Carbon Footprint: Ways to Fight the State and Companies

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Keywords: Carbon footprint, consumption, environment, planet.

Abstract: Modern people are used to living on the machine. When everything is so accessible, it seems that it will always be so. But this is just an illusion that pushes overflowing grocery carts with us, buys another dress, or rushes to get a new generation smartphone. As a result of overconsumption, huge amounts of carbon dioxide and methane enter the atmosphere every day, which lead to serious climate changes. Each of us leaves his mark on the planet, but today this common phrase takes on a new meaning. This article will discuss the concept of the carbon footprint, its impact on our planet and international experience in reducing it.

1 INTRODUCTION

Reduction of human impact on the environment is one of the priorities of Russia's scientific and technological development strategies. The Carbon project is an important part of it. It involves the creation of an environmental control system using remote measurement of the carbon balance. For this purpose, a carbon test site called "WAY CARBON" was built in the Chechen Republic (Chugunkova, 2018).

The carbon polygon is a special territory where the development and testing of technologies that are related to global warming are carried out. This is a measurement of the flow of climate-active gases. In addition to CO2, there is also methane, nitrous oxide and many other gases. Now we have a new era. The economy is transforming into a green area, we need low-carbon technologies that would help reduce greenhouse gas emissions, and we need special climate projects to absorb these same greenhouse gases from the atmosphere.

Landfills are special places, this is a special ecosystem where this processing will be, measurement of greenhouse gases, both in terms of emissions and absorption (Durmanov, 2022).

2 MANUSCRIPT PREPARATION

In Russia, cross-border work on the study of greenhouse gases, especially in forest systems, has been carried out for a long time, but a little bit fragmented. And in the world it is such a tangible scientific trend. Because in the coming years, these very measurements of greenhouse gases will be the basis of the economy: carbon taxes, special penalties that will be paid by those whose products are too energy-intensive, which leaves too much an environmental footprint. All this requires measurements of these same carbon footprints (Porfiriev, 2010).

It is assumed that this project will always be relevant, since in addition to technologies that can be quickly developed or quickly tested and seen in one season, experimental sites were laid, the results of which can be seen in 5-10 years. Here we are talking about the global problem of the 21st century, about climate change. And so the researchers expect that there will be more than a dozen polygons and around each polygon there will be trial experimental sites. And in general, we will be able to get the necessary amount of information in order to train our machines.

The topic of carbon balance, the topic of the low-carbon economy is gigantic. People of various professions are involved in it: botanists, soil scientists, foresters, biologists, specialists in genetics, biochemistry, climatologists. And lately, more and more of the work is done by IT people, these are people who specialize in super-large amounts of data,

Gubasheva, K. and Bolotbaev, B.
Carbon Footprint: Ways to Fight the State and Companies.
DOI: 10.5220/0011570400003524
In *Proceedings of the 1st International Conference on Methods, Models, Technologies for Sustainable Development (MMTGE 2022) - Agroclimatic Projects and Carbon Neutrality*, pages 282-287
ISBN: 978-989-758-608-8

machine learning, and work with neural networks. According to our American colleagues, about 90% of the work is IT.

Polygons should not be limited to research work, they must be educational institutions. This means that there will be special workshops, seminars, special areas where students, graduate students, and researchers of various qualifications will be able to work. After all, we are talking about the fact that we will need, perhaps, hundreds of thousands of new jobs, on the horizon of 5-7 years, in order for us to manage this new green ecological economy.

It is assumed that the entire territory of the country will be covered with polygons and test experimental areas with different densities, depending on what conditions are there, whether there is agriculture there or only forests, what kind of ecosystems are there. But the first polygons that are already being opened in the country have a very interesting biography, and as a result of the work done, it is planned to place them so that the network of these polygons being laid down would cover the most interesting places in our country in a shorter time from the point of view of climate research.

Over the past decade, there has been an increase in the temperature in the environment, all of which is associated with an increasing amount of carbon dioxide released. As we already know, the reason for this is many industries that emit carbon dioxide in the course of their activities, which results in environmental pollution.

