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Article

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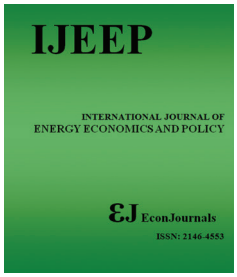

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The Role of Natural Gas in Achieving Sustainable Development Goals

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ABSTRACT

Natural gas started to have an increasingly tangible impact on human civilization in the second half of the 20th century, and today it has come to the forefront, affecting the implementation of practically all sustainable development goals. In this work, the systemic analysis of the natural gas influence on sustainable development not only for specific purposes but also for pillars of sustainable development has been conducted: economic development, social sphere, and environmental protection, which in cooperation generate allowable, fair and acceptable states. As a result of the analysis, it has been found that natural gas, unlike other types of fuel and nonfuel sources of energy, possesses the highest rates of all three states, and it is the most powerful means for sustainable development goals achievement both at the present and, in combination with nature-like technologies of obtaining energy, in the future sustainable development of human civilization.

Keywords: Natural Gas, Sustainable Development, Sustainable Development Goals, Sustainable Development State, Nature-like Energy Sources, Energy Power
JEL Classifications: Q400, Q480, Q490, Q540

1. INTRODUCTION

Natural gas, that had conceived development as a source of energy in the second half of the 20th century and became one of the leaders of energy sources in the 21st century, is recognized as a means of achieving sustainable development goals (SDGs). However, along with the fact that natural gas has already superseded coal as an energy source in certain regions of the world, it has become a target of criticism and attempts to declare "the beginning of the end of the hydrocarbons' era." This sets the target to protect natural gas from such attempts by scientific methods of systemic analysis, despite the obvious absurdity of the allegations about "the beginning of the end."

Therefore, the scientific substantiation of natural gas benefits in SDGs implementation is a pressing scientific challenge. We will support its usefulness not only for each of 17 SDGs but as a whole in terms of sustainable development states indicators characterizing their acceptability, fairness, and allow ability for modern civilization.

The relevance of this issue is associated with the attempts to discredit the environmental advantages of natural gas and the need to demonstrate an objective contribution of the gas industry to achieving SDGs.

The research goal is to analyze the role of natural gas in sustainable development for each of its components: economic, environmental and social ones.

Research objectives:

1. To carry out a systemic analysis of the economic, environmental and social factors of sustainable development when using different sources of energy
2. To examine the role of each SDG in terms of natural gas role in SDG achieving
3. To compare sustainable development indicators characterizing their states when using natural gas in all economic sectors.

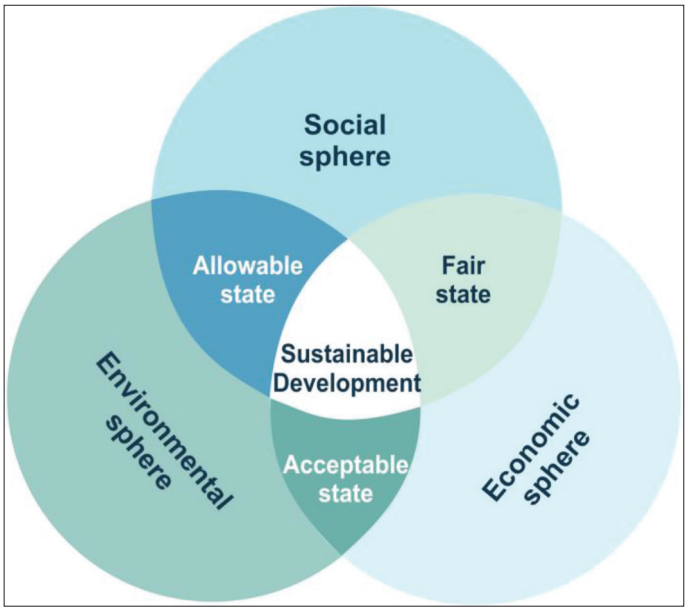
2. ISSUE STATUS

In 2015, the UN general assembly adopted the resolution on "transforming our world: The 2030 agenda for sustainable development" (United Nations, 2015). All 17 SDGs are connected one way or another with the increasing demand for energy, and there is an ongoing dispute about which energy sources are the most effective for SDGs accomplishment (World Health Organization, 2018).

Figure 1 sets forth the SDGs briefly, but they clearly represent the entire spectrum of human relationships, their economic and social life, and conditions of existence, i.e., environmental component.

Many works have been dedicated to the role of natural gas as a basis of sustainable energy power development (BP, 2017b; Gazprom, 2016; Kucherov et al., Martynov et al., 2017; 2015; U.S. Census Bureau, 2018). From 1981 to 2015, the energy power production in the world had grown twice – from 6.68 to 13.23 billion tons of oil equivalent, while a steady growth in the generation of all types of energy power had been observed. During the same period, the Earth population had grown from 4.5 to 7 billion people – slightly more than 1.5 times. Thus, we can say that over the past 35 years the growth rate of energy generation has exceeded 1.3 times the growth rate of the world population, and this trend will apparently continue in the medium term. This is an inevitable consequence of the present stage of scientific and technological progress and the resulting accelerated growth in energy consumption in 2015

Figure 1: Sustainable development scheme



(Martynov et al., 2017). This is primarily because natural gas is the most energetically efficient and environmentally clean fossil fuel (Kucherov et al., 2015).

