



**REDUCTION OF GREENHOUSE GASES BY
GASIFICATION
of Sofia Municipality**

JI Project Design Document

Sofia, April 2004

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1. PROJECT INFORMATION

1.1. Project characteristics

Supplier

Company name:	Overgas Inc. AD
Visiting address: Zip code + city:	5, Philip Kutev str. 1407 Sofia
Postal address: Zip code + city:	P.O.Box 104 1407 Sofia
Country:	Republic of Bulgaria
Contact person: Job title:	Mrs. Stela Blagova Head of Ecology and Sustainable Development Dept.
Telephone number:	+359 2 96 03 360
Fax number:	+359 2 962 17 24
E-mail:	stela_blagova@overgas.bg
Number of Employees:	157
Registration number in the Bulgarian Chamber of Commerce and Industry:	№ 4048730300/01.12.1995 Sofia
Date of registration:	Company case №30913/1992 Sofia District Court
Bank account number:	Account in EUR № 1426217210 SWIFT CODE: UBBSBGSF
Bank name:	CB United Bulgarian Bank AD
Company's core business:	The core activity of Overgas Inc. AD includes marketing and feasibility studies, analysis, assessment and elaboration of gas projects, and investments in municipal and urban infrastructure, including gasification, centralized heating systems, power supply and water supply. Overgas Inc. AD disposes of the controlling holdings in 26 local gas distribution companies.

Project partners:

Company name:	Sofia Municipality
Position in the project:	The implementation of the project has significant economic, ecological and social importance for the Municipality. The project foresees gasification of over 200 municipal sites.
Visiting address:	3, Moskovska str.
Zip code + city:	1000 Sofia
Postal address:	3, Moskovska str.
Zip code + city:	1000 Sofia
Country:	Republic of Bulgaria
Contact person:	Mr. Stefan Sofianski
Job title:	Mayor
Telephone number:	+359 2 9377 303
Fax number:	+359 2 87 09 68
Number of Employees:	442

Company name:	Sofiagas EAD
Position in the project:	Overgas Inc. AD is the sole proprietor of Sofiagas EAD. Sofiagas EAD carries out the activity of “gas supply” on the territory of Sofia Municipality, ensuring deliveries and sales of natural gas to end users. Licenses and permits have been obtained from the State Energy Regulatory Commission for the activity of “gas supply” on the territory of Sofia Municipality. The Company will provide safe and trouble-free operation of the gas supply network and related equipment, thus guaranteeing safe and reliable gas supply to all consumers.
Visiting address:	85, Europa Blvd.
Zip code + city:	2227 Bozhurishte
Postal address:	85, Europa Blvd.
Zip code + city:	2227 Bozhurishte
Country:	Republic of Bulgaria
Contact person:	Mr. Svetoslav Ivanov
Job title:	Executive Director
Telephone number:	+359 7112 3017
Fax number:	+359 7112 3017
E-mail:	sofiagas@mail.bg
Number of Employees:	14
Date of registration:	Company case N 591/2001 Sofia District Court
Company’s core business:	Investment, design, construction, operation and repair of gas pipeline networks in sites connected with natural gas use on the territory of Sofia Municipality. Provision and sales of natural gas to the industrial, public and administrative, and household end users in Sofia region.

Company name:	Gastec BG AD
Position in the project:	The company works out detail designs for gas distribution networks, gas appliances, and internal installations that use natural gas. The company prepares environmental impact assessments as a result of gasification projects implementation.
Visiting address:	5, Philip Kutev str.
Zip code + city:	1407 Sofia
Postal address:	5, Philip Kutev str.
Zip code + city:	1407 Sofia
Country:	Republic of Bulgaria
Contact person:	Mr. Alexander Levashki
Job title:	Executive Director
Telephone number:	+359 2 96 03 425
Fax number:	+359 2 962 17 63
E-mail:	alexander_levashki@overgas.bg
Number of Employees:	69
Date of registration:	Company case № 15645/1995 Sofia District Court
Company's core business:	Consulting, research and project design for gas distribution systems, gas facilities and installations, technical supervision of gas installations, metrological inspections of natural gas meters, training of employees in the field of gas technologies

Company name:	Overgas Engineering AD
Position in the project:	Overgas Engineering will construct the gas distribution network on the territory of Sofia Municipality.
Visiting address:	5, Philip Kutev str.
Zip code + city:	1407 Sofia
Postal address:	14, Tsar Simeon str.
Zip code + city:	8600 Yambol
Country:	Republic of Bulgaria
Contact person:	Mr. Stoicho Ilkov
Job title:	Executive director
Telephone number:	+359 2 96 03 485
Fax number:	+359 2 962 21 93
E-mail:	engineering@overgas.bg
Number of Employees:	283
Registration number in the Bulgarian Chamber of Commerce and Industry:	№4034389200/30.03.1999 Sofia
Date of registration:	Company case №532/1993 Yambol District Court
Company's core business:	Building and construction engineering activity in the field of oil and gas.

Appendix 1 presents the information about the industrial and the public and administrative potential users of natural gas in Sofia Municipality.

1.2. Project Abstract

- **Project Title**

**REDUCTION OF GREENHOUSE GASES BY GASIFICATION
of Sofia Municipality**

- **Abstract**

The project aims at the reduction of greenhouse gases in Sofia Municipality by switching to natural gas from liquid and solid fuels, and electric power used by the end users and increasing the energy efficiency of their combustion installations.

The project involves construction of a gas distribution network in Sofia Municipality and restructuring of the end users' installations in industrial, public and administrative sectors, and households.

The project implementation will contribute significantly to the sustainable development of the Municipality.

1.3. Background and justification

Gasification

The gasification involves the following main activities:

- Bringing natural gas to the end-users by constructing a distribution network;
- Restructuring of combustion installations and switching to natural gas from liquid and solid fuels, used by the end users in industrial, public and administrative sectors, and households;
- Advancement of the use of natural gas by an intensive marketing and public relation campaign;
- Support of end-users on buying natural gas utilization equipment.

This project will make natural gas available to industrial enterprises, public and administrative and residential users in Sofia Municipality. Gasification creates opportunities for expanded use of cogeneration, which will raise the efficiency of use of the main energy sources. The gasification of Sofia will have a positive effect on other gasification projects in Bulgaria, and enhance the economic growth in the region.

- **Industrial sector**

The economy of Sofia enfolds all major industrial sectors and has near 800 large enterprises on its territory. In terms of economic structure, the industry has the largest share (near 250 enterprises). 75% of the Bulgarian ferrous metallurgy, 50% of the polygraph industry, 15% of the electro technical and electronic industry and 14% of the furrier and shoe industry are concentrated in Sofia. The petrochemical, textile and food processing industries are well developed. The same refers to the construction and trade industries, which are closely linked to the building and functioning of the material and social infrastructure of the town.

The well- developed industrial structure of Sofia makes it one of the most important and economically developed centers with crucial importance to the national economy.

There are four industrial zones in Sofia. The oldest zone, having the largest economic potential is the Northern Zone. It is specialized in machine-building, light and petrochemical industry. This zone includes the industrial areas: Svetovrachane, Novi Iskar and Kremikovtsi.

The second largest industrial zone in terms of economic potential is the Eastern zone – Gara Iskar. It includes enterprises and companies with diversified industrial profile – non-ferrous metal processing, cellulose and paper production, furrier products, stone and other materials for lining, etc.

The third industrial zone is located in the southwest area. Textile, food processing and machine-building industries are the largest contributors to its economic potential.

The fourth industrial zone is located in the southeast between “Mladost” residential area and Gorubliane. The enterprises and companies engaged in food processing and light industry have the largest share.

- ***Public and administrative sector***

On its territory Sofia Municipality has a large number of education institutions and vocational schools (specialized in different fields) general education and kindergartens.

There is a great number of catering establishments, food and other shopping centers, markets, shops for other services, offices. Sofia Municipality has very good potential for developing various kinds of tourism. The favorable climate conditions, the existence of natural and historical monuments, and the development of national handicrafts create opportunities for rest and recreation, sports and tourism throughout the whole year.

In future commercial companies will continue outlining the economic profile of the Bulgarian capital city. It will provide substantial employment of the labor force and secure the income of considerable part of the Sofia population. Sofia economy is characterized by bigger relative share of persons employed by the commercial companies compared to the average percentage for the country. The largest share belongs to persons employed in commerce, transport, health care, education, business services, etc.

- ***Residential sector***

As of 31.12.2001 the population of Sofia stands at 1 170 842 citizens, or near 400 000 households.

The marketing studies conducted by Overgas Inc. show increased interest of the potential users of natural gas in faster implementation of the project, in fuel switch and raising the energy efficiency. Independent surveys conducted by the National center for studying the public opinion and Gallup International confirm the opportunities and willingness of the population to switch to natural gas. (*Appendix 3: Extract from Sociological surveys conducted by the National center for studying the public opinion and by GALLUP regarding the willingness of residential users to use natural gas*).

1.3.1. History and preconditions for the initiation of the project

- ***History***

Natural gas is in use by some large industries, large cogeneration and district heating stations in Sofia. However no gas distribution network has been constructed. In 2001 in the Municipal Region (MR) Bankya, natural gas is being introduced to users in the public and administrative, and residential sectors. The project served as a pilot for the gasification of Sofia. The current gasification of Bankya is taken in account of the baseline scenario. The current consumption of natural gas in Bankya is excluded from the calculations of the total ERUs for the project.

In the three consumers sectors the end users' combustion installations are of different types and use various energy sources. The non-gasified industrial enterprises and the buildings in the public sector use boilers, which are fired mostly by liquid fuels – fuel oil and gas oil. In the residential and public and administrative sector low efficiency boilers, fueled with solid fuels and electric power, are used.

• **Preconditions:**

- Sofia as a Bulgarian Capital City is an administrative, cultural and intellectual center of the country;
- The Municipality has strategic geographic location;
- Extremely attractive and fast growing market, which is characterized by:
 - High indicators of demographic, urban and economic development;
 - Sustainable growth of industrial and public sector development;
 - Forecasted high and sustainable energy consumption.
- Need of environment improvement;
- Availability of a natural gas up to the city gate stations;
- Absence of a gas distribution network;
- Surveys that prove the need and willingness of customers of different market segments to use more efficient, cheaper and more environmentally friendly fuel – natural gas;
- The ERUPT 4 revenues.

These prerequisites, alongside with the economic, environmental and social advantages of natural gas compared to solid and liquid fuels are favorable for the project progress.

1.3.2. Advantages of natural gas compared to the other energy sources used in the three sectors

➤ **Economic advantages**

- Opportunity for individual adjustment and measuring of consumption;
- No storage facilities required for the energy sources;
- Reduced costs for heating during storage and handling of fuel oil;
- Reduced energy costs as a result of the lower price of natural gas;
- Stable price of energy in the near future;
- Strengthening of the economic growth in the region;
- Strengthening of the competitive power of the industrial and commercial sectors.

➤ **Technological advantages:**

- High energy efficiency of the combustion installation and the energy systems using natural gas;
- Opportunity for introduction of new energy efficiency technologies;
- Lack of slag handling, which is inevitable when using solid fuels.

➤ **Environmental advantages:**

- Lower carbon dioxide emissions factor of natural gas compared to that of the fuels being replaced;
- Considerable decrease of greenhouse gases, no emissions of sulfur oxides and dust.

The solid and liquid fuels being replaced have high carbon dioxide emission factor. During burning they release also other harmful emissions. The replacement of these fuels with natural gas results to reduction of the greenhouse gases, acid oxides, heavy metals and dust owing to its smaller emissions factor. The carbon dioxide emission factors of the different fuels are shown in *Table 1*.

<i>Fuel</i>	<i>Carbon dioxide emission factor, t_{CO2}/TJ</i>
Fuel oil	77.4
Gas oil	74.1
Subbituminous coal	96.1
Bituminous coal	94.6
Briquettes	96.1
Natural gas	56.1

Table 1: Carbon dioxide emission factor

*The data from IPCC in t_C/TJ and have been converted into t_{CO2}/TJ.

