inventory is the first GHG inventory developed by Gazprom for a gas-producing company.

The Inventory has the Conclusion of Russian and foreign independent experts involved in the development of national GHG inventory.

Inventory management includes stock-taking inventory, GHG emission metering and control.

Development technology of EEl allows specialists of several production subsidiaries of the company, original sources of information, to independently download initial data for greenhouse gas emission calculation. It is ensured by access of specialists of a certain subsidiary to the EEl local section for data logging. Data quality is controlled and errors occurring in the process of logging initial data to EEl are minimized.

Full EEl information is available for specialists of different levels, company management of Gazprom, Gazprom VNIIGAZ and Gazprom dobycha Yamburg.

EEl assists in choosing cost-effective emission management methods, planning and implementation of measures on GHG emission reduction and increase in energy efficiency of equipment used in the Company.

In future it is planned to improve methods for GHG emission assessment by updating used corporate emission factors at natural gas combustion and its losses at production and preliminary treatment for transmission. These updates will be based on direct measurements and corresponding statistical processing.

The form and materials of the developed inventory are the basis for designing the unified regularly updated GHG inventory of Gazprom.

6. REFERENCES

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5. GOST R ISO 14064-1-2007 Requirements and Guidelines for Quantitative Assessment and Reporting of Greenhouse Gas Emissions and Disposal at the Level of the Organization. Moscow, Standartinform, 2010.
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7. FIGURES

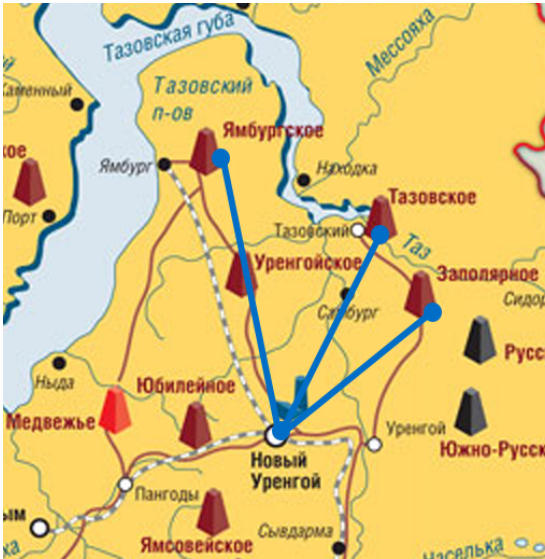


Figure 1a – Current centralized scheme of data submission and exchange between the Environment Protection Department and subsidiaries of the Company

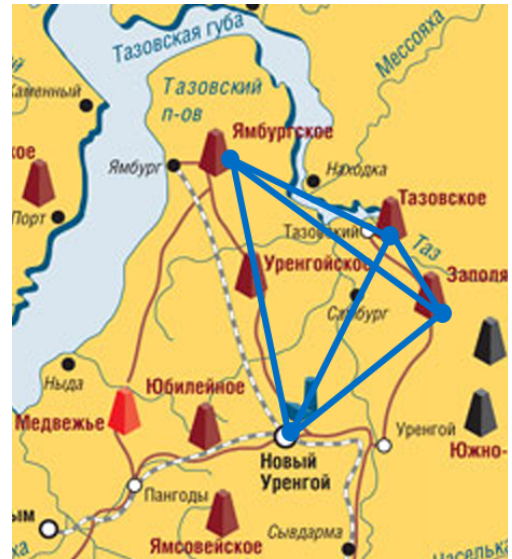


Figure 1b – New possibilities of submission, exchange, analysis and collective handling of data provided by the software system based on web-architecture

