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GLOBAL CLIMATE CHANGE AND GREENHOUSE EFFECT

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Abstract. The climate has changed significantly under the influence of human behavior. And first of all, this is due to the change in the proportionality and concentration of greenhouse gases in the atmosphere (water vapor, carbon dioxide, methane, ozone, PFC (perfluorocarbons). This paper analyzes the dynamics of greenhouse gas emissions. Climate change has many consequences on human health throughout the world, especially in African countries. The growth of greenhouse gas emissions is viewed as a cause of infectious and non-infectious diseases, negative effects on nutrition, water security and other social disruptions. The global average temperature gradually increases, and the atmospheric CO_2 concentration has exceeded 400 ppm due to the intensification of greenhouse effect. The method of energy balance was featured to simulate the trends in Greenhouse Gas Emission Forecast in different sectors until 2030. Through sensitivity analysis, we found that the reduction of anthropogenic CO_2 emissions from people (cars and households) would deescalate the consequences of the above trends. Emissions are mostly associated with industries, which can be reduced if local Government will want to achieve the Paris Agreement goal.

Keywords: global warming; emission reduction; greenhouse effect; climate change; greenhouse gases

1. Introduction

Global climate change is an important problem in this time. It leads to a gradual increase in the average annual temperature of the planet, which began with the industrial revolution in the beginning of the XX century. Extreme weather in recent years has made the talks about the growth of Earth's temperature more intense. The change in temperature is explained by high levels of manufacturing and economic activity that includes emissions of main greenhouse gases: carbon dioxide, methane, etc. (Albergel et al., 2010).

The climate system of the Earth covers the atmosphere, the ocean, the land, the cryosphere (ice and snow) and the biosphere. The figure suggests a visual representation of its components and operations of the process. The climate is described by such characteristics as temperature, the amount of precipitation, air humidity and soil, the state of the snow and ice cover, and many others. The climate is constantly changing due to many different natural factors. A significant new factor, which has been influencing the Earth's climate more and more in the last 200 years, has become human activity. Its impact is defined by the so-called greenhouse effect (Alirezaei et al, 2017; Bayer, 2015; Moumen et al., 2019; Chehabeddine, Tvaronavičienė, 2020).

An additional stumulation to its popularization in the 20th century was machine learning modeling of global temperature, which, according to reserchers, proved the anthropogenic greenhouse effect (Babic, 2017).

The introduction of this paradigm into the mass consciousness began in USA and Europe in the last century. This paradigm was a subject of many critiques after the 1997 Kyoto conference. Highly developed countries were determined there. They can create a general cataclism in the future, or, alternitavely, reducte green house emissions. It will stimulate the companies to more attentive research for global warming evidence (Bergamaschi, 2013).

Climate change has been caused by the influence of natural processes. However, anthropogenic influence factors are becoming significant in relation to global warming. There are two major reasons of global climate change: Earth's magnetic field changes and greenhouse gases in the lower levels of Earth's atmosphere (Chen and Chen, 2016).

According to last researches, the global temperature of the Earth grew 0.5-1 °C in the last 100 years. Moreover, it is reported that the total greenhouse gas emissions in Russia are likely 404.9 million metric tons of carbon dioxide, which is the equivalent to 0.0086154 metric tons per capita (Cui et al., 2016). There is an exclusion in the regions of sub-Saharan Africa from the global trade converges with the climatic productivity of agriculture.

In the past ten years, the problem of climate change caused by antropologic activities has become the most serious amongst environmental issues. This problem is also adjacent to population growth, deforestation, globalization, economic growth, production and consumption of industrial goods (Chen et al, 2015; Cloy, 2018).

2. Literature review

The calculations of the International Commission on Climate Change show that the average global temperature by the next century will rise by 6 °C if the current trends in the use of fossil fuels and deforestation are not reversed (Denisova et al., 2019; Elzan and Hohne, 2008; 2010).

Climate change also occurs in parallel and in combination with other pressured situations affecting global health, including widespread changes like globalizaiton. Furthermore, it is expected that the global population will increase more than 30 per cent by 2050. Such pressure often has a geographic specificity. For example, in sub-Saharan Africa, the increase of population growth leads to increased demand for natural resources which, in combination with regional exclusion from the global trade, damages the climatic productivity of agriculture. There is already disproportionately high infectious disease in the region, which becomes increasingly more dangerous if it is also participants in global environmental change and other serious and related problems (Denisova, 2019; Fan et al., 2010).

A firm understanding of subject links and their differential effects, based on differential socio-economic conditions is needed to completely prepare and respond to current and short-term problems of climate change on health and societies. Moreover, it is necessary to develop and include new and effective preventive approaches of negating long-term negative health effects (Flolking et al., 2006).

A report of the Commission on Climate Change includes short-term investments in research, monitoring of climate change and health consequences, the adoption of mechanisms to facilitate intra- and intergovernmental cooperation with emphasis on the extent to which additional global environmental changes affect health outcomes. The report also discusses the processes of phasing from coal-fired power generation and transition to human and planetary cities (Gotovsky et al., 2018).

This research makes an important contribution to the body of knowledge on carbon emissions' forecasting. Furthermore, it works to complete the gap in research on the role of carbon emissions in climate change that remains a debate for previous researchers through empirical testing of mediating role aiming for no climate change in (Lopatin, 2019b; Meynkhard, 2019b; Meynkhard, 2020).