The conducted analysis of the dynamics of the energy generation structure in the world over the past 35 years has shown that the proportion of natural gas extraction has grown at the fastest rate among all types of generated energy and was 4.5 % (Kucherov et al., 2015).

An Atlas was published about the interconnection between natural gas and SDGs, i.e. the set of all relationships of natural gas and SDGs (IPIECA et al., 2017). The Atlas is a joint project of the United Nations Development Programme (UNDP), the International Finance Corporation of the World Bank Group (IFC) and IPIECA, global oil and gas industry association for environmental and social issues. The Atlas discusses the links between the oil and gas industry and SDGs. It contributes to an understanding of how the oil and gas industry can most effectively support SDGs achievement. It displays the existing contributions of the industry and encourages companies to identify additional opportunities to assist countries in SDGs achievement. The Atlas may also help oil and gas companies and their stakeholders to develop a common understanding of how the industry manages environmental and social issues while maximizing economic benefits. How do companies integrate SDGs in their core business? The SDGs range provides that business is to go beyond social investment and corporate philanthropy for long-term sustainability. Thus, discussion of each goal in this Atlas comprises ways and possibilities of integrating contributions to SDGs in the core business of a company. Many of the problems the SDGs implementation faces go beyond the capability or control of a separate company and are beyond its core business needs.

When developing the Atlas, its authors have found that the oil and gas industry can contribute to all 17 SDGs. However, there are some SDGs, in which the industry has particularly strong opportunities for participation, for example, goals related to affordable and reliable energy (SDG 7); climate and life below water and on land (SDGs 13, 14 and 15); economic development and innovation (SDGs 8 and 9); and health and access to clean water (SDGs 3 and 6). Many goals are interrelated. A good example is the climate change sector. Although it is included as a separate SDG, it has implications for all 17 SDGs. Climate change may disproportionately affect the poorest and most vulnerable population segment, undermining the efforts to eradicate poverty (SDG 1), achieve gender equality (SDG 5), and reduce disparities among and within countries (SDG 10). Climate change may threaten food security (SDG 2), increase the load on water resources (SDG 6), and change ecosystems and harm biodiversity (SDG 14 and SDG 15). It can also change the structure of infectious diseases' spreading and thus affect global human health (SDG 3). All these effects could threaten the world and our safety (SDG 16). At the same time, the response to climate change may also contribute to progress in respect of other SDGs, for example by improving the energy efficiency and renewable energy and technologies' investments (SDG 7) that can open new economic opportunities (SDG 8) (IPIECA et al., 2017).

The work by International Gas Union and Eurogas (2015) also represents a detailed analysis of SDGs. It has been shown that SDGs provide a guiding framework for society as they try to respond to a number of urgent challenges. One of these problems is the absence of access to energy; thus, SDGs have become paramount for policy-making in the field of energy power. However, while governments around the world have already declared that the SDGs are "integrated and indivisible," there are still gaps in knowledge about how the interaction between the targets of energy power SDG and other SDGs, not related to the energy sector, may develop in different contexts. This review reports a widespread evaluation of relevant literature on energy issues (International Gas Union and Eurogas, 2015). Energy is addressed primarily to achieve SDG 7, ensuring access to affordable, reliable, sustainable and modern energy for all people. Particular attention in publications is paid to the role of natural gas for sustainable development (McCollum et al., 2015).

All researchers (Averchenkova et al., 2017; Bylin et al., 2016; Krupnick et al., 2014; Shields, 2016) note the positive role of natural gas in SDGs implementation. Most experts agree that the ability to provide economically efficient development of extensive globally scattered deposits of natural gas is the basis for the energy industry of the future. This resource base is a new opportunity for domestic and global economic growth, as well as for change in fuel choices in many sectors.

In recent decades, an unprecedented breakthrough in the gas industry has been achieved, which helps to improve the energy balance and promote low-carbon economy development (Chengzao et al., 2014).

The ways the gas sector may contribute to SDGs implementation are described in works (Alloisio et al., 2017; Cutter et al., 2015; Lahn and Bradley, 2016; Sinclair, 2018; Sullivan, 2017;). And even gender equality is related to natural gas (Cutter et al., 2015). It is emphasized that natural gas has been rapidly gaining geopolitical importance (Rice University's Baker Institute for Public Policy, 2004). Gas is transported over long distances for consumption in various sectors of the economy. The growing importance of natural gas imports for the modern economy will promote new ways of thinking about energy supply security. The relationships developing between major gas suppliers and major consuming countries will create new geopolitical initiatives, which will reach the highest levels of economic and security policy. The work by Sinclair (2018) explicitly states the transition from coal and oil to natural gas.

3. METHODOLOGY, RESULTS AND DISCUSSION

The economy plays a major role in people's lives, and it is well known how energy resources affect it. Economic growth is associated with the increasing use of natural gas.

Natural gas is one of the cheapest resources. In the equivalent amount of energy (per 1 MW), natural gas capital intensity is $ 1,023, whereas, for example, solar power capital intensity is $ 3,873 (U.S. Department of Energy, 2018).

The exports of natural gas to Europe are well correlated with the growth of the EU economy (Figure 2).

The use of natural gas requires the minimal involvement of land resources (Figure 3). This is despite the fact that each year we lose 6 million hectares of arable land that is the basis for the production of food resources.