- Avoidance of the risk of spillage that occurs with using liquid fuels.
- **Social advantages:**
- Improved working and living conditions – low pollution in the working areas and homes;
 - Regional economy growth through raising productivity, competitiveness and opening new jobs;
 - Health improvement owing to the improved air quality and establishing comfortable working and living conditions;
 - Energy expenditures controlled by the end-user.

1.3.3. Problems the implementation of the project will solve

The project implementation is of strategic regional importance and has economic, social and environmental impact with respect to the following:

- Improvement of the Municipality environment;
- Introduction of modern technologies;
- Reduced energy consumption per unit of GDP;
- Less costly industrial production as a result of using cheaper fuel;
- Opportunity for the public and administrative, and residential sectors to use cheap and environmentally friendly fuel;
- Removal of the restrictions on the use of up-to-date combustion installations in the households;
- Reduced unemployment rates.

The project implementation will resolve the problems relating to the regular supply and storage of the solid and liquid fuels currently in use.

1.3.4. Core business of project partners and description of their relations

“Overgas Inc.” AD is the leading company in the project. “Gastec BG” AD and “Overgas Engineering” AD provide technical support to “Overgas Inc.” AD. “Sofiagas” EAD is the company distributing and selling natural gas to the end users. The Sofia Municipality actively supports the gasification.

“Overgas Inc.” AD is the biggest private investor on the gas market in Bulgaria. It was established in 1992 as a joint stock company with 50% participation of the Russian Gas company “Gazprom”. Now the company has experience, professional potential and financial resource to guarantee to their partners and clients reliable implementation of all projects and to help the development of natural gas market in Bulgaria. As of the present moment, it has invested EUR 46.3 million for the implementation of gasification projects in 26 towns in Bulgaria.

The company carried out marketing research, and technical and economic studies for gasification of Sofia Municipality. Currently, the company has invested EUR 2,5 million in the project. As a main investor, Overgas Inc. AD will control the investment process.

Sofia Municipality

Already in the planning and preparation phase, the Municipality has supported the development of the Project actively. Due to the switch to natural gas, the end users in the public and administrative sector will account for over 14 % of the total expected consumption of natural gas for the Project. The implementation of the project for the gasification of Sofia Municipality will stimulate the development of the Municipality in many economic, social, and ecological aspects.

Gastec BG AD with shareholders Overgas Inc. AD, Overgas Holding AD, Gastec NV – The Netherlands, prepares the detailed designs for the gas distribution network, the gas equipment, and the internal installations of the users in Sofia Municipality. The company has developed the detailed designs for gas distribution networks in 24 towns and has designed more than 1175 projects for internal gas installations. Gastec BG AD organizes and carries out the training of the staff in the field of designing, construction and operation of gas distribution systems and gas installations. The company also exercises the technical supervision of gas equipment and gas installations.

Overgas Engineering AD with a scope of business including production, trade, research and development, consulting and engineering activities in the oil and gas field, will carry out the construction of gas distribution networks and equipment. Overgas Engineering is the first gas company certified by Lloyd’s Register Quality Assurance in connection with the approval of the Quality Management System in accordance with ISO 9001:2000

Sofia gas EAD is a company, with a sole-proprietor Overgas Inc. AD, established in 2001 for the implementation of the Project for the gasification of Sofia Municipality. The company carries out the activity of gas supply on the territory of Sofia Municipality by providing supply and sales of natural gas to end users.

End users

The end users in the industrial and, public and administrative sectors represent 60 % of the total amount ERUs for the project, in the result of fuel switch. Therefore it is of great importance that on this early stage we have confirmation of the Municipal government and company managers that they will switch to natural gas and generated by them emission

reduction units to be added to the total ERUs for the project. This is confirmed by statement from the Mayor of Sofia Municipality and declarations from the managers of the industrial and commercial companies. (*Appendix 4: List of the companies, which had sent declarations for addition of their greenhouse gases emissions reduction as a result of the switch to natural gas to the total quantity of the emission reduction units of the project “Reduction of greenhouse gases by the gasification of Sofia Municipality”*).

The General Conditions of the natural gas sale contracts between Sofiagas EAD and the end users will include a clause that the emission reduction units they generate will be transferred to the total emission reduction units under the Project Reduction of Greenhouse Gases by Gasification of Sofia Municipality. (*Appendix 5: Letter from State Energy regulatory commission*)

1.3.5. Related financial commitments

The project required an investment of EUR 27.3 million for construction of the gas distribution network on the territory of Sofia Municipality (2004-2013). End users have to invest at least EUR 45 million for the restructuring of end users’ installations to use natural gas.

To facilitate the fuel switch in households, Overgas Inc. AD has developed the “Coziness and warmth in your home” technical/financial tool. “Coziness and warmth in your home” provides for:

- delivery of gas appliances, including a safe installation, conforming the actual regulations and
- a financial deal, dispersing the investment cost of the end-user over a longer period.

1.4. Intervention

Overgas Inc. AD is actively contributing to making popular the image of natural gas and to encouraging potential household consumers in Bulgaria. The company makes use of a varied set of instruments as integrated marketing communications aimed at achieving synergy effect.

The communication efforts are grouped in two main categories:

- National PR campaign targeting the advantages of natural gas and in particular:
 - Natural gas is cheaper;
 - Natural gas is cleaner;
 - Natural gas is not being stored;
 - Natural gas has higher heating value;
 - Natural gas is supplied directly to the site of consumption.

- Encouraging campaigns aimed at stimulating potential consumers to take a swift decision in regard to gasification. Aims of the campaigns:
 - To inform target groups about specific current proposals;
 - To point out concrete advantages of household gasification;
 - To provide information on the gasification procedure.

At the same time gas distribution companies open Demonstration centers on the territory, where they operate. In these centers citizens could get information needed for the household gasification, as well as demonstrations and consultations by specialists. Overgas is also making use of additional channels in attempting to reach potential consumers by involving commercial agents and elaborating programs of work with current consumers as opinion leaders.

1.4.1. Project goals

- Development of Gasification of Sofia Municipality;
- Replacement of currently used solid and liquid fuels and part of the electric power by natural gas from all industrial and public and administrative end users and most of the users in the residential sector;
- Reduction of greenhouse gases and delivery of 500 000 tons emission reduction units to Senter Internationaal according to the Joint Implementation mechanism.

1.4.2. Project purpose

Reduction of greenhouse gases by gasification of the end users on the territory of Sofia Municipality.

1.4.3. Project results

The results that will be achieved by the implementation of the project are:

- Reduction of greenhouse gases emissions – from 99 094 tons in 2007 up to 157 900 tons in 2012;
- Reduction of the total emissions of polluting components in the air;
- Enhancing energy efficiency of combustion installations in the region;
- Significant reduction of energy costs for all end users as a result of lower cost of the used energy source and increased efficiency of the combustion installations;
- Increasing of the living standard qualities: Ensuring a higher level of human health as a result of improved air quality, raising household standards, automation of combustion processes allowing easy and safe operation of gas appliances and opening of new and attractive jobs.

The full spin off of the project will be much bigger. The use of natural gas will create new living standard, not only in Sofia but also in the whole country.

1.4.4. Activities:

- Construction of 583 km gas distribution network in Sofia Municipality;
- Construction of internal installations for 135 industrial enterprises, 228 sites in the public and administrative sector and over 31 800 households;
- Commissioning and operation of gas distribution networks and end users' installations (ensuring safe operation of gas distribution networks and regular natural gas supply to the end users);
- Monitoring of natural gas consumption and realized emission reduction units.

1.4.5. Detailed project description

The project for Reduction of Greenhouse Gases by Gasification of Sofia Municipality foresees switch to natural gas of the non-district-heated sites of the industrial, public and administrative and residential sectors.

The project foresees construction of 583 km of gas distribution network of steel and polyethylene gas pipelines, the 32 000 related facilities in Sofia Municipality and reconstruction of the installations at the end users. The gas distribution network includes distribution steel gas pipelines under pressure up to 16 bar and polyethylene gas pipelines under pressure of 10 bar and 4 bar, and supply to over 65% of the main users of the industrial and public and administrative sectors in the regions of Sofia Municipality until the year 2008. (*Appendix 6: Plan for construction of a gas distribution network and facilities in Sofia Municipality*)

Bulgargas will provide the city gate stations. Bulgargas is the Bulgarian gas transport company, providing gas up to the city gas stations, transferring the custody to the local gas distribution companies.

For the gasification of the Southern regions, named MR Ovcha Koupel, MR Vitosha and MR Pancharevo a main half-ring will be constructed from city gate station (CGS) Sofia-4 Ivanyane to CGS Sofia-1 Kazichene, and radial branches for development of the Gas Distribution Network in the above mentioned regions. From a marketing point of view a consumer potential has been concentrated in this region. This potential is solvent; it requires a modern infrastructure, energy efficient solutions and clearly stated readiness to be connected to the gas distribution network.

In the second and third year of the project implementation CGS Sofia-3 Lulin and CGS Sofia-2 Svetovrachene will be used, as well as the existing gas pipelines of Toplofikacia Sofia (Sofia district heating company) for construction of radial gas pipelines and GDN for gasification of the Northern regions and some of the central Regions.

The gasification of MR Kremikovtzi will be conducted by means of construction of a new ACGS and utilization of CGS Yana.

In the further stages the radial gas pipelines will be connected and a common gas distribution system will be established, which will be developed in the non-district-heated areas and along the boundaries of the areas with district heating from "Toplofikatsia Sofia".

The main parameters of the gas distribution system will be as follows:

- Technical capacity (Q_{max}) – 115 000 sm^3/h (3.91 TJ)
- Estimated availability (Q_{es}) – 92 000 sm^3/h (3.13 TJ)
- Estimated capacity ratio Q_{max}/Q_{es} – 1,25
- Estimated level of project activity (Estimated Annual Consumption) – 150 million sm^3/a (51 100 TJ/a), in 2013.

In the first 10 years of the investment project implementation it is planned users from the three sectors to be included with estimated annual consumption as follows:

• Industrial sector	135 sites	82,3 million sm ³
• Public and administrative sector	228 sites	21,3 million sm ³
• Residential sector	over 31 800 households	46,5 million sm ³

Appendix 7: Number of the end-users provided for gasification, by years and by sectors

Appendix 8: Projected natural gas utilization, thousand sm³

Stages in the implementation of the project

The **market penetration** is being done gradually. In the first stage the main gas distribution pipelines and facilities are constructed and industrial companies are switched to natural gas. In the second stage public and administrative sites are gasified and the residential users are gradually switched to natural gas.

Generally the construction of the gas distribution network will go through the following stages:

➤ ***First stage (2004)***

Construction of GDN in MRs Gorna Banya, Vitosha and Pancharevo. Connecting of 9 users from the industrial sector, 26 users from the public and administrative sector and 3000 households. This stage will be used to demonstrate the advantages of natural gas use at a first-class location.

➤ ***Second stage (2005 - 2008)***

In this period gasification will be conducted in the north-eastern regions, thus bringing to completion the gasification of the peripheral parts of Sofia Municipality, and starting gasification towards the central parts of Sofia. Over 15000 users will switch to natural gas during this stage.

➤ ***Third stage (2009-2013)***

During this stage the gasification of the residential sector will continue. The network constructed by that time will be made denser. In case of changes in the development construction and new construction of gas distribution network will be made for them as well.

2. DESCRIPTION OF THE CURRENT SITUATION

The flow chart of the current deliveries with its main components and connections is shown in Figure 2.