The greenhouse effect is an increase in the temperature of the earth's surface due to the heating of the lower layers of the atmosphere by the accumulation of greenhouse gases. As a result, the air temperature is greater than it should be, and this leads to such irreversible consequences as climate change and global warming (Huang et al., 2016).
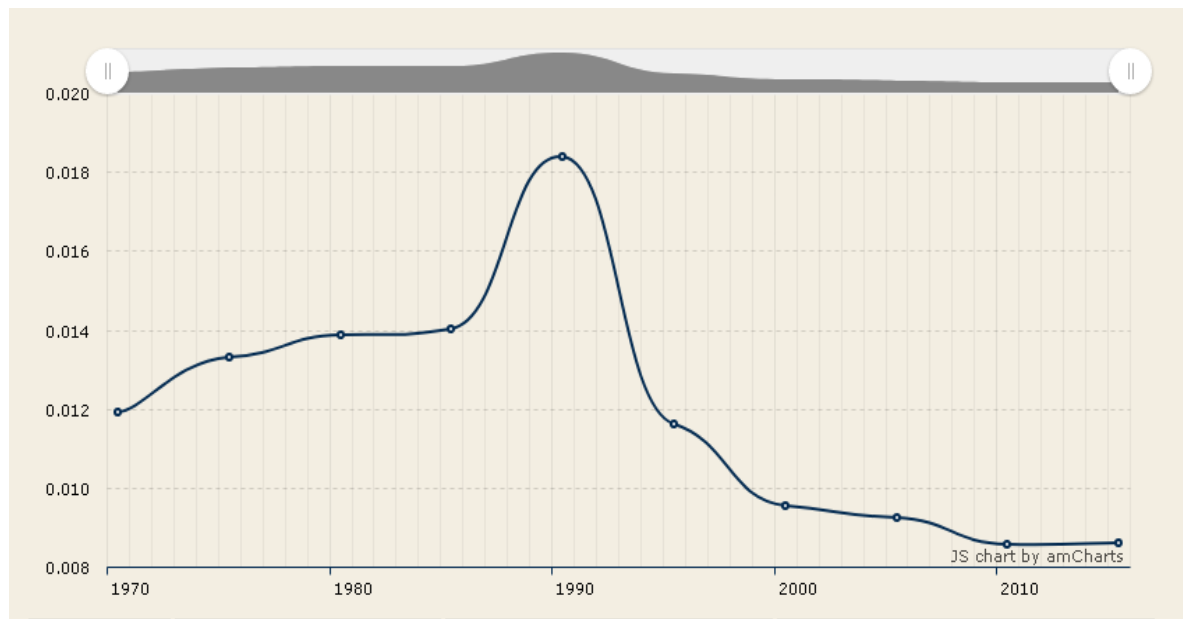
Fig. 1. Total greenhouse gas emissions (metric tons per person)
Source: European Environment Agency. https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

Discussions about the phenomenon first began in 1827. An article by Jean Baptiste Joseph Fourier "A note on the temperatures of the globe and other planets" detailed ideas about the mechanism of the greenhouse effect and the

causes of its appearance on Earth (Inamdar, 1994). The latter conducted experiments with a blackened glass vessel closed and placed under sunlight. The temperature inside the vessel was much higher than outside. This is explained by the following factor: thermal radiation can not pass through the darkened glass, and therefore remains inside the container. In this case, the sunlight boldly penetrates through the walls, since the vessel remains transparent outside (Isacs et al., 2016; Kohler et al., 2017).

Table 1. Greenhouse gas summary

Compound	Formula	Concentration in atmosphere (ppm)	Contribution (%)
Water vapor and clouds	H_2O	10–50,000[A]	36–72%
Carbon dioxide	CO_2	~400	9–26%
Methane	CH_4	~1.8	4–9%
Ozone	O_3	2–8[B]	3–7%

Source: European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

The causes of the greenhouse effect are as follows: the use of combustible minerals in industries - coal, oil, natural gas, which emits a huge amount of carbon dioxide and other harmful compounds into the atmosphere when burned; different means of transportation - cars and trucks emit exhaust fumes that also pollute the air and enhance the greenhouse effect; deforestation, which absorbs carbon dioxide and releases oxygen, and with the destruction of each tree on the planet the amount of CO2 in the air increases; forest fires are another source of plant destruction on the planet (Table 1). The increase in population affects the growing demand for food, clothing, housing. Correspondingly, on order to comply with this demand industrial production is growing, which is increasingly polluting the air with greenhouse gases; agro chemistry and fertilizers contain a different number of compounds, the evaporation of which releases nitrogen - one of the greenhouse gases; decomposition and burning of garbage at landfills contributes to the increase of greenhouse gases (Levin, 2012; Li, 2017; Lisin, 2020).