Our daily lives depend on reliable and affordable energy services, as well as on uninterrupted operation and equitable access to energy resources.

One in five people worldwide has no access to electricity. 2.8 billion people use wood, charcoal, dung, and coal for cooking and domestic heating, which annually causes more than 4 million deaths due to indoor air pollution.

Figure 2: Correlation between natural gas exports to Europe and the EU economic growt

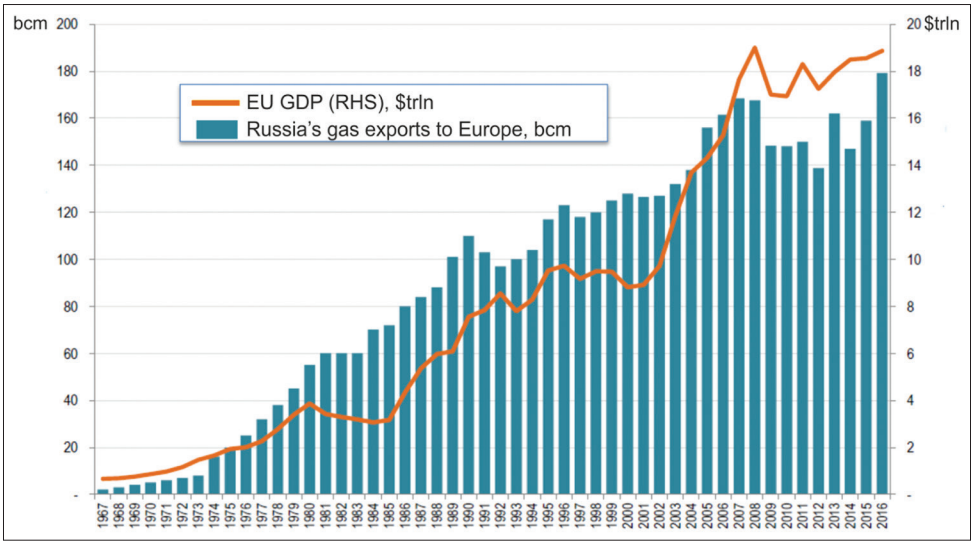
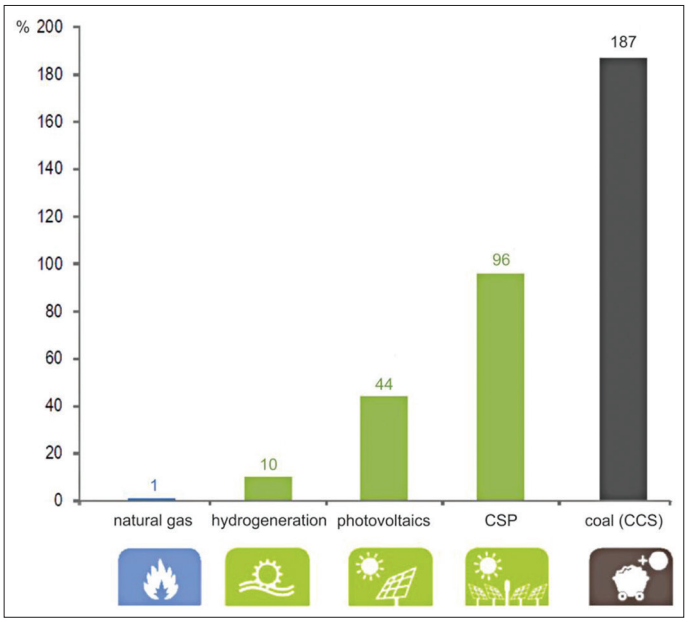


Figure 3: Contribution of various sources of electric power to the land use (UN Environment Programme, 2018). CSP – concentrated solar power



The solution to these problems is to use natural gas since it gives a reliable and uninterrupted supply of energy (energy security). Remaining technically recoverable resources of traditional gas are enough for 300 years (with the current level of gas extraction). Pipeline natural gas ensures sustainable gas supplies in the long term.

Natural gas is the most promising energy source. Natural gas consumption is expected to increase in all sectors, and the consumption of coal and oil is expected to decrease (Figure 4).

And finally, the energy return on investment for different energy sources, i.e., the ratio of usable (useful) energy produced from a particular energy source to the amount of energy expended to obtain that energy resource, is in favour of natural gas (Figure 5) (U.S. National Renewable Energy Laboratory, 2018).

Natural gas is an important energy source to reduce pollution; it contributes to the maintenance of normal environmental conditions.