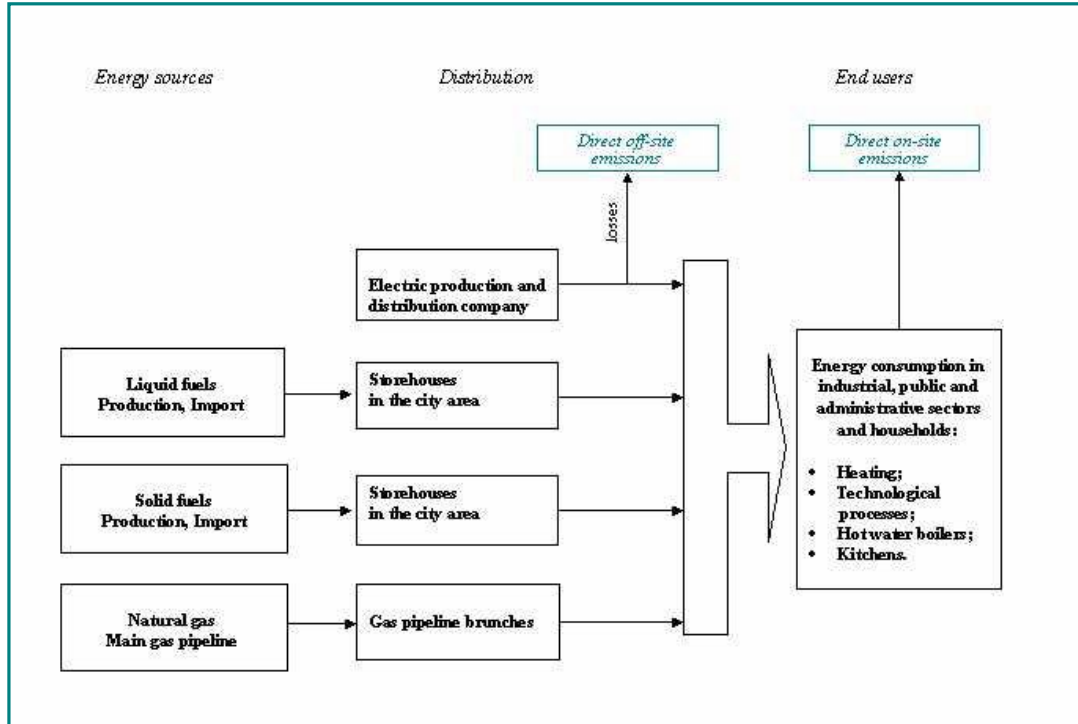


Figure 2: Block scheme of the current delivery system

Information about the condition and adequacy of the current delivery system, operation regime of the current delivery system

⇒ Electric power

The high conversion and distribution losses are inherent to the use of electric power. Electric power is used for heating, hot water supply (HWS) and technological needs in the industrial, public and administrative, and residential sectors. Electric power occupies a major share in the energy balance of the end users in all sectors. The energy supply companies are required to provide continuous electric power supply all year round. A major supplier in the country and region under review is the National Electric Company EAD (NEC EAD).

“Electric power distribution – Sofia Municipality” EAD is a sole-proprietor company, which ensures supply and sale of electric power to the users. The company maintains the sites and facilities in compliance with the technical requirements; develops the distribution network; maintains and develops auxiliary networks; ensures continuous electric power supply and quality of the supplied electric power.

The power transfer network of Sofia Municipality is of 7 982 km length, of which 6 628 km are in the 4 towns and 1 354 km are in the 34 villages. 4 824 switchgears have been constructed, of which 4 316 are in the towns and 508 are in the villages. Sofia is the biggest consumer of electric power in Bulgaria.

Electric power for distribution

In 2002 15 310 TJ of electric power were bought by users, which is by 1,95 % more than the electric power bought in 2001.

Electric power to end users

For the year 2002 the total quantity of supplied electric power was 12 290 TJ, which is by 1,82 % more than the power sold in 2001, which was 12 070 TJ. Electric power distribution company – Sofia Municipality EAD supplies and sells electric power to 659 855 customers. As of December 2002 the company was delivering its services to 586 798 residential and 73 057 economic, public and industrial consumers. The number of customers in 2002 increased by 5 296 new consumers compared to 2001.

Users	2001		2002	
	TJ	%	TJ	%
Industrial	3 453	28.61	3 095	25.18
Utilities	2 624	21.74	3 048	24.80
Residential	5 746	47.60	5 872	47.78
Street lighting	123	1.02	122	0.99
Neighboring power distribution companies	124	1,03	154	1,25

Table 2: Supplied electric power in Sofia by types of users

⇒ *Liquid fuels*

The supply and distribution of liquid fuels (fuel oil, gas oil, diesel and light ship oil) is concentrated in the hands of the private entrepreneurs at regional and national level. A major supplier is the oil refinery in Bourgas, which is owned by Lukoil AD. A small amount of fuels is delivered through direct imports. Liquid fuels are used for technological purposes (most of them), heating, and the smallest part is used for HWS. In the area of Sofia municipality Petrol AD is the supplier of fuels for the bodies of the Ministry of Health, Ministry of Defense, Ministry of Education and Science, as well as the Council of Ministers and the Supreme Judicial Council. The facility of NAFTEX PETROL AD, which is at the nearest distance, is not far from the center of Sofia to the north-west towards the Ring Road – North, and is located in the Iliantsi suburb. Other large suppliers are Shell, Topливо and OMV. Transportation of liquid fuels is energy intensive. Liquid fuels require extensive storage facilities.

⇒ *Solid fuels*

The delivery and distribution of solid fuels (wood, coal and briquettes) is conducted by a number of small companies that have established their warehousing facilities in the city of Sofia and the settlements in the vicinity. They are the main distributors of the mining companies operating in the Republic of Bulgaria. Transportation of solid fuels is energy intensive. Solid fuels require extensive storage facilities.

The use of wood in the public and administrative sector is mainly in the schools around Sofia, which are part of Large Sofia municipality and have no district heating installation.

The wood used in the region comprises 11 % of the total energy consumption, the main consumers being households. It is expected after the gasification the use of wood for heating in the residential sector to be declining gradually.

“Toplivo” AD is a major supplier and to a large extent satisfies the demand for wood and wood pallets in Sofia Municipality.

Subbituminous coal and briquettes are produced and delivered by the following larger coal mining deposits:

- Maritsa Iztok Mines EAD, Radnevo town
- Stanyantsi Mine EAD, Stanyantsi village, Godech municipality, Sofia district
- Choukourovo Mines EAD
- Vitren Mines EAD, Kyustendil town
- Pirin Mine EAD, Simitli town, Blagoevgrad district
- Antra Mine EAD
- Chernomore Mine EAD
- Zdravets Mine EAD, Dimitrovgrad
- Lev Mine EOOD

⇒ ***Heating energy***

In Sofia Municipality electric power, heat and steam for technological needs are generated by two large Combined Heat and Power Plants (CHP): CHP Sofia and CHP Sofia Iztok. Only heat is generated by two large heat generation plants: HGP Lulin and HGP Zemlyane, and by eight small seasonal heat generation plants. Currently, only six of the small heat generation plants have not been yet gasified.

The length of the district heating network in Sofia more than 850 km, and it delivers services to more than 340 000 homes, which comprise over 72,5 % of the total number of homes in the town.

Residential end users connected to the district heating network will not be connected to the gas distribution network.

⇒ *Natural gas*

Bulgargas EAD

Bulgargas constructed in 1976 – 1977 Sofia Section of the National Gas Transfer Network.

A total of 9 City Gate Stations (CGS) are located on it. Five CGS are used for gas supply to sites in Sofia:

- CGS “Sofia – 1” – Kazichane
- CGS “Sofia – 2” – Koumaritsa
- CGS “Sofia – 3” – Volouyak, near heat generation plant Lulin
- CGS “Sofia – 4” – Ivanyane
- CGS Sofia – Kremikovtsi

From the first four CGS main transport lines have been constructed to the cogeneration plants of Toplofikacia – Sofia EAD: CHP Sofia – Iztok, CHP Sofia, HGP Lulin, and HGP Zemlyane together with district heating station Ovcha Koupel 1 and 2. Later on main gas transport lines were set up connecting about 20 large consumers directly to Bulgargas EAD.

The maximum hour consumption of natural gas by the Bulgargas clients under winter conditions in Sofia municipality amounts to about 450 000 m³/h, at an annual consumption of about billion m³/a.

Sofiagas EAD

In the Bankya pilot from CGS “Sofia – 4” – Ivanyane a gas distribution pipeline has been constructed to Bankya town, along with the gas distribution network in Bankya. Totally for the three years of work under the pilot, 43 km of gas pipeline network has been constructed.

<i>Fuel</i>	<i>Energy consumption in 2003</i>			
	<i>Industrial</i>	<i>Public and administrative</i>	<i>Households</i>	<i>Total</i>
Fuel oil	2231,10	0,00	0,00	2231,10
Gas oil	565,65	565,65	116,19	1247,49
Subbituminous coal	39,55	38,53	267,81	345,89
Bituminous coal	0,00	0,00	127,50	127,50
Briquette	0,00	0,00	190,00	190,00
Wood	7,50	9,90	630,53	647,93
LPG	21,53	0,00	97,44	118,97
Electricity	0,00	0,00	475,20	475,20
Total	2865	614	1905	5384

Table 3: *Energy consumption in 2003 of the end users covered by the project by fuels and by sectors according to the marketing survey, TJ*

Sources of information for assessment of energy consumption in Sofia Municipality

➤ Detailed market studies on the territory of Sofia Municipality in 2000
Meetings with representatives of all industrial, public-administrative and larger trading entities were held. Questionnaires were received with information about consumption of fuels and energy, types of installed equipment and the attitude of the different users towards using natural gas

➤ Sociological survey was assigned to the National Center for Studying the Public Opinion (NCSPO) aimed on exploring the residential sector in 2001

This study submitted information about the attitudes of the residential sector regarding the gasification process and allowed for making estimates of the domestic natural gas consumption in the above mentioned settlements, taking into account the specific actualities.

➤ Mail inquiries, carried out by Overgas Inc. AD, which covered over 2,500 households.

➤ Detailed market study of Sofia municipality In the period 2001 – 2003 study covered all regions which are not completely supplied with district heating

➤ Information on the boilers in use obtained from the State Agency for Metrology and Technical Supervision.

➤ Quantitative ad-hoc study (personal home interviews) was performed by GALLUP on the territory of Sofia City In July – August 2003, and it covered mostly the households without district heating.

This study submitted additional information on the consumption of fuels and energy:

- The average consumption of coal for a household in the Sofia regions without district heating is approximately 6 tons per heating season. For some households this quantity reaches 10 – 12 tons per a heating season.
- The average consumption of gas oil/diesel oil for households, which have heating installations, is at the range from 5 to 15 tons per a heating season.
- Electric power is used predominantly for heating. The average consumption is between 12 – 15 MWh/year for heating and hot water.

Summary

Currently the energy sources used in the project area are almost only electric power and fossil fuels rich in carbon. Over the period under review until 2012 the intensity of the use of energy based on carbon is expected to decline owing to the use of nuclear power, waterpower, low-carbon raw materials and increased efficiency of conversion.

Secondary effects of the switch from conventional fuels to natural gas include lower transport costs and losses, and no need for local storage facilities. End-users gain full control on their energy use, generally leading to lower spillage.

Natural gas will contribute to a higher economical stability. The Project will encourage the further gasification of Bulgaria.

The use of wood for heating comprises 11 %, and that of propane butane is 1.7 % of the end energy use in the project area. There are no grounds to expect that the use of wood or propane butane will increase considerably over the project period.

Production of renewable energy is not planned to a substantial degree during the project duration. The planned development of nuclear energy and hydro energy use in generation of electric power is included in the SENTER data. After the project period natural gas may prove out to be the product leading the way towards wide use of renewable energy sources.

3. GREENHOUSE GAS SOURCES AND PROJECT BOUNDARIES

3.1. Description of the Sources of GHG Emission under the Project

The Project includes the natural gas supply and its use by the end users from the industrial, public and administrative, and residential sector. The implementation of the present project will result in gradually replacing solid and liquid fuels with natural gas.

The end users' combustion installations in the three consumer sectors are the only consumers of fuels within the project boundaries. The substitution of solid and liquid fuels, which have a high carbon dioxide emission coefficient, for natural gas has the greatest effect on the reductions of GHG emissions. The high-energy efficiency of natural gas, in comparison with other fossil fuel, provides a further reduction of the greenhouse gas emissions.

The combustion installations in the three consumer sectors are of different types and with different energy efficiency. The industrial and the public sector use boilers burning mostly liquid fuels – fuel oil and gas oil. The residential and small part of the public sectors uses low-efficiency fire-grate boilers. Replacing them with new gas boilers will result in a considerable reduction of fuel consumption and GHG emissions.