3. Materials and methods

In Northern Europe, especially in the Baltic region, the amount of surface and channel flow may increase exponentially (Lopatin, 2019a; Meynkhard, 2019a).
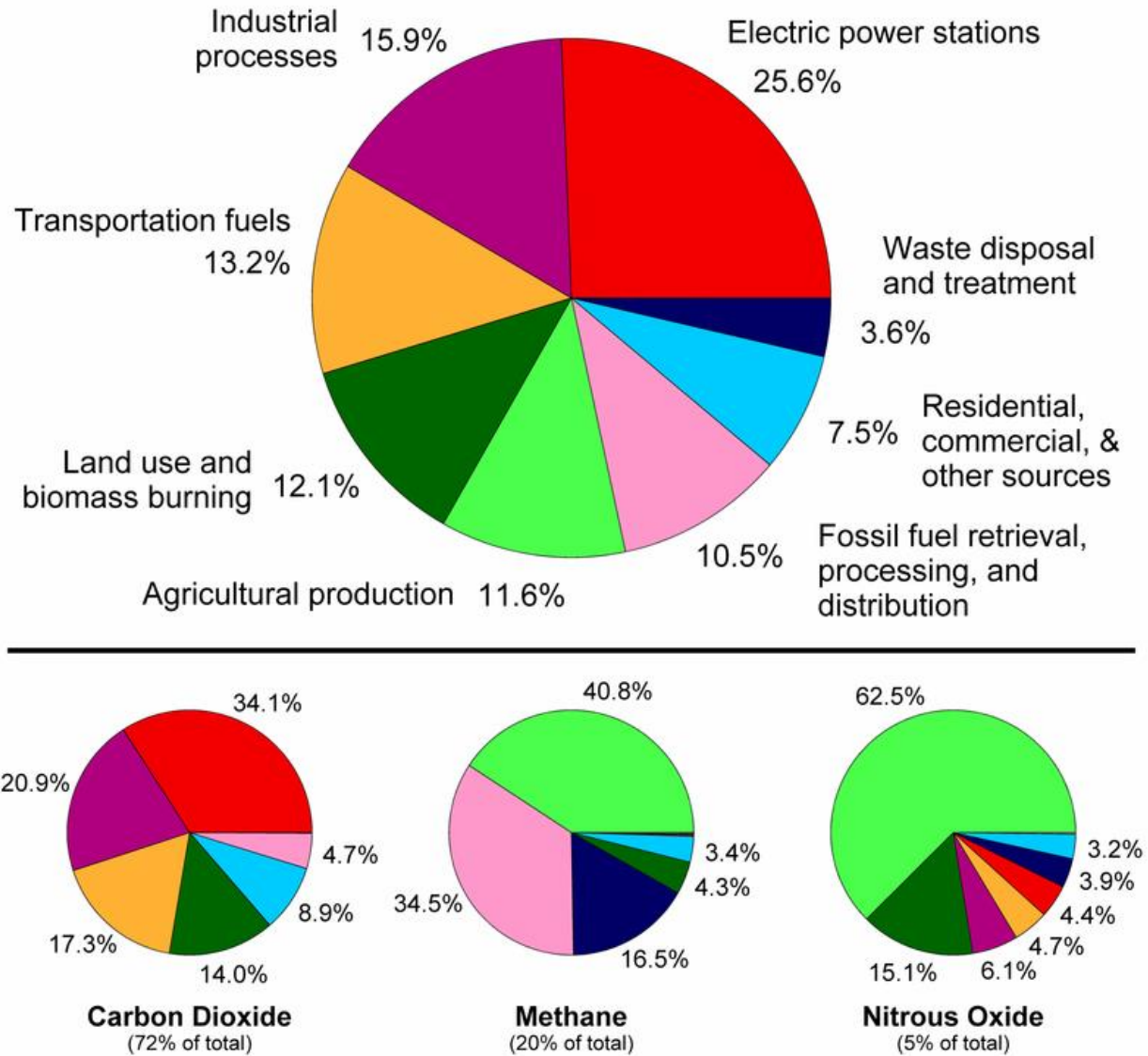
Fig. 2. Greenhouse Gas Emissions by Sector.
Source: European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

This will be caused by changes in nitrogen concentration (Fig. 1, 2). The underlying results of this process will be pollution and arising problems in varios ecosystems (Mikhaylov, 2018; Magazzino, 2016). Global temperature growth will cause the decrease of the share of minearals in legumes or the increase of the number of available chemical elements. The rate of mineralization can change the release of nitrogen.

A method of energy balance: this mode is mainly based on the energy balance model established under the law of conservation of energy. The energy balance equation is Equation 1:

$$C \, dT/dt = Rad\downarrow - Rad\uparrow \qquad\qquad (1)$$

where C is the thermal inertia of land, ocean and the atmosphere, Rad↓ is the incoming radiation, Rad↑ is the outgoing radiation.

Equation 1 can be converted into Equation 2:

$$C \, dT/dt = Q \, (1-\alpha) - \Delta I - E(F) \tag{2}$$

where Q is the solar radiation, α is the reflectivity, ΔI is the outgoing long-wave radiation, $E(F)$ is the net energy flux along the circle of latitude.

The atmospheric CO_2 equilibrium equation is as follows:

$$dT/dt = P_{fos} + P_{bio} + K_{ma}(N_m + \xi_{nm}) + K_{am}(N_a - n_a) + F_{bi,a} + F_{a,bi} + F_{h,a} \tag{3}$$

where P_{fos} is the CO_2 release rate of fossil fuels, P_{bio} is the rate of CO_2 release due to land use change, K_{ma} is the ocean atmosphere exchange coefficient, K_{am} is the atmosphere ocean exchange coefficient, N_m is the total amount carbon in the ocean, N_a is the total carbon in the atmosphere, n_a is the atmospheric carbon increment, ξ_{nm} is the ocean buffer factor, $F_{bi,a}$ is the CO_2 exchange flux from land to the atmosphere, $F_{a,bi}$ is the CO_2 exchange flux from the atmosphere to land, $F_{h,a}$ is the CO_2 exchange flux from soil humus to the atmosphere.

Climate change will cause efficiency in agriculture and forestry to fall. The impact of economic growth on the environment is observable. Moreover, it is likely to lead to a change in the model of precipitation (Marino et al., 2017; Meinshausen et al., 2009).

Russia ratified the Paris agreement on combating global climate change, which replaced the Kyoto Protocol. Countries participating in the Paris Agreement should prevent increasing the average global temperature by more than 2 degrees Celsius (Ogle et al., 2018; Perry et al., 2012).