Compared with other energy sources, natural gas has a number of advantages:

Figure 4: Natural gas – growth prospects (BP, 2017a)

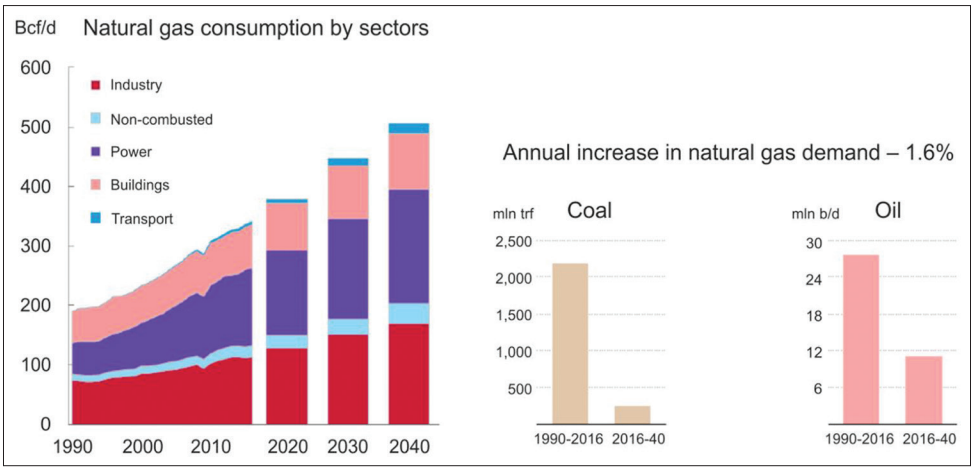
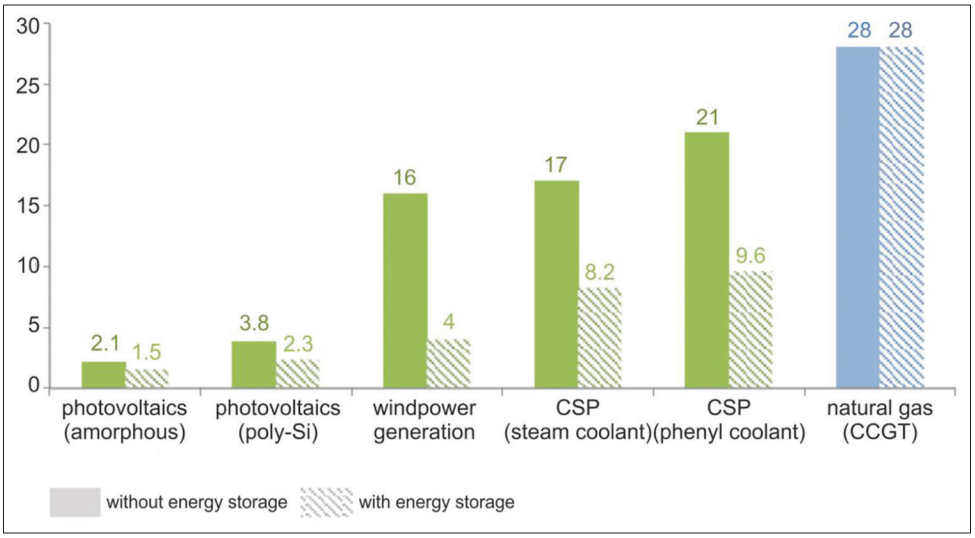


Figure 5: The energy return on different energy sources



In burning it releases mainly carbon dioxide and water vapour – a mixture we encounter in our glasses of soda water;

- It starts burning at once, and its combustion process is easily adjusted
- It contains no solid contaminants and other harmful components; and it is relatively cheap.

Methane is one of the greenhouse gases, it has been criticized by fighters against global warming, however, it is known that methane is found in the atmosphere primarily in the surface layer, which is called the troposphere, and it has a thickness of 11-15 km. Methane concentration does not depend a lot on the height from the ground surface to tropopause, which is caused by the high speed of mixing throughout the height in the range of 0-12 km (1 month) compared with methane lifetime in the atmosphere.

The study of the isotopic composition of gases testifies that the role of fossil methane as a greenhouse gas has been exaggerated. The study by Nisbet et al. (2016) of the ratio of methane isotopes in two stable carbon isotopes ^{12}C and ^{13}C has shown that methane emissions from gas fields are typically more enriched with ^{13}C compared to the atmosphere, and they are not the cause of the observed isotope shifts. Emissions from quarry bituminous mines of coal basins in the Southern Hemisphere have possibly contributed to the isotope shifts. A large part of the world emissions' variability may be due to the El Niño-Southern Oscillation (ENSO) indicators.

It was found out that a globally averaged molar proportion of methane in the atmosphere had risen from 2007 to 2013 by 5.7±1.2 parts/bln/year. At the same time, the indicator $b^{13}C_{CH4}$ (the ratio of carbon isotopes $^{13}C/^{12}C$ in methane) since 2007 has shifted towards significantly more negative values.

The extreme growth of value by 12.5±0.4 bln^{-1} was recorded in 2014, a further shift to more negative values was observed in most latitudes.

Isotope evidence represented in work by Nisbet et al. (2016) indicates that the growth of methane is mostly influenced by an increase in biogenic methane emissions, particularly in the tropics, for example, due the expansion of tropical wetland areas in the years with abnormally high rainfall or due to the increase in the number of sources of methane emissions related to agriculture sector, such as ruminants and rice fields.

According to Aksyutin et al. (2018), the share of methane in total greenhouse gas emissions is low, and the share of methane emissions from the Russian gas industry is only 0.004% of global greenhouse gas emissions.

The total content of methane in the atmosphere is about 5 billion tons while the annual emissions, estimated at 540-568 million tons, are almost equal to the natural intake from the atmosphere (529-555 million tons). That means the mechanism of changes in methane concentration in the atmosphere has its own natural character similar to the regulation of water vapour balance.