Gasification provides favorable conditions for energy system optimization and the use of for example cogeneration and combined cycle power production, which again reduces the energy consumption and consequently reduces GHG emissions.

Most of the households use electricity for hot water preparation and cooking. Using natural gas instead of electrical power will reduce significantly the off-site GHG emissions in the production of electrical power.

3.2. Project boundaries

The project boundaries include combustion installations of the industrial, public and administrative, and household end users in Sofia Municipality, excluding the sites gasified before the starting date of the project.

The block-scheme of the project with its main parts and connections and the project boundaries are shown at figures 3a and 3b. Figure 3a shows the situation before the fuel switch; figure 3b the situation after the fuel switch.

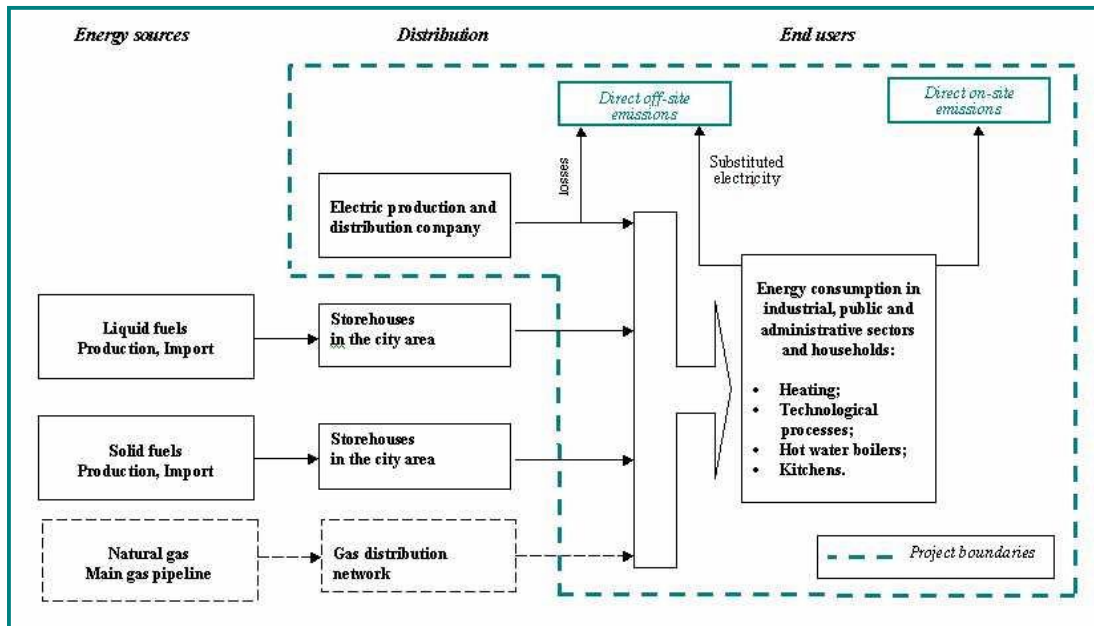


Figure 3a: Block-scheme of the fuels delivery before gasification

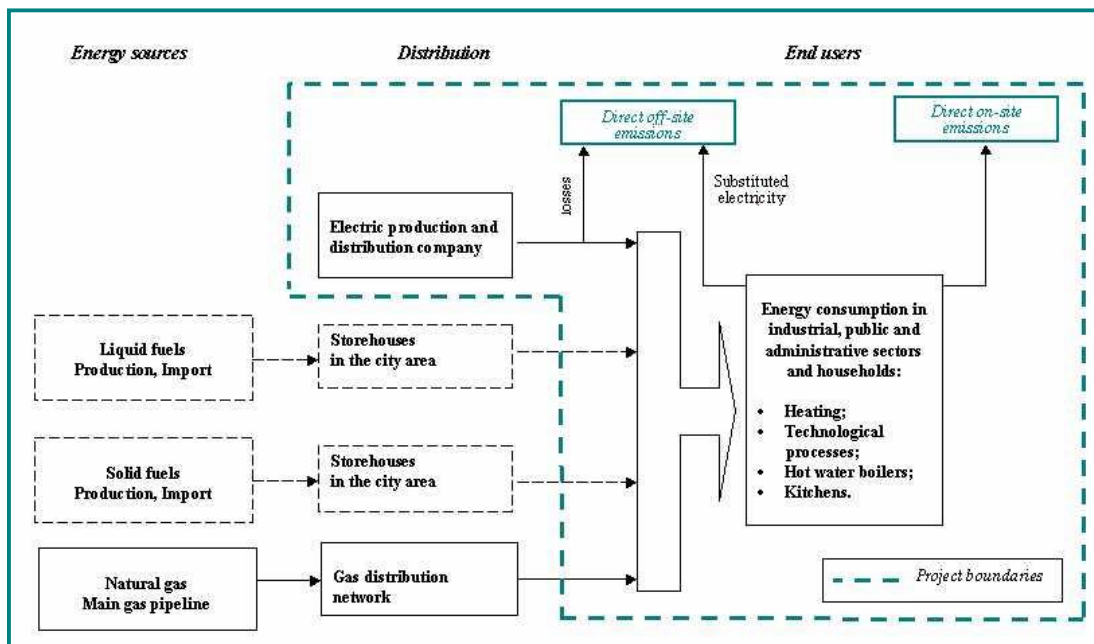


Figure 3b: Block-scheme of the fuels delivery after gasification

3.3. *Direct on-site emissions*

The emissions from the combustion installations of end-users provide all direct on-site emissions of green house gasses.

3.4. *Direct off-site emissions*

By using the SENTER tables on the emissions for substituted electricity all related direct off-site emissions for electricity are taken in account.

Emissions caused by losses of natural gas from the gas distribution networks have been excluded from the calculations since they are lower then 1 % (in carbon dioxide equivalents). Overgas will use an up-to-date 4 bar distribution network to connect the end-users. This kind of gas distribution networks is fully leak tight.

3.5. *Indirect on-site and off-site emissions*

The indirect on-site and off-site emissions may be characterized as follows:

- Emissions during the production and processing of fuels;
- Emissions during the production of metals, transport vehicles and tanks for transportation and storage of fuels;
- Emissions during transportation and disposal of wastes of fuels.

The control on these emissions is outside the scope of the project. Conform the guidelines of SENTER “emissions related to activities to produce, transport or to deliver the fuel “at the gate”” are neglected. /page 6, operating guidelines volume 2 item 1.3.3/.

4. KEY FACTORS INFLUENCING THE BASELINE AND THE PROJECT

The main purpose of studying the key factors is to identify and analyze their impact on the baseline and project development.

4.1. External key factors

4.1.1. Legal factors

The legal and institutional framework for the energy sector in Bulgaria is set out in the Energy Act (amended as of March 5, 2004) and Energy Efficiency Act (effective as of March 5, 2004) and the regulations for their application. These fundamental Acts settle the public relations in the energy sector with regards to state governance, regulation and efficient use of energy and energy sources, as well as the rights and obligations of legal entities in conducting activities in production, import, export, transfer, distribution and sales of electric power and heating energy and natural gas, raising energy efficiency and encouraging the use of renewable energy sources.

The State Energy Regulation Commission, in conformity with the Energy Act, has issued to Sofiagas EAD license P No JI-127/09.10.2003 for the activity “Natural gas distribution” for the territory of Sofia Municipality.

Bulgaria has signed and ratified the major international treaties and conventions in the field of environment protection, including the Kyoto Protocol.

As far as **environmental protection** is concerned in September 2003 the Environmental Protection Act update was adopted. It establishes the required legal framework for further progress in environmental impact assessment; access to information; protection and control over industrial pollution.

4.1.2. Macro-economic factors

The energy efficiency in Bulgaria is generally quite low. Improvement of the energy utilization will improve the Bulgarian economy considerably.

The trends of the key macro-economic factors laid down in the forecasts for development of gasification in the region under review over the period 2003 – 2015 are as follows:

- Steady pace of economic development, including:
 - Maintaining the fixed exchange rate with the Euro,
 - Implementing cautious and flexible fiscal policy;
 - Reducing the country's dependence on the IMF;
 - Acceleration of the structural reform;
 - Establishing competitive market economy.
- Increase of the population income and more favorable conditions for consumer loans;
- Subsidies on energy consumption will be phased out,
- Closing down Units 3 and 4 of Kozloduy NPP at the end of 2006;
- Improving the energy efficiency of the economy and the consumption of electric power in the households.

Estimated macro-economic indicators of Bulgaria until 2007 (National Plan for Bulgaria's Economic Development by 2007, State Agency for Economic Analyses and Forecasts, April 2002/¹:

- GDP (real growth) 5.5%
- Inflation rate 3.5%
- Unemployment rate 10.0%
- Savings /GDP 18.6%

Replacing electric power for heating with natural gas, reaching an efficiency of over 90 %, is a major measure for raising the energy use efficiency.

4.1.3. Price factors

The following need to be taken into account and analyzed in this respect:

- Trends of the long-term development of prices and the methodologies for calculation of the prices of fuels;
- Trends in the behavior of local currency with regards to the currency relating to the import of fuels.

The dynamics of the prices of the main energy sources for end energy use is quite a substantial factor for the development of gas supply, because it is the ratio of the prices of natural gas and the other energy sources that determines the market demand for natural gas.

The forecast for the prices of energy sources is based on the following assumptions:

- *Liberalized liquid fuels market*

The liquid fuels market in Bulgaria was liberalized in 1997. The domestic prices follow the trend of international prices of petroleum products and have been estimated depending on the fluctuations of the latter taking into account also the taxes and fees in the country.

- *Regulated natural gas market*

By Decree No. 53 of the Council of Ministers of 6 March 2002 the Regulation on the Formation and Application of Natural Gas Prices and Tariffs was adopted. Since 1 April 2002 the gas transfer company and the gas distribution companies have been applying natural gas prices formed pursuant to the provisions of the aforementioned Regulation.

The natural gas prices, when natural gas is sold by gas distribution companies, include the following components:

- Natural gas price at the input of the gas transfer network;
- Price for natural gas transfer along the gas transfer network;
- Price for natural gas transfer along the respective gas distribution network for the respective user group.

The price of natural gas at the input of the gas transfer network is tied up to the international prices of oil and liquid petroleum products and is forecasted depending on their fluctuations.

The natural gas price at the output of the gas distribution network is tied up to the investment costs incurred by the gas distribution companies.

¹ At present in Bulgaria long-term forecasts for macroeconomic indicators are done only at central government level.

4.1.4. Market factors

A main market factor is the consumer potential of the natural gas market on the territory of Sofia Municipality, which is affected by:

- availability of consumer need and amount of market demand for natural gas in a territory;
- availability and supply of energy sources alternative to natural gas;
- availability and supply of natural gas in the Republic of Bulgaria;
- the approximate estimated volume of natural gas sales assessed in two aspects – replacement by natural gas of conventional energy sources, such as fuel oil, electric power, solid fuel, and second, occupying the free share on the regional market of energy sources;
- the natural gas price levels compared to the other energy sources, now and in the foreseeable future - (*discussed under Price Factors above*);
- ability of the population to pay – considered in two aspects: (*discussed under Social-demographic factors*)
 - elasticity of natural gas consumption when the supply price rises above certain level;
 - capability of purchasing and installation of gas fueled equipment.
- Objective assessment of the own potential and the potential of the competition.

4.1.5. Political factors

In the early 1990-s the country's transition to democracy and market-oriented economy was characterized by a slow pace of the structural reforms. After the economic and political collapse in 1997 the pursuing of a good macro-economic policy and large-scale program for structural reforms caused the occurrence of a rapid positive turn in Bulgaria's economy. Although the project term is longer than the term of mandate of the current government, the expectation is that the policy towards EU integration will be maintained.

4.1.6. Social and Demographic factors

This group of factors is of substantial importance because they are directly related to the pace of implementation of the project for gasification of Sofia Municipality in the residential sector. The impact of these factors is directly dependent on:

- Raising the competitiveness of the regional economy;
- Improvement of the basic infrastructure and protection of the environment;
- Human resources development – raising the living standard of the households in the territory covered by the investment project; improvement of the structure and composition of the population, reduction of unemployment rate, increasing the average income and buying power;
- Balanced and sustainable economic development of the region – establishing conditions for development and support of SMEs, creating conditions for attraction of foreign investments, mitigation of the differences among regions and social groups, accompanied by general raise of the living standard.