4. Results

Russia has been a participant of the world climate agreements for many years: the Kyoto Protocol and the Paris Agreement. For Russia, the issue of climate change is very important. This is a chance for us to build an economy on new foundations: on energy efficiency, a low-carbon economy is a chance to move to a new level of development (Pugh et al., 2016; Shao et al., 2016).
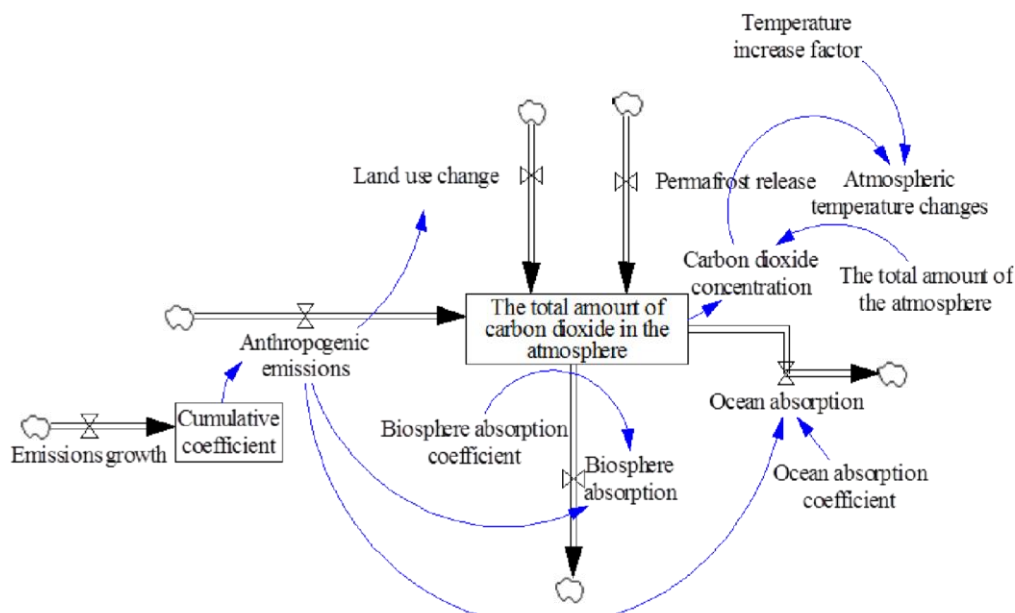
Fig. 3. Greenhouse Gas Emissions Scheme.
Source: author

The Paris Protocol poses several major challenges for all countries to achieve the goal. These goals are the end of the fossil fuels era, the development of low-carbon technologies and the adaptation of countries to climate change. Total emissions in 2017 were 2.2 times lower than in 1990 and decreased from 853 to 393 million tonnes of carbon equivalent.

From 1990 to 2017, carbon dioxide emissions decreased by 2.2 times (from 643 to 297 million tonnes of carbon equivalent), methane decreased by 2 times (from 151 to 73 million tonnes of carbon equivalent), nitrous oxide emissions dropped by 2.5 times (from 59 to 24 million tons of carbon equivalent).

The largest share of total greenhouse gas emissions in 1990 was carbon dioxide - about 75 percent. Methane emissions in 1990 were about 18 percent, and nitrous oxide were 7 percent of total emissions. This distribution practically did not change by 2017: carbon dioxide emissions accounted for 76 percent, methane for 18 percent, and nitrogen for 9 percent (Shi and Guo, 1997).

The greatest contribution to total greenhouse gas emissions comes from the extraction, production and consumption of energy resources; from 1990 to 2007 it fluctuated between 76 and 86 percent. The reduction in energy emissions from 1990 to 2007 was one of the most significant among all industries and amounted to 54 per cent. In 1990, net greenhouse gas absorption by forests was 73 million tonnes, and by 2007 it had been reduced to 44 million tonnes of carbon equivalent. The Russian government adopted the Energy Policy untill 2035 in the Sphere of Climate Change. This document is at the state level, which aims to limit the amount of CO2 emissions. Under the agreement with the EU, the country should also introduce an internal system for trade in greenhouse emissions. Russia needs to develop a quota allocation plan and introduce permits for greenhouse gas emissions in order to achieve this (Fig. 3, 4).

But before quotas can be earned, it is necessary to collect accurate data on the amount of CO2 is being emitted by industrial enterprises. For industrial regions, it is a good opportunity to improve the ecological situation and attract environmental investments. Industrial enterprises must decide on the means of reducing emissions (Sikharulidze et al., 2016; Stark et al., 2018).
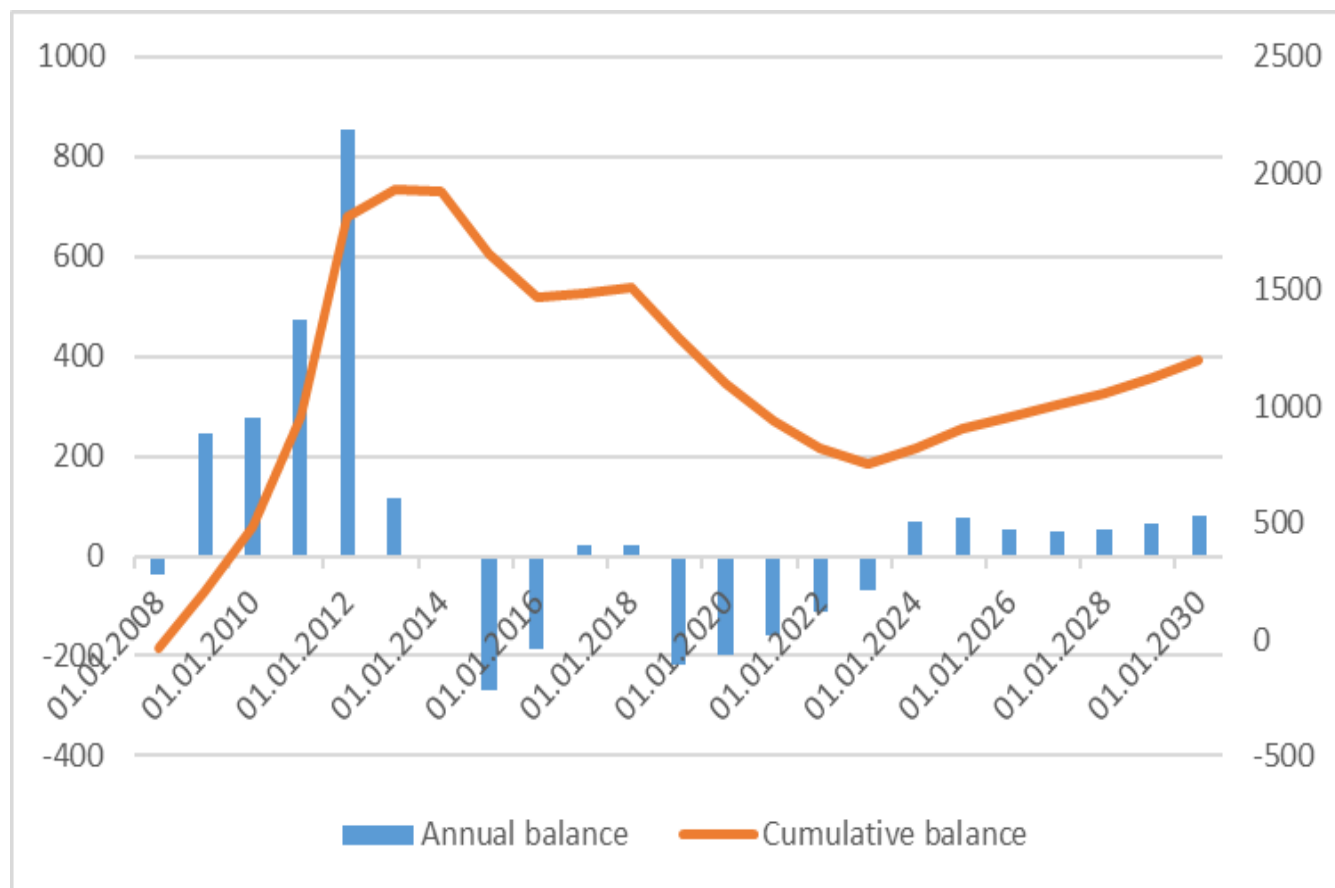
Fig. 4. Greenhouse Gas Emissions Balance Forecast.
Source: European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