The 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) notes:

- There is no single system of indicators for accurate comparison of all the effects of various emissions, all the metrics have limitations and uncertainties
- Up to the IPCC 4th Assessment Report, the global warming potential (GWP) was the most common metric indicator
- Nowadays the role of global temperature change potential increases (GTP), based on the change in global average surface temperature at the selected time and also in respect of the change caused by the CO_2 reference gas. According to the specified methods (potentials) methane has different conversion factors to convert in CO_2-equivalent. The IPCC has conducted potentials data refinement in preparing the regular assessment reports. Figure 6 shows the evolution of methane potentials compared to CO_2 according to different methods in the IPCC reports (Aksyutin et al., 2018).

According to experts, the anthropogenic influence on climate as a whole is much lower than that of natural causes (deviation of Earth's orbit, change of solar activity, volcanic phenomena with aerosols release), and is compensated by natural recovery processes and self-regulation (natural balance) in the atmosphere.

Figure 6: CH_4/CO_2 estimated ratio comparison according to different methods of assessing methane's role in climate change

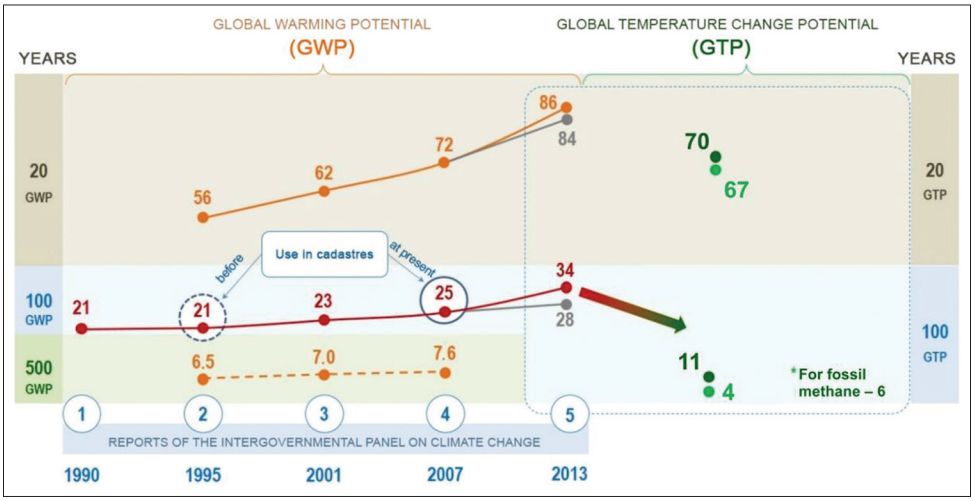
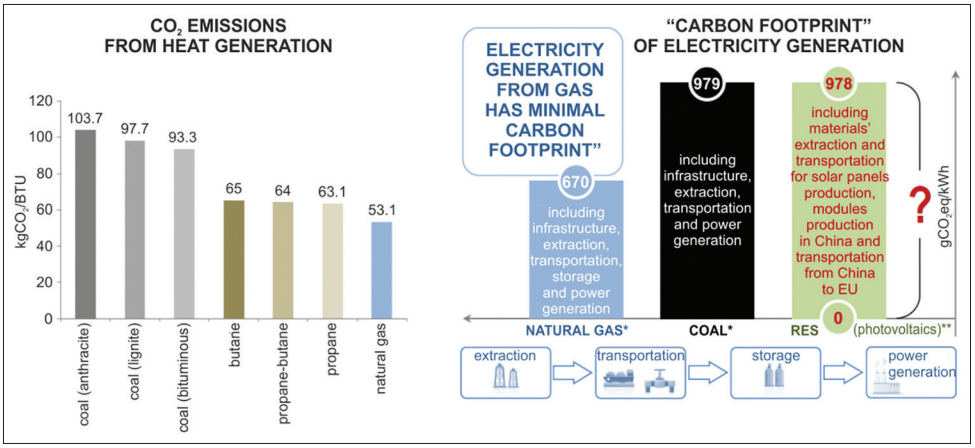


Figure 7: Climate safety of natural gas



In the assessment of methane's contribution to global climate change, it has to be taken into account that its percentage in the overall picture of the greenhouse gases' impact on climate is 4-9%, whereas water vapour's – 36-72%. It is water vapour that supports thermal balance and is a natural regulator of atmospheric processes. Analysis of the role of each greenhouse gas confirms the conclusion that the methane's impact on climate can be regarded as insignificant in the context of water vapour natural regulation and methane's short life in the atmosphere.

For an objective assessment of different types of fuel, it is required to analyze the CO_2 emissions when using them, as well as the carbon footprint (greenhouse gas emissions throughout the production chain) of energy resources. CO_2 emissions vary for different types of fuel. Figure 7 gives their comparison according to data (European Institute for Climate and Energy, 2016; U.S. Energy Information Administration, 2018; U.S. National Renewable Energy Laboratory, 2018).

It is obvious that heat generation from natural gas is accompanied by lower CO_2 emissions, and that electricity generation from gas is characterized by the lowest "carbon footprint." Generation from gas is characterized by the minimal impact on the ecosystems.

The second objective of the work is the analysis of gas' contribution to each SDG (Table 1) to objectively compare natural gas to other energy sources.