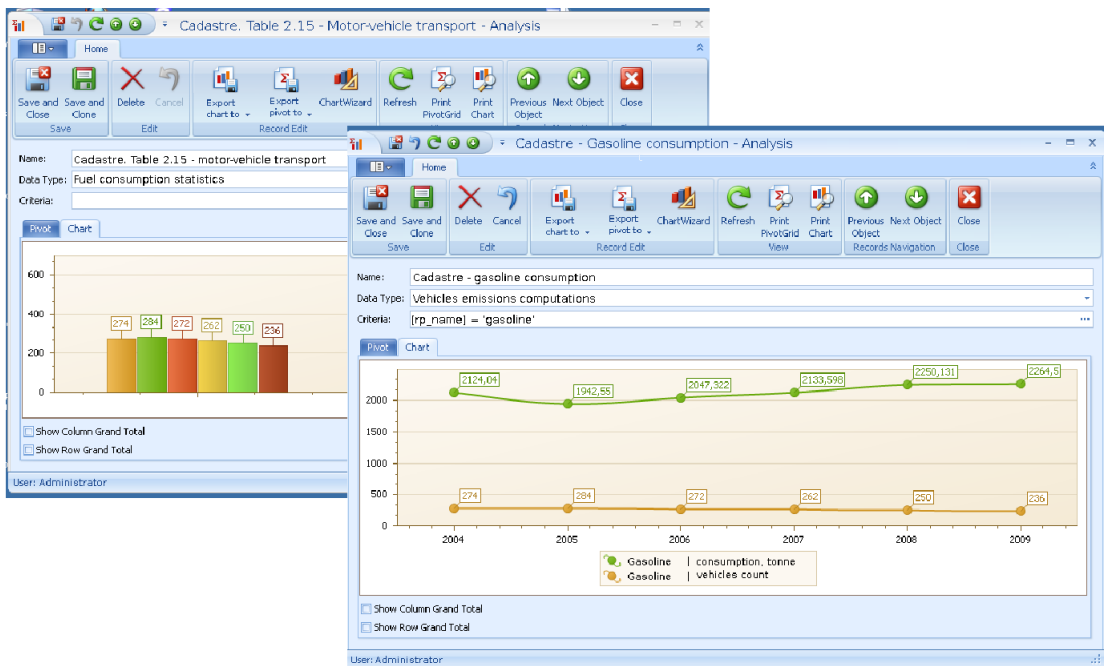


Figure 2: Work with diagrams

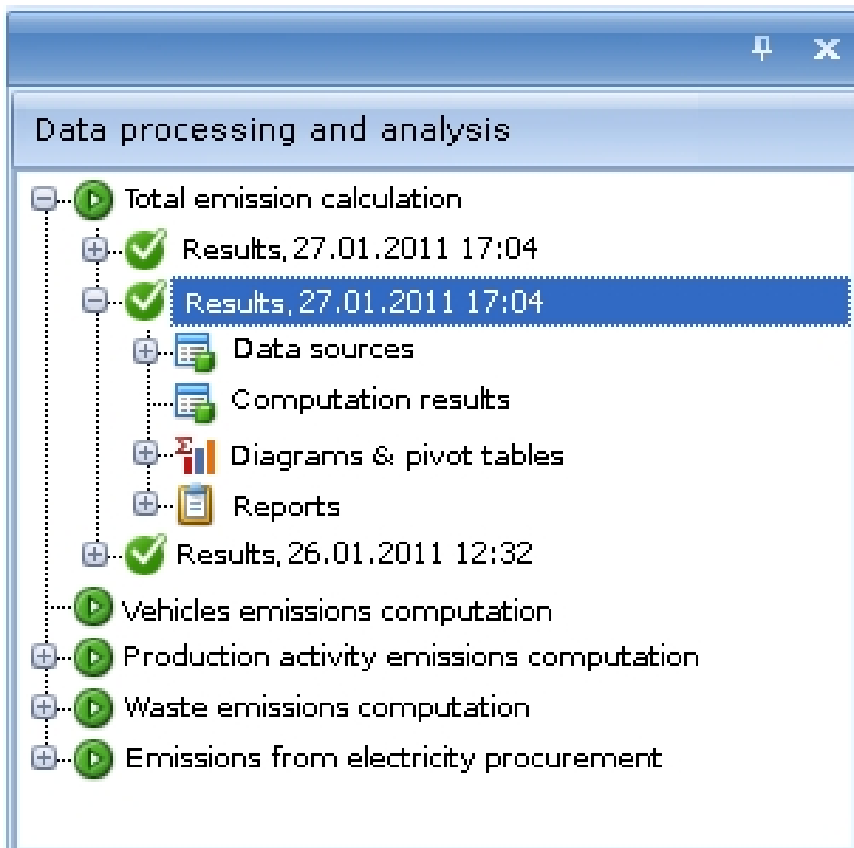


Figure 3: Use of sleeping record technology