First, Russia will create a monitoring system for verification of emissions reporting. Then the Russian Federation will develop and begin to execute a plan of distributing quotas among six sectors of the economy. The quotas themselves are most likely to be paid. Having received a certain quota, the enterprise can implement measures aimed at reducing greenhouse gas emissions and selling surplus quota to another enterprise that lacks its own (Van den Berrgh and Botzen, 2015).

Furthermore, on a global scale, a World Bank program is now introducing pilot projects in six sectors of the economy in order to develop reporting templates for greenhouse gas emissions (Xu and Shang, 2016).

The quota system itself will force enterprises to either buy quotas or implement measures that will reduce emissions. This will make it possible to obtain quotas based on reliable data. The basis of the PMR project is to develop a monitoring and verification system for reporting data on such indicators as emissions, so that the developed scheme is the basis of the legislation. Rosneft is a company that represents the energy sector and is one of the largest emitters of greenhouse gas. Therefore our participation in the project is very important. And, of course, we are preparing for the introduction of an internal emission trading scheme in Russia. In the end result, this will lead to the implementation of measures aimed at reducing the burden on the environment.

The goal of this system is to reduce greenhouse gas emissions, as well as stimulate economic modernization. In the world about 20 per cent of CO_2 emissions are given by machines with an internal combustion engine. At the

same time, the number of machines in the world is growing. At the current pace there will be about 1 billion cars in the world until 2030, and well over a billion in 2050 (Tu, 2015; Zhang et al., 2018).

The Ministry of Infrastructure offers to release the following volumes of imported electric vehicles until 2021: vehicles from VAT - 16.8 per cent, collection to the Pension Fund - 4.8 per cent and excise duty - 109 euros. In addition, the government wants to make a tax rebate to car dealers on the income tax and reimburse part of the cost to the car buyer. The government wants to to cancel VAT and introduce a preferential land tax rate until 2028 for domestic manufacturers of electric vehicles, furthermore, collections to the Pension Fund will be canceled only until 2021. They also plan to cancel the import duty for electric cars' components and establish a delay from the paying of VAT for six months.

The nature of this phenomenon is explained by the different transparency of the atmosphere for radiation from space and from the surface of the planet. For the sun's rays, the atmosphere of the planet is transparent, like glass, and therefore they easily penetrate it. And for thermal radiation, the lower layers of the atmosphere are "impenetrable", too dense for passage. That is why some of the thermal radiation remains in the atmosphere, gradually sinking to the lowest layers of it. At the same time, the amount of greenhouse gases that condense the atmosphere is growing. Even at school we were taught that the main cause of the greenhouse effect is human activity. Evolution led us to industrialization, so we burn tons of coal, oil and gas, get fuel, fill roads with cars. The consequence of this is the release of greenhouse gases and substances into the atmosphere. Among them - water vapor, methane, carbon dioxide, nitrogen oxide.

When we talk about the consequences of the greenhouse effect, we understand its influence on the Earth's climate. First of all, it is global warming. Many identify the concepts of "greenhouse effect" and "global warming", but they are not equal, but are interrelated: the first is the cause of the second. Global warming is directly related to the world's oceans. Here is an example of the two cause-effect relationship.

The average temperature of the planet grows; liquid begins to evaporate. This applies to the oceans: some scientists are afraid that in a couple of hundred years, they will begin to "dry out." At the same time, because of the high temperature, glaciers and sea ice will begin to melt actively in the near future. This will lead to an inevitable increase in the level of the World Ocean. We already observe regular floods in the coastal areas, but if the level of the World Ocean increases substantially, all the approximate parts of the land will be flooded, our harvest will die.

Greenhouse gases are steam (from water), carbon dioxide (carbon dioxide), methane, ozone. The prior is the main contributor to the formation of the greenhouse effect (up to 72 per cent). The next most important is carbon dioxide (9-26 per cent), methane and ozone share 4-9 and 3-7 per cent, respectively.