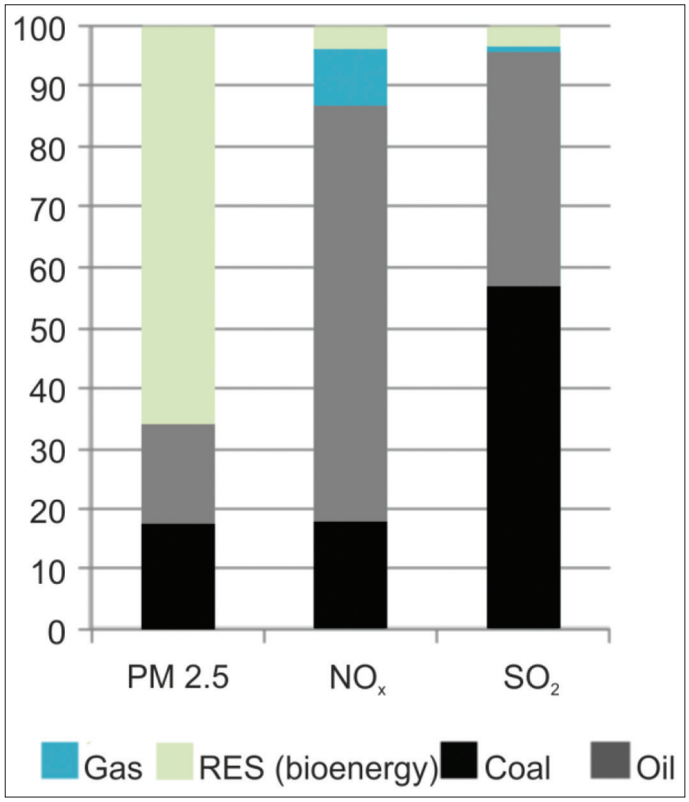
Social aspects of sustainable development are evident in the objective view of the use of natural gas.

It is above all the impact on human health (SDG 3). Figure 8 presents emissions from various energy sources, affecting human health (Arutyunov and Lisichkin, 2017).

The coal causes 36% of lung cancer deaths, 34% of deaths from stroke, and 27% of deaths from heart diseases.

In today's world, the total area of cities constitutes only 3% of the Earth's land, but they account for 60-80% of energy consumption and 75% of carbon dioxide emissions. "Carbon footprint" of gas engine transport (CNG) is lower in comparison with the transport running on oil fuels. In comparison with electric cars, CNG has advantages with a significant percentage of coal in the energy mix.

Figure 8: Contribution of various energy sources to global emissions of toxic substances, 2015. PM2.5 – solid particles (particulate matter) smaller than 2.5 microns



Gas infrastructure development greatly contributes to air cleanliness. This issue is particularly pressing in China and India. To achieve the SDG 3 (good health and well-being), coal power plants should be closed and electric generation with the use of natural gas should be developed. Figure 9 provides data in terms of the sources on the example of India (International Energy Agency; 2017).

Smog in cities is a very serious social problem. Today, 50 % of the world population, i.e. 3.5 billion people, live in the cities. In 2014, 9 out of 10 people who lived in cities breathed the air that did not meet the safety standards set by the WHO. "Toxic footprint" in gasoline production is 7 times higher than for the CNG lifecycle.

Table 1: The natural gas contribution to each SDG

Sustainable development goal	Natural gas contribution
End poverty in all its forms everywhere	Nearly 2.2 billion people live below the poverty line (more than 700 million people live in extreme poverty and experience difficulties in meeting the most basic needs). Natural gas is one of the cheapest and most affordable energy resources
End hunger, achieve food security and improve nutrition, promote sustainable agriculture	Generation from gas uses land and other resources rationally (to a minimal extent). Natural gas can be used for food synthesis
Ensure healthy lives and promote well-being for all at all ages	Air pollution poses the greatest threat to human health; it annually causes deaths of approximately 7 million people. The use of natural gas is characterized by a minimal impact on health
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Sustainable economy and human health, which natural gas can ensure, promote the growth of education and improvement of its quality
Achieve gender equality and empower all women and girls	Creation of an economic basis for the implementation of gender equality should become one of the most important goals in both developed and developing countries. Natural gas is one of the cheapest low-carbon energy sources promoting sustainable economy in developed countries
Ensure availability and sustainable management of water and sanitation for all	Water shortage affects more than 40% of the world population. 783 million people do not have access to clean water. More than 80% of liquid wastes obtained from human activity are dumped into rivers or seas without any processing. Freshwater accounts for only 3% of all the world's water reserves. This is an exhaustible natural resource, which requires reasonable consumption. Generation from gas is characterized by minimum consumption of clean water (0.7 m^3/MW/h)
Ensure access to affordable, reliable, sustainable and modern energy for all	One in five people worldwide has no access to electric power. 2.8 billion people use wood, charcoal, dung, and coal for cooking and domestic heating, which annually causes more than 4 million deaths due to indoor air pollution. The solution is natural gas: natural gas means the safe and continuous supply of energy (energy security); pipeline natural gas ensures sustainable gas supplies in the long term
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Gas industry means a responsible employer who provides local employment, decent payment, helps to raise the level of employees' education
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Natural gas is the basic element of the transition to low-carbon development. The gas industry is the high-tech economy sector, it serves as a driver of innovation in other industries
Reduce inequality within and among countries	Fairness to convenient and affordable energy source reduces the level of inequality within and among countries
Make cities and human settlements inclusive, safe, resilient and sustainable	Today, 50 % of the world population, i.e., 3.5 billion people, live in the cities. Transport is a major source of emissions in major cities. In 2014, 9 out of 10 people who lived in cities breathed the air that did not meet the safety standards set by the WHO. "Toxic footprint" in gasoline production is 7 times higher than for the lifecycle of compressed natural gas (CNG). "Carbon footprint" of gas engine transport (CNG) is lower in comparison with the transport running on oil motor fuels. In comparison with electric cars, CNG has advantages with a significant percentage of coal in the energy mix
Ensure sustainable consumption and production patterns	In 2030, the world will need 40% more water, 50% more food, and 40% more energy. Responsible production and consumption are important. The use of natural gas is characterized by a minimal loss of energy. In energy terms, generation from gas is more efficient than from renewable energy. It is characterized by the lowest materials and valuable chemical elements consumption
Take urgent action to combat climate change and its impacts	Production of heat from natural gas is accompanied by fewer emissions of CO_2. Generation from gas is characterized by the lowest "carbon footprint."
Conserve and sustainably use the oceans, seas and marine resources for sustainable development	More than 3 billion people depend on marine and coastal biodiversity. 16% of ecosystems were classified in categories of "high" or "highest" risk of eutrophication of coastal waters.
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Generation from gas is characterized by the minimal impact on ecosystems
Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Peaceful and open society may exist only where there is access to the source of energy in the form of natural gas. If available, it reduces tensions in society
Strengthen the means of implementation and revitalize the global partnership for sustainable development	Natural gas and global partnership are closely related. A clear example is the Nord stream gas transmission system