As of the end of 2003, the population of the city of Sofia was 1 194 164 inhabitants, which is 15.22% of Bulgaria's population. Compared to the census as of 01.01.1992 there is an increase in the number of permanent urban population by (+ 1.0%).

The unemployment rate in Sofia in the recent years is about 3 times lower than that for the country. The expectation for the program period is that the private sector will be opening new jobs and attracting the labor force laid-off from liquidated and/or restructured state-owned companies.

The average gross annual income per capita for 2001 - 2003 is EUR 2 800, which is 3 times higher than the average for the country. The increase in the buying power of the population by 2010 presupposes a growth of 2.7% to 4% per annum.

4.1.7. Economic factors

Sofia's dominant position in the national economy is demonstrated in:

- Over 20% of the national GDP;
- Over 50% of the total costs for acquisition of fixed assets;
- Multi-sector and sustainable economic activity, with clearly identified industrial sectors;
- European center for entrepreneurial activities. In terms of the indicator "costs for acquisition of fixed assets" Sofia forms over 50% of it in the country.

4.1.8. Environmental factors

- ***Emissions of greenhouse gases lower than the quantities defined as per the commitments undertaken by Bulgaria under the international agreements;***

According to the Basic Scenario under the National Plan for Climate Change and the World Bank report titled Energy – Environment, Bulgaria will not face problems with the implementation of the requirements of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol for limiting the greenhouse gases emissions over the period 2008-2012.

- ***Implementation of the commitment undertaken under international agreements for limiting the sulfur and nitrogen oxides emissions;***

Gasification offers an opportunity and is an alternative for observing of the commitments undertaken by Bulgaria towards the EU and the UN for protection of the atmospheric air.

- ***Implementation of the regional sustainable development and energy efficiency plans and programs***

The implementation of the project Reduction of Greenhouse Gases by Gasification of Sofia Municipality is in compliance with the sustainable development plan. Those plans will benefit from gasification, allowing energy efficient solutions and improvement of the air quality and raising the standard of living.

4.2. Internal key factors

4.2.1. Technical factors

- ***Factors related to engineering activities***

Design work is done using specialized software for dimensioning of the facilities, for optimization and analysis of gas transmission networks. The state-of-the-art CAD systems being used have an option for integration with geographic information systems (GIS). OVERGAS Engineering AD is using modern technologies and equipment of burying and welding of steel and polyethylene gas pipelines. The materials and equipment used meet the requirements set by the Bulgarian and European standards. They are supplied by leading companies in the sector, which have ISO 9001 certification.

- ***Factors relating to the construction and assembly work***

This group of factors takes into account the presence of construction and assembly risks, commissioning risk and a possible delay in commissioning, risk connected to obtaining permits for starting regular operation of the site.

Main evidence that the implementation-related risks do not jeopardize the project implementation:

- High professional level of conducting the preliminary natural gas market studies at national and local levels;
- Quality of the delivered service;
- Precision and fulfillment at high technological level of the detailed designs and construction of city networks;
- The experience gathered.

Gasification of certain boiler stations in public and business buildings, as well as homes, is a matter of conventional technologies well-known and already proven over time, whereby practically such risks are not present in the activities of the gas distribution companies and OVERGAS.

The optimal organization and application of contemporary technologies for trench-free burying of the gas distribution network allow for construction even in densely populated areas without distortion of the daily routine of the population and without effecting of the other of underground networks. Environmental protection and the reconstruction of disturbed terrains are compulsory components of construction and assembly works.

4.2.2. Financial factors

Investment projects relating to natural gas distribution are considered to be reliable and highly efficient on the long term due to the competitiveness of these energy sources in terms of price. The financial planning shows that not earlier as in the second year of operation of the gas transfer networks some net profits will be generated. The payback period is about nine years.

Summary

The project fully complies with the strategy of the Bulgarian government for raising the energy efficiency in all consumer sectors. The growth of the GDP has a direct impact on the increase of the total quantity of energy consumption in the country, including the consumption of natural gas.

The local authorities support the project. Therefore, all prerequisites of market nature, which support the project, are in place.

The required budget for the project implementation will be available on the provision that the revenues of ERUPT 4 will materialize.

Marketing studies show that in case the opportunity is in place, all industrial and, public and administrative sites, and a large part of households will switch to natural gas, on the assumption that a relative low gas price may be maintained in the foreseeable future.

5. ADDITIONALLITY

The project “Reduction of greenhouse gases by gasification of Sofia Municipality” is additional to any scenario that would otherwise occur. Three test methods are accepted by the UNFCCC to prove this statement. In all three evaluations the most likely, and only, alternative to the fuel switch, is no fuel switch: the continuation of the current practice in using oil, gasoline, electricity, wood and coal as energy sources. This is the same "baseline scenario" as used also elsewhere throughout this PDD. The three test methods are:

- Test 1: The project is not business-as-usual because an alternative exists that is more economically attractive
- Test 2: The project is not business-as-usual because without the sales of carbon credits the project is not economically viable
- Test 3: The project is not business-as-usual because several significant barriers exist for the project

Test 1 is strictly limited to the economic evaluation of the Overgas Inc. AD business, and gives therefore an incomplete story on the additionality. Avoidance of the fuel switch, thereby continuing the use of the carbon rich coal, GPL and oil is economic attractive since no additional investments in appliances and installations are needed.

Test 2 is also not really applicable since it also disregards all efforts and investments by the end-users. To assist the end-users in their decisions Overgas Inc. AD transfers the ERUPT 4 revenues to a lower gas price to the end-users. As a result for industrial sector the price of natural gas will be reduced with 13%, for public and administrative users with 5%, and for households the price will be reduced with 7%. The pay back period of the end users investments is perceived as unattractive. However, the lower gas price, due to ERUPT 4, will reduce the payback time to more acceptable period for large groups of end-users.

By this transfer the direct economic impact of the ERUPT 4 revenues on the business of Overgas Inc. AD is negligible. The secondary impact is enormous due to the access obtained from large groups of end-users, thereby improving the economy of the whole project.

The financial additionality is considered in details in item 4.4 of the Business plan.

Due to the character of the Project, test 3 will prove most clearly the additionality of the project.

End-users` importance

The evaluation of the project should consider two aspects. Not only the business aspect related to the gas distribution company has to be taken into consideration, but also the investments by the end-users.

Significant barriers

Earlier attempts to initiate the gasification of Sofia were without results. Only in the region of Bankya a small gasification pilot was initiated by Overgas with some lasting success. Assistance of the ERUPT 4 revenues will have strong and positive influence on the project. Significant barriers exist in the further gasification of Sofia. The barriers are legal, technical,

financial, institutional, social and cultural. The ERUPT 4 is not only important for its financial revenues but also add an essential momentum to overcome subjective barriers.

Legal barriers

Regulations are important to ensure a safe use of energy. The general use of natural gas is new for a large group of consumers in Bulgaria. New regulations must be introduced and be accepted and understood by the officials. Essential modifications of the building regulations for example, requires long time to be designed, and more over to be incorporated in the daily practice. All procedures for installation permits are slow and complicated.

It took more then two years to obtain official permits for the gasification of Sofia, due to slow procedures at regulating bodies and lack of experience with the subject.

Technical

The use of natural gas is new to nearly all future end-users in the Sofia municipality. Overgas Inc. AD has to organize the training and education of installer. An intensive public campaign must familiarize the end-users with the safe and efficient application of natural gas. The technical options are not readily available to the installers and end-users. In this project provisions are arranged to make the technical options available on a large scale.

Skills to install natural gas pipes, flue gas chimneys and appliances are only latent available. In this projects large scale training and education of installers has to overcome this barrier.

The technology is new to the Sofia municipality and has to be adapted to the typical Sofia situation, for example the use of natural gas in large, existing, compact apartment buildings. Installing a full new network in the densely populated area of Sofia requires essential adaptation of existing pipe laying technologies.

The use of natural gas is associated with widely perceived safety risks, not only at the potential end-users, but also at involved local authorities. In this project an intensive public relation campaign will be needed to overcome this barrier.

Financial

The use of natural gas requires important investment by the end-users. The lower gas price, due to the ERUPT 4 revenues, will support the potential end-users in their decision the switch to natural gas and will reduce the pay back period of their investments. Also Sofiagas EAD has to face four years of negative cash flows. Only after about 9 years the positive cash flows have balanced out the negative cash flows of earlier years. The ERUPT 4 revenues will reduce the period with negative cash flows and pay back period.

Equity participation has to be found in Bulgaria and internationally. The ERUPT 4 revenues are of essential importance to acquire the equity participation.

In case the ERUPT 4 tender will be won, loans for financing the project will be arranged far more easily. Due to perceived denomination risk still a high interest rate of at least 10% has to be paid, because banks still consider investments in Bulgaria as risky.

Institutional

Apart from the ERUPT 4 revenues there are no subsidies available. The Bulgarian government has policy to support the fuel switch. However, this support does not include any financial incentives: neither for Overgas Inc. AD, nor for the potential end-users.

Cultural

Current infrastructure is dedicated to the use of conventional fossil fuels. Stakeholders are familiar with all aspects of the use of oil, coal and LPG: prices, availability, appliances, risks and precautions. The awareness of the qualities of the utilization of natural gas is still nascent at most stakeholders.

End-users consider the use of conventional fossil fuels as standard practice. The utilization of natural gas is still perceived by most stakeholders as new and risky. For nearly all end-users the utilization of natural gas will be “a first of a kind” experience.

Summary

Significant economic, social and technological barriers have prevented up to now the large-scale switch to the utilization of natural gas in the Sofia Municipality. The revenues of ERUPT 4 will allow the fuel switch, in the first place by the financial revenues but also by the momentum induced. The ERUPT 4 revenues provided the catalyst for the fuel switch. The project is not business as usual and thus additional.

6. IDENTIFICATION OF THE MOST LIKELY BASELINE AND THE ASSOCIATED GHG EMISSIONS

Changes in greenhouse gases emissions is directly determined by:

- Overall energy consumption rate;
- Structure of the energy sources used;
- Changes in the specific energy consumption per unit of production.

The key factors influencing the changes in GHG emission are external: legal, macro economic, price, market, social and demographic, environmental factors, and internal: technical and financial factors.

6.1. Baseline selection, specification and calculation of the emissions

Experts from “Energoproekt” AD and the Agency for economic analyses and prognoses develop the prognosis for the progress trend of end user energy consumption (EEC). The general prognosis for EEC progress trend in Bulgaria is worked out in three scenarios – accelerated, moderated and restricted development. (Table 4) The policy on energy efficiency improvement in economy and households is considered in this prognosis.

Scenario	2004	2005	2006	2007	2008	2009	2010	2011	2012
Accelerated development	491028	512088	517656	522596	529965	536957	556091	562790	567228
Moderate development	491028	506854	517656	522596	529965	536957	548722	562790	567228
Restricted development	459334	461260	468210	463688	461343	458329	452551	463646	457617

Table 4: End energy consumption forecast in the Republic of Bulgaria, in TJ

According to the marketing survey of “Overgas Inc.” AD for the gasification of Sofia Municipality the structure of energy sources in 2003 is as follows: 66.8 % solid fuels, 24.4 % liquid fuels and 8.8 % electric power. This structure is supposed to be retained in the baseline scenarios during the whole period from 2003 up to 2012.

The energy use in 2003 is taken as the starting point of the prognosis of the energy consumption. Also the fuel mix and quantity at that year are taken in consideration. (Table 3). The wood consumption in the household sector is calculated on the basis of the expert assessment of “Energokonsult” AD.

To develop the energy consumption baseline, “Overgas Inc.” AD use the data as per the moderate development scenario for end energy consumption in Bulgaria. Due to the forecasts of favorable long-term development of the economic situation, underlying this scenario, both parallel and proportional EEC development can be expected on regional and national levels.