Recently, you can often hear about the greenhouse effect as a serious environmental problem. But this phenomenon has a positive side. Due to the fact that the greenhouse effect exists, the average temperature of our planet is about 15 degrees above zero. Without it, life on Earth would be impossible. The temperature could only be minus 18.

The reason for the appearance of the effect is the activity of many volcanoes on the planet millions of years ago. At the same time, the concentration of water vapor and carbon dioxide in the atmosphere significantly increased. The concentration of the latter reached such a value that a super-strong greenhouse effect appeared. As a result, the water of the World Ocean almost boiled, its temperature became too high.

The appearance of vegetation everywhere on the surface of the Earth caused a fairly rapid absorption of carbon dioxide. The accumulation of heat has decreased. Equilibrium was established. The average annual temperature on the surface of the planet turned out to be close to the present (Table 2).

Table 2. The contribution of atmospheric components to the greenhouse effect for various numerical models of the general circulation of the atmosphere.

| Source	BA	Cloudiness	BA+Cloudiness	CO_2	Rest greenhouse gases
Schmidt	39,0–61,9	14,5–36,3	66,9–80,9	14,0–24,3	4,9–9,2
The NASA model	36–66	16	66–85	9–26	2–8
The average value	37,5–64,0 (~50)	15,3–36,3 (~25)	66,5–83,0 (~75)	11,5–25,2 (~20)	3,5–8,6 (~5)