Table 1 shows that virtually every SDG using natural gas has positive dynamics.

The third objective, which is the analysis of sustainable development's components ratio "economy-ecology-social field," should be associated with the global challenges of today. Now it is trendy to start a list of global issues with "global warming." It should be noted that the scientific community is already shifting away from the terminology of global warming: The term "climate change" is more common now.

Figure 9: Polluting emissions potential reduction during the transition from coal-fired electricity generation to gas-fired electricity generation. PM2.5 – solid particles (particulate matter) smaller than 2.5 microns

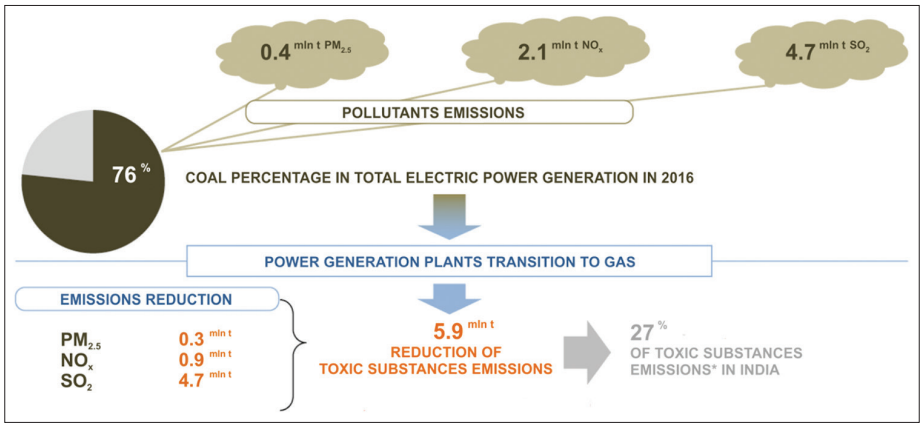


Figure 10: Responsible energy production and consumption (American Gas Association, 2018

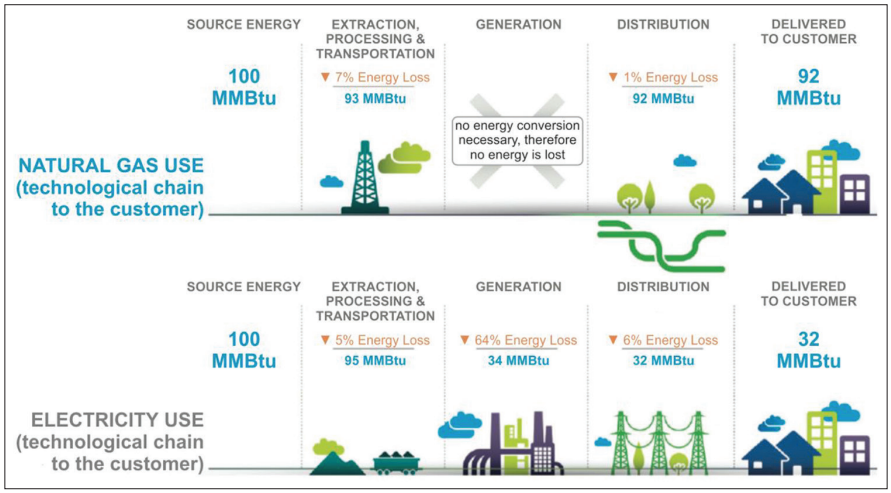
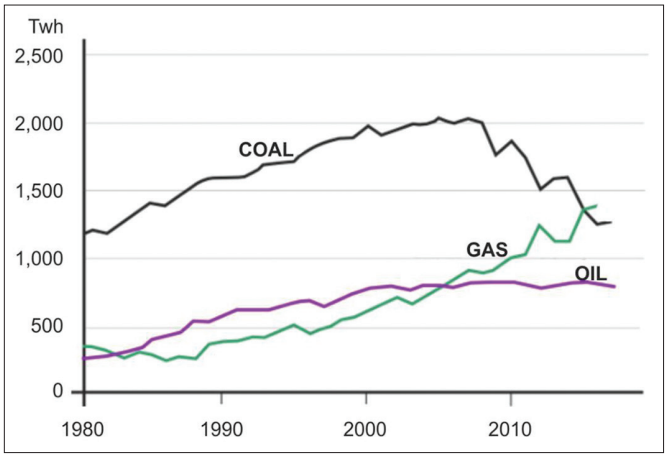