In the baseline scenario it is expected that the energy consumption will follow the rate of economic growth by sectors. (Table 5) This forecast is more conservative than the forecasts of the National Electric Company in regard to power consumption growth from 1.4% to 1.6%²,

² Capital, weekly newspaper, 21 February 2004

and of the Ministry of Energy that envisage a growth of energy consumption by 1.8% in Bulgaria till 2010³.

	<i>Industrial</i>	<i>Public and Administrative</i>	<i>Residential</i>
Expected energy consumption growth	1.00%	2.00%	1.41%

Table 5: Average annual EEC growth in percents (2003 – 2012) by sectors

Bulgaria envisages an average annual growth rate of EEC of 1.21 % over the period 2002 – 2015 and is based on average GDP growth in 2003 of 5.0 % and an annual growth of 5.5 % for the period 2004 – 2007⁴. At the same time low inflation rates are projected (3.9 % in the period 2003-2007), increased population’s income by 2012 up to 2.5 % per year and a development of better consumer lending terms. It is assumed that GDP and inflation rates will be stable after 2007.⁵ The baseline energy consumption envisages an increase of the consumed energy from 5384 TJ in 2003 to 6081 TJ in 2012 or by 12.9%. (Table 6)

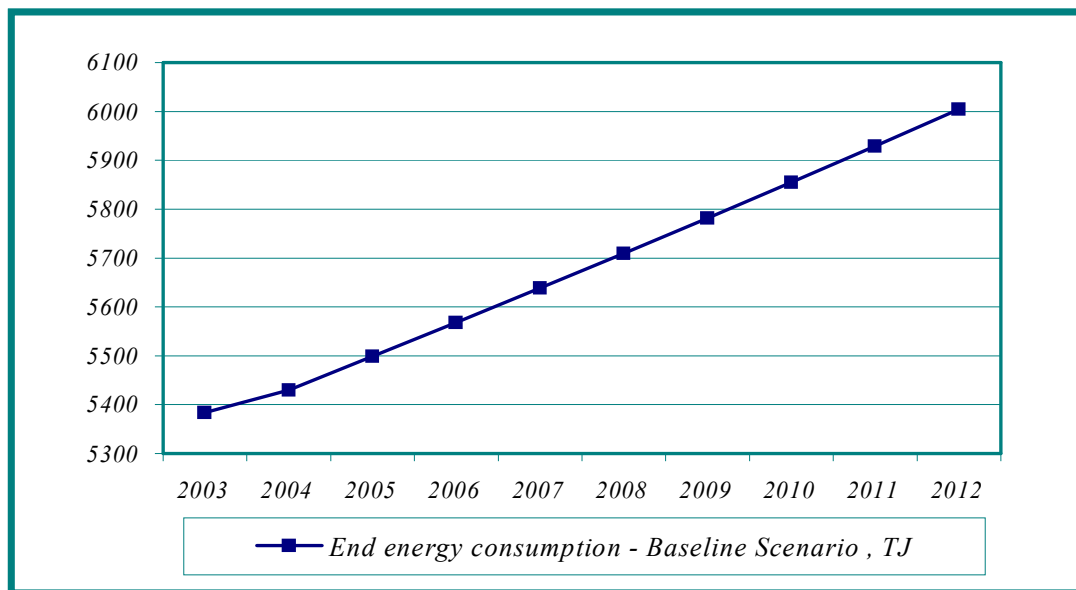


Chart 1: On-site energy consumption without project implementation, TJ

³ Dnevnik, daily newspaper, 23 February 2004

⁴ National Plan for Economic Development of the Republic of Bulgaria for 2000-2006, June 2003

⁵ Projected year for Bulgaria to become an EU member.

The prognosis for energy consumption by energy sources, including losses from transportation, storage and sales for the baseline is presented in *Table 6*.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel oil	2231	2253	2276	2299	2322	2345	2368	2392	2416	2440	2465
Gas oil	1247	1266	1285	1304	1324	1344	1364	1384	1405	1426	1448
Subbituminous coal	346	351	356	361	366	371	377	382	388	393	399
Bituminous coal	128	129	131	133	135	137	139	141	143	145	147
Briquettes	190	193	195	198	201	204	207	210	213	216	219
Wood and wood waste	648	657	666	676	685	695	705	715	725	735	746
LPG	119	99	100	102	103	105	106	107	109	111	112
Electricity	475	482	489	496	503	510	517	524	532	539	547
Total	5384	5430	5499	5568	5638	5710	5782	5855	5929	6005	6081

Table 6: Energy consumption by energy sources, baseline scenario, in TJ

6.2. Indication of the emissions in the absence of project activities - baseline

The baseline represents the greenhouse gases amount without project implementation for each year up to 2012 inclusive. Using the emission factors shown in *Table 7* the calculation of greenhouse gas emissions is made.

Fuels	LHV, TJ/t	Source	$EF_{CARBON\ DIOXIDE}$, t/TJ	Source
Fuel oil	0.0402	MEW*	0.0774	Vol 2a***
Gas oil	0.0419	MEW	0.0741	Vol 2a
Subbituminous coal	0.0113	MEW	0.0961	Vol 2a
Wood and wood waste	0.0100	MEW	0	Vol 2a
Bituminous coal	0.0255	MEW	0.0946	Vol 2a
Briquettes	0.0190	MEW	0.0961	Vol 2a
Natural gas	0.0340	MEW	0.0561	Vol 1
Liquid petroleum gas (LPG)	0.0468	IPCC**	0.0631	Vol 2a

Table 7: Emission factors for calculation of greenhouse gases

Note: The above used data are taken from:

* Methods for calculations of the pollutants in the atmospheric air, Ministry of Environment and Water, Sofia, 2000

** Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Workbook Vol.2

*** Operating guidelines for project design document of JI Projects, Vol.1, Annex C

In defining the total quantity of GHG emissions only the carbon dioxide emissions generated by the end users' combustion installations are taken into account.

The growth of energy consumption during the concerned period leads respectively to the increase of the released emissions. The only exception is electricity, which during the years has different emission factors that give an account of the expected increase of the efficiency of power generating installations. (Table 8)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bulgaria	1002	979	957	934	912	890	867	845	822	800

Table 8: Baseline carbon dioxide emission factors for JI projects reducing electricity consumption (in gCO₂/kWh)

It is envisaged that the efficiency of the power generating installations in Bulgaria will gradually draw level with those in the EU by 2020.

The total quantity of greenhouse gas emissions for the observed period is shown in Table 9.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Baseline										
Greenhouse gas emissions	468458	469980	472991	475860	478861	481858	484706	487690	490520	493488

Table 9: Greenhouse gas emissions, Baseline, ton CO₂ eqv

Summary

The construction of the baseline is based on the following trends:

- Energy consumption follows the economic growth rate;
- Gradual decrease of the carbon dioxide emission factor for reducing electricity consumption during the observed period according to the Senter Internationaal data;
- Constant level of the carbon dioxide emission factor for all other energy sources.

7. ESTIMATION OF PROJECT EMISSIONS

7.1. Prognoses of natural gas annual consumption

Natural gas market is defined as a combination of:

- End users;
- Relationships established between the natural gas distributor and consumers in respect to satisfying the specific energy needs (quantity, transmitted energy, access, terms, price, service quality, etc.)
- Specifics of the relationship with the competitors-distributors of other energy sources.

➤ Sources used for assessing the natural gas market in Sofia Municipality

The assessment of the natural gas market is based on data from the inquiries in the industrial and public and administrative sectors carried out by marketing experts of “Overgas Inc.” AD. Digital models of the Municipality and its administrative and territorial planning to town sections provide data on future grows of all MR’s.

Analyses were based on:

- The installation capacities in the heating sources of the industrial and public and administrative sectors;
- Dynamics of the energy consumption by the users for the last three years and trends of development;
- The existing potential energy consumption in the three sectors and opportunity for switch to natural gas as a main energy source;
- Expected level of individual energy consumption per household;
- The penetration rate of the household market;
- Clients request and demand.

The results of marketing studies are given in *Table 12*. Type and characteristics of the boilers in public and administrative, and industrial sectors are presented in *Appendix 9*.

7.2. Description of the emissions calculation method

➤ Description of factors used for estimation of project emissions

The total project emissions are influenced by the following factors:

- Total energy consumption growth rate;
- Energy efficiency of the combustion installations before and after the gasification;
- Carbon dioxide emission factor of the substituted fuels.

All calculations for the project emissions are specified by the end-user sectors.

➤ Input data

The energy consumption and the fuel mix in Sofia Municipality by types of energy sources in 2003 are taken as the departing point of the prognosis of the energy consumption. (Table 3, item 2 of PDD)

The prognoses of energy consumption by sectors with the project implementation are the accepted one in Baseline Scenario (item 6 of PDD) in the baseline calculation. It's expected that the annual growth rates are constant over the whole project period.

Marketing studies provide information on the rate natural gas will replace the conventional used fossil fuels and electricity. Table 12 summarizes these data as a total for all sectors for each year. In the calculations are used data detailed by sectors.

The energy efficiency factors by sectors and energy sources (Table 10) and conversion efficiency factor of natural gas equivalent to the substituted fuels by energy sources and by sectors (Table 11) is used in the calculations. The values presented in Table 10 are rather conservative. In general the switch to natural gas induces a higher energy efficiency improvement.

	<i>Industrial</i>	<i>Public and Administrative</i>	<i>Households</i>
Heavy fuel oil	0,80	not used	not used
Gas oil	0,88	0,88	0,80
Subbituminous coal	0,70	0,70	0,65
Wood and wood waste	0,65	0,65	0,65
Bituminous coal	not used	not used	0,65
Briquettes	not used	not used	0,65
LPG	0,90	0,90	0,89
Electricity	not used	not used	0,98
Natural gas	0,90	0,90	0,90

Table 10: Energy efficiency factors by sectors and types of energy sources

Fuel oil

According to the available documentation of the appliance manufacturers the efficiency factor of new boilers in the industrial sector using fuel oil is 0.88 ± 0.02 at optimal operating conditions, excluding the energy losses caused by ancillary equipment (e.g. blowers and heaters). Field studies in relation to projects PHARE BG 9107-03-14 and PSO BG-4-4-99 indicated a real operating efficiency factor of existing combustion installations on fuel oil of 0.80 for the boilers of KM12 type and 0.81 for the big boilers of the VK type (VK – water heating boiler). In view of the fact that the greater part of the consumed quantity of heavy oil is used in KM12 type, an efficiency factor is 0.80 for combustion installations on heavy fuel oil in the industrial sector is considered as the most realistic.

Gas oil – according to producers’ catalogues the water heating and steam boilers of the KVN, ON and PKN type produced in Bulgaria have efficiency factors between 0.87-0.89⁶. As per the questionnaires of consumers these efficiency factors have lower values depending on the operational state of their combustion installations. Due to this the efficiency factor of the boilers using gas oil in the industrial and public and administrative sectors is assumed to be 0.88 and 0.80 in the household sector.

Solid fuels (coal, briquettes and wood) – the installed boilers on solid fuels in the industrial sector are of very old types and they are no longer produced. The efficiency factor for fire-grate boilers using solid fuels as described in reference books and technical literature⁷, ranges between 0.55-0.77. The maximum efficiency factor for boilers in the industrial and public and administrative sectors is assumed to be 0.70. The efficiency factor in the household sector is very low 0.65.

Natural gas - in all combustion installations after gasification an efficiency factor 0.90 is assumed. On the basis of these data the conversion factors for different fuels in different sectors are estimated and represented in *Table 11*. The utilization of high efficient and condensing appliances may result in efficiencies of 1,00 up to 1,06.

Electric power – for the electricity used for cooking, for hot water and heating an energy efficiency factor 0,98 is assumed.