Source: author

Water vapor is not taken into account as a climatic factor. Direct emissions of water vapor from anthropogenic activities create prenegligibly small contribution to the radiation forcing.
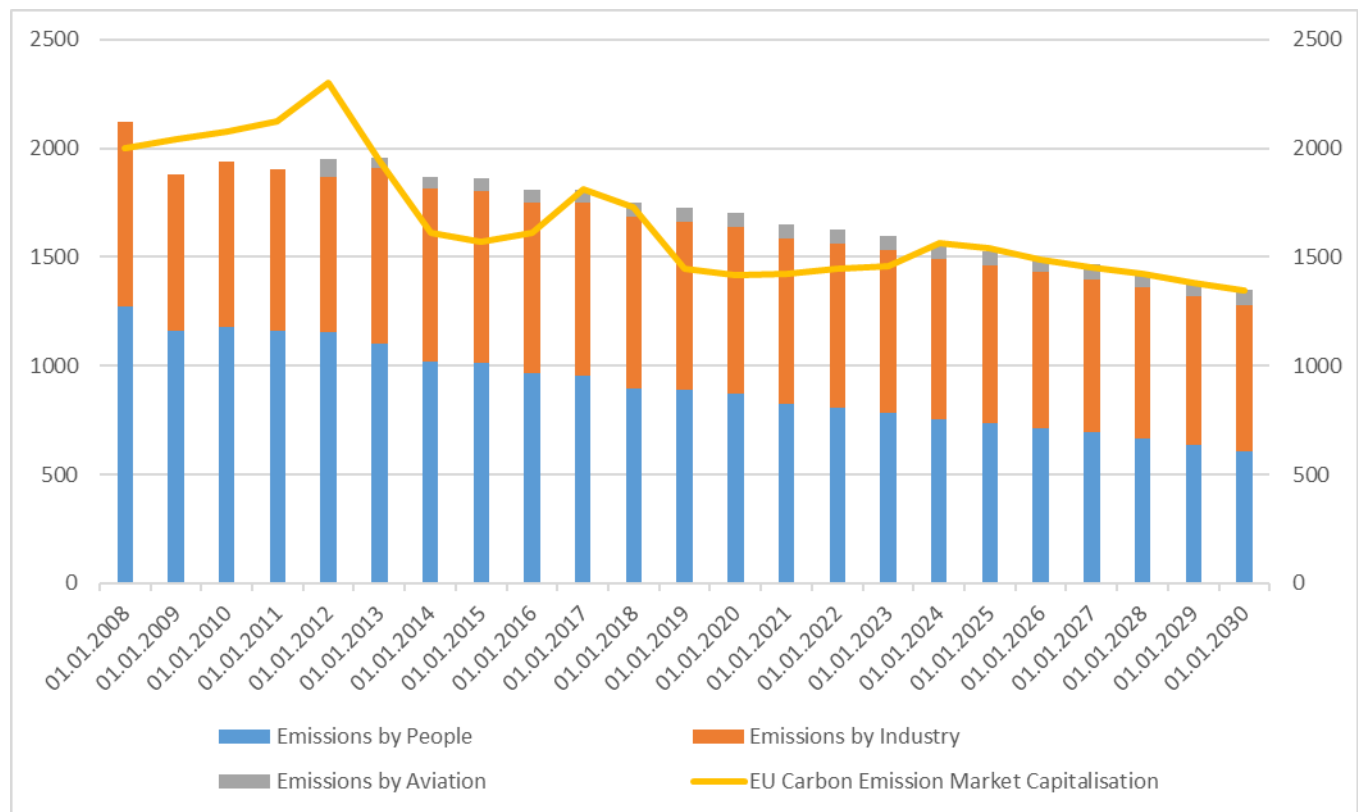
Fig. 5. Greenhouse Gas Emission Forecast by People and Industry.
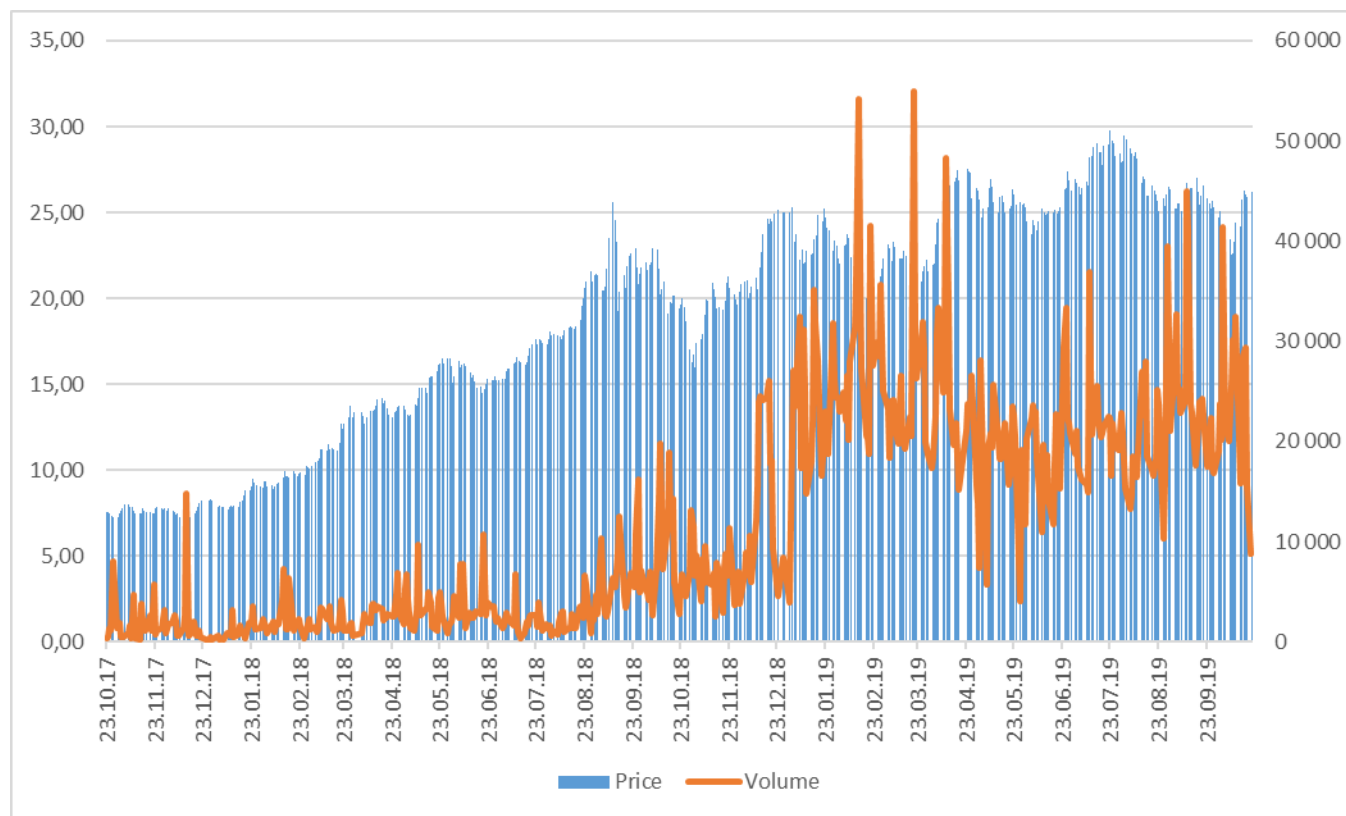*Source:* European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6c
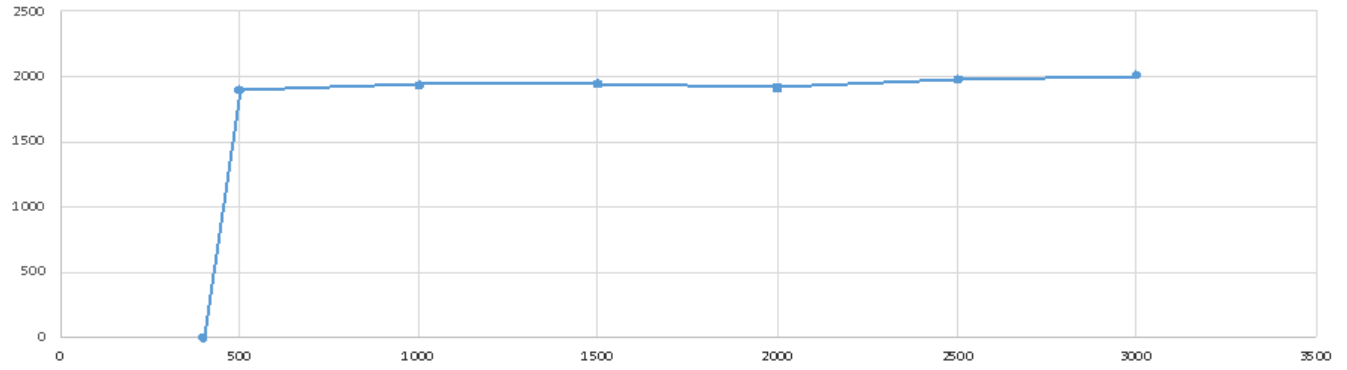
Fig. 6. Greenhouse Gas Emissions by Sector.
Source: European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

Since water vapor content is directly dependent on evaporation, then, in fact, the trend of irretrievable water consumption can be considered as part of the trend of atmospheric moisture content. In the 20th century it was 0.013 mm / year. If we take into account that the area of the globe is 510 million km^2, then the trend in the water use will be 39 km^3 year / 510 000 000 km^2 = 0.0764 mm / year (Fig. 5, 6).