Figure 11: Victorious march of natural gas in the USA (Carbon Brief, 2017).



There are other global problems as well – the depletion of resources (earth, soil, water, forest, biological, etc.), as well as global pollution (garbage islands).

For the sustainable development indicators ratio to be acceptable, allowable and fair, we should ensure the solution of other challenges along with the climatic ones.

Water resources are a crucial issue (SDG 6). Water shortage affects more than 40% of the world population. 783 million people do not have access to clean water. More than 80% of the liquid wastes obtained as a result of human activity are dumped into rivers or seas without any processing. Freshwater, a finite natural resource, constitutes only 3% of all the world's water reserves.

Natural gas ensures responsible energy consumption (SDG 12). Figure 10 shows data on production chains. The use of natural gas is characterized by a minimal loss of energy.

Depletion of material resources is also an important issue. It is a matter of concern that in pursuance of the improvement of solar energy efficiency:

1. Valuable and rare materials (rare-earth) are used: Energy is renewable but materials are not
2. New materials are produced and used, many of which contain toxic substances: Solar panels are a source of waste 300 times more toxic than waste from conventional energy generation (countries like Ghana, India, and China, where many people live at the expense of electronic wastes, will suffer from "solar garbage" much more than the countries that use these solar panels). Generation from gas is characterized by the lowest material and valuable chemical elements' consumption.

At the conclusion of the analysis, we should also mention gas hydrates, their reserves being enormous. According to the United States Department of Energy, the amount of gas in Arctic sands amounts to 283 billion m^3. Hydrates from marine sandstones contain from 1000 to 10,000 trillion ft^3, and hydrates scattered in marine muds contain hundreds of thousands of trillion ft^3 of methane (U.S. Department of Energy, 2018). One of the technical solutions with synergistic effect may be the use of a floating NPP for the methane hydrates' extraction

Victorious march of natural gas continues. It has left behind coal and has a rate higher than that of oil (Figure 11).

4. CONCLUSIONS

Natural gas as a source of energy has a significant positive impact on the implementation of the SDGs adopted by the UN General Assembly in 2015.

Eradication of poverty and hunger, health and longevity maintenance associated stemming from the favourable environment can be achieved much faster provided the natural gas is used more widely. Sustainable economy and good health of people, which the natural gas can provide, contribute to the growth of education and improvement of its quality. Even gender equality issues are associated with the establishment of the economic base conducive to equality. The most important SDGs – 6 and 7 (water and access to energy resources) – may also be potentially solved through the use of natural gas. One in 5 people worldwide has no access to electricity. 2.8 billion people use wood, charcoal, dung, and coal for cooking and domestic heating, which annually causes more than 4 million deaths due to indoor air pollution. The solution is natural gas because it provides a reliable and uninterrupted supply of energy (energy security), and pipeline natural gas ensures stable supplies in the long run.

Equal access to convenient and affordable energy source reduces the level of inequality within and among countries (SDGs 9 and 10).

Today, 50% of the world population, i.e., 3.5 billion people, live in the cities. In 2014, 9 out of 10 people who lived in cities breathed the air that did not meet the safety standards set by the WHO (SDG 11), which is first of all due to transport emissions. "Toxic footprint" in gasoline production is 7 times higher than for the CNG lifecycle. "Carbon footprint" of gas engine transport is lower in comparison with the transport running on oil motor fuels.

In 2030 the world will need 40% more water, 50% more food, and 40% more energy. Responsible production and consumption are important. The use of natural gas is characterized by minimal loss of energy (SDG 12).

In energy terms, generation from gas is by an order of magnitude more efficient than renewable energy, as it is characterized by the lowest material and valuable chemical elements' consumption.

The main advantage of natural gas in achieving the SDGs is the drastic solution to SDG 13: Take urgent action to combat climate change and its impacts. Heat production from natural gas is accompanied by lower CO_2 emissions, and generation from gas is characterized by the lowest "carbon footprint."

More than 3 billion people depend on marine and coastal biodiversity. 16% of ecosystems were classified in categories of "high" or "highest" risk of eutrophication of coastal waters. Generation from gas is characterized by the minimal impact on ecosystems (SDGs 14 and 15).

Peaceful and open society may exist only where there is access to the source of energy in the form of natural gas (SDG 16). If available, it reduces tensions in society. Natural gas and global partnership are closely related (SDG 17). A clear example is the Nord Stream gas transmission system.

The overall analysis has shown that natural gas is the best of energy sources and, besides, is a valuable raw product for obtaining materials; all of this contributes to the solution of global problems and achieving all SDGs.

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