For the calculation of the conversion efficiency factor fuels the following formula is used:

$$K_{fuel} = \frac{(\text{LHV}_{fuel}, \text{TJ/t}) * \text{Eff. factor}_{fuel}}{(\text{LHV}_{\text{natural gas}}, \text{TJ/1000m}^3) * \text{Eff. factor}_{\text{natural gas}}}$$

Where:

K_{fuel}	Conversion factor for the relevant fuel;
$\text{LHV}_{fuel}, [\text{TJ/t}]$	Low heating value of the substituted fuel;
$\text{Eff. factor}_{fuel}$	Energy efficiency factors of the combustion installation before gasification;
$\text{LHV}_{\text{natural gas}}, [\text{TJ/1000m}^3]$	Low heating value of natural gas;

⁶ Catalogues of Boiler Construction AD, Sofia

⁷ Heating, ventilation and air conditioning appliances, Prof. V.I.Ivanov, PhD B.M.Krapchev, State Publishing House Technika, Sofia, 1978

Reference book on heating, ventilation and air conditioning, Part 2, Heating and heat supply, edited by Prof. PhD S.Stamov, State Publishing House Technika, Sofia, 1991

Questionnaires of end users

Eff. factor_{natural gas}. Energy efficiency factors of the combustion installation after gasification.

	<i>Dimension</i>	<i>Industrial sector</i>	<i>Public and administrative sector</i>	<i>Household</i>
K Heavy fuel oil	1000 sm ³ /t	1.051	-	-
K Gas oil	1000 sm ³ /t	1.205	1.205	1.095
K Subbituminous coal	1000 sm ³ /t	-	0.258	0.240
K Bituminous coal	1000 sm ³ /t	-	-	0.542
K Briquette	1000 sm ³ /t	-	-	0.404
K Wood	1000 sm ³ /t	0.212	0.212	0.212
K LPG	1000 sm ³ /t	1.376	1.376	1.361
K Electricity	1000 sm ³ /GWh	-	-	115.29

Table 11: Conversion factor for conversing energy sources into natural gas by sectors

The expected annual consumption of natural gas and the other energy sources during the project implementation is calculated as follows:

- Determination of the energy sources' amounts replaced by natural gas by sort of the fuel and by sectors from the marketing data;
- Calculation of the quantity of natural gas equivalent to each replaced energy sources, by multiplying the quantity of replaced fuel by conversion efficiency factor from *Table 11*;
- Calculation of energy sources quantities by sectors, as a difference between fuels quantity without project implementation and the amount of the replaced energy sources;
- Calculation of the project emissions released from the end users' combustion installations using the IPCC values (*Table 7*)

During the observed 10-year period, natural gas will gradually replace solid and liquid fuels used in industry, public and administrative sector and households. Initially, the large industrial enterprises which use predominantly fuel oil, and the municipal facilities which use mainly gas oil will switch to natural gas after the distribution mains from the GDS are constructed. The data on the replacement rates of the energy sources used in Sofia Municipality are presented in *Table 12*.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel oil	2219	1964	314	213	68	68	68	68	68	68
Natural gas	184	1126	2937	3370	4056	4329	4595	4784	4945	5103
Gas oil	1175	648	537	430	119	83	28	12	10	6
Subbituminous coal	338	309	272	211	177	130	89	85	75	50
Bituminous coal	128	94	58	26	13	0	0	0	0	0
Briquette	189	154	137	105	95	76	48	28	10	2
Wood	617	569	476	385	355	252	177	148	88	24
LPG	94	89	84	75	47	44	40	5	0	0
Electricity	468	450	421	414	324	288	252	220	198	184
Total	5411	5402	5236	5228	5253	5270	5297	5350	5394	5437

Table 12: Distribution of used energy sources upon project implementation, in TJ

Arguments in support of the project realistic perspective:

- Favorable conditions and prerequisites;
- High construction rate. Sofia is ranked second in the Top 10 of capitals with highest construction intensity⁸. Recent years are marked by a strong tendency towards construction of office buildings, business and residential edifices mainly in peripheral areas with developed communication systems, which is reflected in the planned stages of gas penetration in the city. Modern construction in all market sectors concerned require energy efficient solutions;
- Solvent consumer demand in the regions envisaged to be gasified in accordance with the project;
- Targeting free market niches (regions that are not connected to central heating);
- Clearly stated will to be connected to the gas distribution network.

⁸ Study of Colliers International, International Real Estate Company

7.3. Estimation of the total projected emissions

Total project emissions include direct on-site and off-site emissions. Indirect on-site and off-site emissions are below 1 % and are excluded of the calculation.

Carbon emission factors taken from IPCC and the calculated carbon dioxide emission factors are given in *Table 13* and are used for the greenhouse gas emissions calculation.

<i>Carbon and carbon dioxide emission factors</i>		
<i>Energy source</i>	<i>Carbon emission factor, tC/TJ</i>	<i>Carbon dioxide emission factor, tCO₂/TJ</i>
Heavy fuel oil	21.2	77.4
Gas oil	20.2	74.1
Subbituminous coal	26.2	96.1
Bituminous coal	25.8	94.6
Briquette	26.2	96.1
Wood	-	0
LPG	17.2	63.1
Electricity	-	800 – 1 024

Table 13: Carbon and carbon dioxide emission factors by energy sources

Table 14 presents data for the greenhouse gas emissions for the period 2008-2012.

	<i>Carbon dioxide emissions with project implementation, tCO₂</i>			
	<i>Industrial sector</i>	<i>Public and administrative sector</i>	<i>Household</i>	<i>Total</i>
2008	155902	37681	158480	352063
2009	157265	37976	150988	346229
2010	157980	38499	143459	339939
2011	159540	39145	137168	335853
2012	161116	39927	134545	335588

Table 14: Carbon dioxide emissions upon project implementation by years and sectors, tCO₂

Due to applying of modern construction technologies, lack of worn out gas distribution networks and internal installations, the losses from transportation of natural gas by pipeline branches, gas distribution network and utilization by end users are insignificant. According to data by Overgas Inc. AD on the operation of gas distribution networks, emissions from annual losses resulting from blowing at joining of new consumers and other activities are below 0.01%.

Summary

- *The quantity of energy sources substituted for natural gas depends on the gasification rate by sectors in compliance with project phases planned;*
- *The estimation of expected natural gas consumption is made after considering energy efficiency of combustion installations and LHV of substituted energy sources;*
- *During the project implementation the emissions are reduced as a result of:*
 - *Substitution of carbon rich energy sources for natural gas;*
 - *Reduced consumption of energy sources due to increased energy efficiency of combustion installations.*

8. CREDITING TIME

<i>Start preparation and planning phase:</i>	2001
<i>Construction starting and finishing dates:</i>	2004-2013
<i>Crediting time of the project (Only if crediting time expires before 2012).</i>	Five years, equivalent to the commitment period from 2008 to 2012

9. ESTIMATION OF EMISSION REDUCTION

9.1. Emission reduction

The greenhouse gas emission reduction was calculated by deduction from the total amount emissions, as per the baseline, of the total amount emissions resulting from the implementation of the project.

The results are presented in *Table 15*.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Baseline GHG emissions	468458	469980	472991	475860	478861	481858	484706	487690	490520	493488
GHG emissions with project implementation	468458	464990	441770	388217	379767	352063	346229	339939	335853	335588
ERUs	0	4990	31221	87643	99094	129795	138477	147751	154667	157900

Table 15: Reduction of GHG emissions with project implementation, tCO_{2eqv}

A reduction of **728 590** emissions units will be achieved with project implementation during the period 2008-2012.

Due to the request of SENTER for conservative approach, the total amount of the ERUs to be delivered in the period 2008 – 2012 is restricted to 500 000 ERUs. (68 % of the total in the period).

9.2. Fuel switch emission reduction factors

In PDD the annual consumption of natural gas (item 7) and the resulting reduction in the carbon dioxide emissions (item 8) for each sector are estimated. By dividing the emission reduction by the natural gas consumption, a factor is obtained quantifying the efficiency of the fuel switch from carbon rich fossil fuels to natural gas in a real environment. This factor is designated by "Fuel switch emission reduction factor" (FSERF) and will be an essential tool in the monitoring procedure. A useful dimension of the FSERF is $tCO_{2eqv}/1000\text{ sm}^3$.

The FSERF depends on the structure of the used energy sources and on the status of the combustion installations before gasification. *Table 16* shows the FSERF by end-users' sectors and by years.

	<i>Natural gas consumption, thousand sm³</i>	<i>Emission reduction, tCO_{2eqv} /ERU/</i>	<i>Fuel switch emission reduction factor, tCO_{2eqv}/thousand sm³</i>
Industrial sector			
2008	76634	73642	0.96
2009	77684	74574	0.96
2010	79734	76177	0.96
2011	80552	76958	0.96
2012	81378	77748	0.96
Public and Administrative sector			
2008	18138	12684	0.70
2009	19279	13397	0.69
2010	19934	13901	0.70
2011	20441	14303	0.70
2012	20851	14590	0.70
Household sector			
2008	24516	43469	1,77
2009	30352	50507	1,66
2010	35493	57673	1,62
2011	39704	63405	1,60
2012	43209	65562	1,52

Table 16: Fuel switch emission reduction factors by sectors and by years

In industrial, and public and administrative sectors mainly fuel oil and gas oil are replaced. Fuel oil and gas oil carbon dioxide emission factors are close as values, therefore the changes in the FSERF are not so abrupt. The use of a varied fuel mix with different emission factors in the residential sector does not permit to determine identically the influence of each fuel on the FSERF. The different energy efficiency of the combustion installations operating on different fuels also influences the FSERF, but to a lower degree.

10. MONITORING PLAN

10.1. Main principles

- To control and determine of the greenhouse gas emissions with project implementation as an indicator will be used the total annual natural gas consumption from the end users by sectors;
- For each sector the effective emission reduction factor for converting of natural gas sales in emission reduction units as defined in item 8 of the PDD is used;
- The fuel switch emission reduction factors include the fuel switch effect and reduced energy consumption due to the increase of the efficiency of the combustion installations;
- The calculation of the total amount of realized ERUs include natural gas sales in the three sectors, and the realized emissions reduction from the project is defined;
- The contractual emission reduction units are determined based on the realized emissions' reduction.
- At a constant calorific value, changes in natural gas composition have no effect on the carbon dioxide emission factor. On an energy base the carbon dioxide emission factor is identical for all natural gases of distribution quality⁹.
- In case of a change in the calorific value of the supplied natural gas compared to that taken into account in the PDD, a recalculation of natural gas quantity will be done.

This approach is justified due to the following facts:

- All natural gas is replacing the currently used fuels;
- In absence of this project end-users would use non-natural gas fuels.

⁹ (www.eia.doe.gov/cnaf/electricity/epav2/html_tables/epav2ta3p2.html)

10.2. Monitoring plan for the reporting of the realized greenhouse gas emissions reduction

Year	Natural gas consumption, Thousand sm ³	Fuel switch emission reduction factor, tCO ₂ /thousand sm ³	Carbon dioxide emission reduction /ERUs/, tCO ₂
Industrial sector			
2008		0.96	
2009		0.96	
2010		0.96	
2011		0.96	
2012		0.96	
Public and administrative sector			
2008		0.70	
2009		0.69	
2010		0.70	
2011		0.70	
2012		0.70	
Household sector			
2008		1.77	
2009		1.66	
2010		1.62	
2011		1.60	
2012		1.52	

Table 17: Calculation of the realized greenhouse gas emissions' reduction

10.3. The activities responsibility, providing for monitoring

- “Sofiagas” EAD will collect the data for buying quantities and will report on month sales of natural gas by sectors;
- “Overgas Inc.” AD will summarize the data for the total natural gas consumption by sectors in an annual report;
- “Overgas Inc.” AD will recalculate the measured quantity to a fixed calorific value of 34.0 MJ/m³
- “Overgas Inc.” AD will prepare a report on the total realized carbon dioxide emission reductions in ERUs.

10.4. Monitoring implementation technology

The monitoring of the greenhouses gas emissions during the project implementation includes supervising and determining the emissions, released by the natural gas burning in the combustion installations of the end users and the methane losses in GDN at the delivery to the end users. Indicators for the quantity of GHG emissions are the amount of purchased gas received in GDN, the amount of losses at delivery and the amount of sold natural gas. For determination of these quantities reported data are used as follows:

- The consumption of natural gas as per the readings of “Bulgargas” AD gas meter;
- The summarized consumption read by the gas meters of end users;
- The amount of losses, estimated as difference between the delivered and sold quantities and those read by the remote monitoring and control system OVERCOMM 2.0.