Fig. 7. European Union Allowance (EUA) price history.
Source: European Environment Agency https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-6

The consequences of the greenhouse effect can be harmful to humans: the melting of polar ice is the cause of rise in sea levels. As a result, coastal fertile lands are under water. If flooding occurs at high rates, there will be a serious threat to agriculture. The crops sink, the area of pastures is reduced, sources of fresh water disappear. First of all, the low-income strata of the population will suffer, whose life depends on their harvest, growth of domestic animals. Many coastal cities, including highly developed ones, may be under water in the future. For example, New York, St. Petersburg. Or whole countries. For example, the Netherlands. Such phenomena will cause the need for a massive displacement of human settlements. Scientists suggest that in 15 years the ocean level can rise by 0.1-0.3 meters, and by the end of the 21st century - by 0.3-1 meter. To completely flood the above-mentioned cities under water, the level should rise by about 5 meters.

The increase in temperature of air leads to the fact that within the continents the period of snow presence is reduced. It begins to melt earlier, as soon as the rainy season ends. As a result, the soil is over-dried, unsuitable for growing crops. Lack of moisture is the cause of desertification of land. Experts argue that an average temperature increase of 1 degree in 10 years will lead to a reduction of forest areas by 100-200 million hectares. These lands will become steppes. The ocean covers 71 per cent of the surface area of our planet. As the air temperature rises, water also heats up. Evaporation increases significantly. And this is one of the main reasons for strengthening the greenhouse effect.

If the water level in the world ocean rises, temperature threatens biodiversity, many species of wildlife can disappear. The reason is the changes in their habitat. Not every species can successfully adapt to new conditions.

The consequence of the disappearance of certain plants, animals, birds, other living things is the direct violation of food chains, the equilibrium of ecosystems.

The rise in water levels causes climate change. The boundaries of seasons are shifting, the number and intensity of storms, hurricanes, and precipitation increases. Stability of climate is the main condition for the existence of life on Earth. The stop in the greenhouse effect saves human civilization on the planet.
High air temperature can adversely affect people's health. Under such conditions, cardiovascular diseases worsen, respiratory organs suffer. Thermal anomalies lead to an increase in the number of injuries, the development of some psychological disorders. The rise in temperature entails a more rapid spread of many dangerous diseases, for example, malaria, encephalitis.

5. Discussion

Today, the problem of the greenhouse effect is a global ecological issue. Experts believe that the widespread adoption of the following measures will help solve the problem: changes in the use of energy sources. Reduction in the proportion and quantity of fossil fuels (containing carbon peat, coal) and oil. The transition to natural gas will significantly reduce CO2 emissions. An increase in the share of alternative energy sources (sun, wind, water) will reduce emissions, because these methods allow to receive energy without troubling the environment. When using them, harmful gases are not released. Change in energy policy. An increase in efficiency at power plants. Reduction of products' energy intensity at enterprises. Introduction of energy-saving technologies. Even the usual warming of houses' facades, window openings, heating plants give a significant result, decreasing the amount of emissions. Solving the problem at the enterprisal, industrial, state levels entails a global improvement of the situation. Everyone can contribute to solving this problem: energy saving, proper disposal of garbage, warming up their own home: development of technologies aimed at obtaining products in new, environmentally friendly ways; use of secondary resources, which is also one of the measures to reduce waste, the number and volume of landfills; restoration of forests, fighting fires in them, increasing the area as a way to reduce the concentration of carbon dioxide in the atmosphere.

Today, the fight against greenhouse gas emissions is at the international level. World summits devoted to this problem are being held, documents are being created aimed at organizing a global solution to the problem. Many scientists of the world are engaged in finding ways to reduce the greenhouse effect, maintaining balance and life on Earth.
It is desirable to invent ways to combat the greenhouse effect. For example, in the United Kingdom and the United States, groups of scientists have already created a device of active molecules that decompose greenhouse gases, and then turn them into useful aerosols. In those years there was not enough technically developed equipment that would allocate these molecules in a free form.

The results of this study support previous research conducted by (Marino et al., 2017; Meinshausen et al., 2009) which finds that carbon emissions and climate change is determined by utilization of networks as a source of opportunities and utilization of resources and their networks to provide service and respond to customers for change towards sustainability. Another research paper was supported in this study, stating that company's uniqueness through product creation may improve product success in customers' market through creation of climate change friendly products (Tu, 2015; Zhang et al., 2018).

This study also supports previous findings that product success in carbon emissions is influenced by company policy (Shi and Guo, 1997). In line with this discovery (Xu and Shang, 2016) carbon emission productivity in achieving performance through response to increasingly dynamic environment.

6. Conclusion

Moreover, climate change is believed, by some researchers, to be company's new long-term breakthrough while maintaining competitive advantage and environmental sustainability (Isacs et al., 2016; Kohler et al., 2017). To enhance reputation and access to customers and wide and broad new markets, climate change is developed in corporate strategy, particularly by adopting greenhouse emissions friendly technology (Van den Berrgh and Botzen, 2015).

Although the carbon emessions study remains a debate among previous researchers, this issue is an interesting study in this article, where we develop and order to fill this gap of carbon emissions and climate change. This study proposes two forecasting models for greenhouse gas emissions balance forecast and greenhouse gas emission forecast until 2030 by industry to be a solution to the aforementioned research gap. This research also develops an empirical research model to further discuss their relationship.

7. Contribution to the Body of knowledge

This paper summarizes the literature review on carbon emissions and climate change into a new implication research. The empirical research shows the effect of carbon emissions on climate change. Therefore, this study suggests that an organization should allocate less carbon emissions into air in the next 10 years. This research makes at least three important contributions to the body of knowledge. The first contribution is the method of energy balance, particularly with regard to long term forecasts. The second contribution is achieved through empirical testing, determining a mediating role to prove that human and industrial carbon emissions fill the gap about emissions' role in climate change which remains a debate to previous researchers. The third one is that the paper found the trends in Greenhouse Gas Emission Forecast until 2030 by industry, people and aviation sector.

This research has limitations. The first one is the use of the method of energy balance. Another method can lead to different results. The second limitation is the source of data (European Environment Agency).

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