“Overgas Inc.” AD will generally follow the company procedures of for quality assurance of operation and reporting on natural gas consumption and leakage. /Appendix 10.1./

10.5. Methods for quality control and procedures for quality ensure

The quality of delivered natural gas, consumers’ consumption and cases of emergency (temperature and pressure alarm levels, gas leakage, presence of electric power at measuring units, facilities security, and calls by consumers) in the Gas Distribution Network are monitored by an automatic dispatcher system OVERCOMM 2.0. In *Appendix 10.2* a detailed information about the automatic dispatcher system is presented.

The data collected to perform the monitoring of the emissions from the project activity and the methods of measurement that will be applied are shown in *Appendix 10.3*.

10.6. Statistical methods used in determining the consumed of natural gas quantities.

To carry out the monitoring implementation as described in it.9.1, the annual natural gas consumption by sectors will be used as an indicator. The methods for determination of the consumed natural gas quantities, recalculated to a calorific value of 34.0 MJ/m³ are presented in *Appendix 10*.

Summary

The monitoring plan is based on observation of the basis factor – quantity of natural gas consumption.

The volumes of consumed natural gas by sectors are initial data for estimation of the realized reduction of greenhouse gas emissions.

The monitoring results will serve as a basis for reporting on submitted ERUs, as well as for the validation by independent body of the quantities realized ERUs.

The method and the sequence of monitoring are clear and are a guarantee for obtaining trustworthy and reliable results.

11. STAKEHOLDER COMMENTS

The requirements for the construction of gas transfer and distribution networks in and outside urbanized territories are treated and controlled in a number of legislative acts, rules and regulations, and other normative documents. By virtue of these documents, the stakeholders – the town communities, municipal administration, specialized state control bodies and communication companies – are deeply involved in each stage of the required procedures.

For the gasification of Sofia Municipality the public was invited for comments that a gasification scheme was adopted by Decision of Sofia Municipal Council through an announcement published in the State Gazette.

There have not been any objections or negative opinions on the contents of the scheme.

- The Farm Land Protection Act also provides for a procedure, which requires that after the completion of the choice of routes, the opinions of municipal administrations, control bodies and communication companies should be obtained.

Based on the support given to the investment proposal by the above-mentioned institutions, the Ministry of Agriculture and Forests approves the route outside urban territories for design and construction of the project.

- **The Procedure for Environmental Impact Assessment is in compliance with the Environmental Protection Act and gives the most concerned parties the opportunity to express their opinion of the project.**

It includes the following stages:

- An Environmental Impact Statement (EIS) is prepared by independent licensed experts;
- The public is informed about this EIS through the local press and a date is announced on which there will be a discussion of the project;
- Public discussion is carried out – the public in the concerned settlement is introduced to the project and the stakeholders express their opinions in a discussion afterwards;
- If there are no objections whatsoever, the Expert Council of the competent body – Regional Inspectorate on the Environment and Waters (RIEW) approves the Environmental Impact Statement and issues a Decision on the implementation of the project.

It is important to note, that the environmental policy of OVERGAS includes the practice of inviting the stakeholder institutions as required by the Environmental Protection Act as well as representatives of NGOs, scientific institutes and CEOs of big enterprises that are provided for gasification by the project, when holding the public discussions. The purpose is to make the investment projects more transparent to the public, to introduce the advantages of using natural gas instead of solid or liquid fuels and to consider the opinions of the stakeholders.

The public discussion of the Environmental Impact Statement of project was held as follows: It was attended by experts from Sofia Municipality, World Movement “Ecoforum for Peace”, the Balkan Ecological Federation, International Center “Ecology and Energy”, OVERGAS Inc. AD, independent experts. The representatives of OVERGAS Inc. AD presented the project, and the independent experts presented the Environmental Impact Statement. The questions asked by the stakeholders concerned mainly specifics about the speed of the project implementation. The statements made were positive and expressed a desire for faster implementation of the project. There were no negative written or oral statements concerning the project.

Following the public discussion and the sitting of the Expert Environmental Council, the Director of RIEW – Sofia issued a Decision on the Environmental Impact Assessment for the Gasification of Sofia Project by which he granted permission for the final Environmental Impact Statement and the Gasification of Bankya, by which the implementation of the site was granted permission. (Appendices 11, 11.1, 11.2, 11.3)

- The detailed designs for the gasification implementation have been agreed with the controlling bodies – the State Technical Supervision, the Regional Fire Protection Service, the Hygiene and Sanitary Inspection, Civil Defence Service and the stakeholder communication companies – Power Supply, Water Supply and Sewerage, Bulgarian Telecommunications Company, Linear Cable Company, Irrigation Systems, and we should note they did not express negative opinions on the project. The Municipality approved the agreed project documentation and permits were issued for the construction of 89 km.
- In compliance with the legal requirements, the permits issued were displayed at an easily accessible place in the Municipality to inform the public as well as the stakeholders personally. Objections and comments on the building permits issued were not submitted.
- Regarding the gasification of the southern areas of Sofia Municipality planned for 2004: The Municipal Council of Sofia Municipality approved a gasification scheme for the southern areas of Sofia and it has been included in the General Layout Plan, which is to be adopted by the National Assembly of the Republic of Bulgaria.
Note: The members of the Municipal Council represent all layers of society, as they have been elected at local elections.
- The Farm Land Protection Act sets forth a procedure which requires that after the documentation for inclusion in the Detailed Layout Plan for a route outside urban territories has been completed, the opinions of the public administration, the control bodies and the communication companies should be obtained.

Based on the support given to the investment proposal by the above-mentioned institutions, the Ministry of Agriculture and Forests approves the route outside the urban territories for design and construction of the project.

Sofia Municipality published an announcement in the State Gazette about the developed Detailed Layout Plan for a route outside urban territories; objections to the investment project proposed were not submitted.

- In connection with the effective environmental protection legislation and the introduction of a regime as deemed appropriate by the respective competent body concerning the need for an Environmental Impact Assessment of the proposed investment project to be made;
 - The public is informed of the proposed investment project through the local press;
 - A request is submitted to the competent body containing enough information to be used in the assessing the need for an Environmental Impact Assessment;
 - If there are no objections whatsoever and after reviewing the submitted documents to support the investment proposal, RIEW issues a decision on assessing the need for an Environmental Impact Assessment.

For gasification of the neighborhoods Suhodol, Gorna Banya, Ovcha Kupel – the old part and Knyazhevo, Karpuzitsa locality, the competent body was of the opinion that an Environmental Impact Assessment is not necessary, expressed in Decisions №46-IIP/2003, №75-IIP/2003 and №02-IIP/2004. (Appendices 12, 13, 14)

- In compliance with the Law on the Structure of the Territories, the project documentation for 54 km of the route was approved by: the State Technical Supervision, the Regional Fire Protection Service and the Executive Agency for Roads, Bulgarian State Railways. Detailed designs were approved without any remarks. The Municipality approved the pre-concerted design documentation and the building permit is to be issued soon.

On March 7, 2003 Overgas Inc. AD held a national meeting named “Overgas and partners” and directed to persons and organizations interested in the project. A lot of companies constructing internal heating installations attended this meeting.

The positive attitude of the consumers of Sofia Municipality regarding the gasification and the mutual trust between the installation companies, Overgas and Sofiagas were confirmed on the meeting.

Summary

Only positive opinions or statements were submitted concerning the implementation of the project under all above-stated procedures giving the opportunity to obtain opinions and comments from the stakeholders – the population of the towns, the specialized state control bodies and the communications companies or experts from science and research organizations. The public in Sofia Municipality was interested in the faster implementation of the project, they were positive towards the gasification projects, were informed of their social and environmental advantages for both the settlement as a whole and each individual consumer.

12. ENVIRONMENTAL IMPACT

The environmental impact of the project is thoroughly examined in the preliminary environmental impact statement (EIS). Independent experts have prepared the report in compliance with Bulgarian law effective during the respective period of time.

The positive decision No 9-2/1998 taken by the Regional Inspectorate of Environment and Water (RIEW), Sofia, is added to the EIS for proceeding to next stage of designing and preparing of final report on the project “Gasification of Sofia” and implementation of the project for the sites ECUVD and Bankya. The validity of permits for the preliminary environment impact assessment (EIA) has been prolonged in accordance with the law. (*Appendices 11, 11.1, 11.2, 11.3*)

1. Summary of the preliminary EIS of the project for gasification of Sofia Municipality

The report examines the impact of gasification in Sofia Municipality on the environment during construction and operation of the gas distribution network. Special attention is focused on technological processes during project implementation and their eventual impact on environment elements.

Two hypothesizes are examined: 1) current situation (use of conventional fuels) i.e. without implementing the project, and 2) gasification of sites in the industrial, public and administrative and household sectors. The impact of gasification on the population, the biological diversity and its elements, including flora, fauna, soils, water, air, climate and landscape, bowels of the earth, material and cultural heritage and their interaction have been defined, described and assessed.

The studies of independent experts as reflected in the report indicate that the composition of emissions from combustion installations changes along with the increase of the share of natural gas as an energy source in Sofia Municipality. Greenhouse gases are reduced significantly, sulfur oxide emissions, as well as particles emissions are eliminated, while the total quantity of noxious emissions is reduced by 16 times. The advantages of natural gas in comparison to solid and liquid fuels and the urgency of the project for improving environment conditions in Sofia Municipality are shown. By using modern methods to forecast and design emissions and by taking into account the tendencies for development of the city it is quite clearly indicated that the project construction and operation will not have a negative impact on environment components. The gasification of sites in the three consumer sectors will improve the state of ambient air and environment and will have a favorable effect on the sustainable development of the Municipality.

2. On 30 September 2003 the Law on Environment Protection was amended, which led to certain mitigation in relation to the preparation of the EIS. The new law stipulates the preparation of an application to RIEW to consider the need of an EIS. For this purpose the investor prepares the necessary documents, which contain information concerning the project and the impact of project construction and operation on environment components. On this

basis the control authority takes a decision in regard to the need for preparing the statement. So far only applications to RIEW concerning the gasification of municipal regions Ovcha kupel and Vitosha have been prepared. In the decisions of RIEW, Sofia, No02-IIP/2004, No46-IIP/2003 and No75-IIP/2004 it is indicated that because of gasification durable positive effect on environment components it is not necessary to make an EIA of Sofia municipality gasification project. The same procedure is in process and for the rest regions of Sofia Municipality.

Summary

The conclusions of the independent experts that have prepared the preliminary EIS indicate categorically that the project has lasting positive effect on environment components and health of people, which is due to the switching from solid and liquid fuels to natural gas. The experts define the project significance as ecological and social.

The decisions of the control authority – RIEW, concerning the elimination of the requirement for an EIS in view of the indisputable positive ecological effect of gasification are quite important in order to obtain a construction permit.

ABBREVIATIONS USED IN THE DOCUMENT

CGS	City Gate Station
CHP	Combined Heat and Power Plant
CO₂	Carbon Dioxide
CO₂eqv	Carbon Dioxide Equivalents
EEC	End Energy Consumption
EF	Emission Factor
EF	Emission Factor
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ERU	Emission Reduction Unit
ERUPT	Emission Reduction Unit Procurement Tender
EU	European Union
FSERF	Fuel Switch Emission Reduction Factor
GDN	Gas Distribution Network
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HGP	Heat Generation Plant
HWB	Hot Water Boiler
HWS	Hot Water Supply
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JI	Joint Implementation
LHV	Low Heating Value
LPG	Liquid Petroleum Gas
MEW	Ministry of Environment and Waters
MR	Municipal Region
NEC EAD	National Electric Company EAD
NGOs	Non-governmental Organisations
NPP	Nuclear Power Plant
PAS	Public and Administrative Sector
PDD	Project Design Document
PE-HD	Polyethylene High-density
PR	Public Relations
RIEW	Regional Inspectorate of Environment and Waters
sm³	All sm ³ represents, unless otherwise stated, a standard m ³ at 1,013,25 bar and 273,15 °C
SERC	State Energy Regulatory Commission
SME	Small and Medium Enterprises
UN	United Nation
UNFCCC	United Nations Framework Convention on Climate Change