3 RESULTS AND DISCUSSION

Reducing carbon emissions can be achieved by moving towards energy sources and industrial processes that produce fewer greenhouse gases, thereby moving towards a low-carbon economy. The shift to renewable energy sources such as wind power, geothermal power and solar power, as well as nuclear power, reduces greenhouse gas emissions. While the production of both renewable and non-renewable energy results in some form of carbon emissions, renewable sources produce little or almost no carbon emissions. The transition to a low-carbon economy would also mean making changes to current industrial and agricultural processes to reduce carbon emissions, such as changing the diet of livestock, such as cattle, could potentially reduce methane production by 40%. Carbon projects and emissions trading are often used to reduce carbon emissions, and it is sometimes even possible to prevent carbon dioxide from entering the atmosphere entirely (for example, through carbon cleanup) (Pinyavina, 2021).

One way to introduce carbon neutral products is to make these products cheaper and more profitable than carbon positive fuels. Various companies have pledged to become carbon neutral or negative by 2050, including: Microsoft, Delta Air Lines, BP, IKEA, and BlackRock. However, without cheaper carbon-neutral products, companies are less likely to switch to renewables.

Carbon neutrality means that there is a balance between the release of carbon and the absorption of carbon from the atmosphere in carbon sinks. The removal of carbon monoxide from the atmosphere and its subsequent storage is known as carbon sequestration. To achieve zero emissions, all of the world's greenhouse gas (GHG) emissions must be balanced by carbon sequestration.

A carbon sink is any system that takes in more carbon than it releases. The main natural carbon sinks are soil, forests and oceans. Natural sinks are estimated to remove 9.5 to 11 Gt of CO2 per year. Annual global CO2 emissions reached 38.0 Gt in 2020.

To date, no artificial carbon sinks have been able to remove carbon from the atmosphere on the scale needed to combat global warming.

Carbon stored in natural sinks such as forests is released into the atmosphere through wildfires, land-use change or logging. This is why it is so important to reduce carbon emissions in order to achieve climate neutrality (Durmanov, 2022).

Forests are natural CO2 sinks. But, firstly, this happens until a certain age of the trees. Old trees, on the contrary, strive to emit CO2. Under natural conditions, the forest as a complex ecosystem is in balance: how much it absorbs, the same amount it gives. Absorbing capacity is possessed by growing, young forests or forests planted on the site of clearings.

Thus, it is new forest plantations that are important for more efficient absorption of greenhouse gases. This is a long process - 5–7 years before the appearance of growth, which can be considered as absorbing CO2 from the atmosphere.

However, existing forests should not be left without protection. In addition to ethical, there are also climatic reasons. Indeed, in the event of forest fires, all the accumulated carbon will again be in the atmosphere.

Forest is a difficult category to account for. For example, you rented a forest that was previously considered a reserve, and there was no supervision over it, and dug a moat around it, installed sensors to

protect it from possible fires. If a year after you rented it and there were no fires, would this mean that you made additional CO2 absorption or emission reductions?

It's not clear if there was a fire if you hadn't done anything. That is, we can draw conclusions only over long intervals and very probabilistically. By the way, it is precisely because of the high uncertainty and volatility that the EU does not count absorption by forests against greenhouse gas emissions. That is, if your company is included in the number of regulated companies, it is impossible to compensate for emissions by absorption in forests.

Thus, not all forest projects will automatically be equated with climate projects. Just fence off a piece of forest and say that everything that has grown there is a carbon absorption, and you won't be able to sell it. If a company is going to reduce its carbon footprint in this way, then it needs to deal not only with protection, but also with planting forests.

However, the forest theme still requires further study. It is possible that the absorbing capacity of green massifs is greater than we expect.

The absorption coefficients that we have now were calculated in other climatic conditions. It is possible that now trees can absorb more CO2, because its concentration in the atmosphere has increased.

A high share of nuclear energy, large forest areas, due to the closure of many industrial enterprises after the collapse of the USSR, greenhouse gas emissions into the atmosphere also decreased. However, our country also found its Achilles heel. It's about methane. It has already been said above that CO2 is considered to be the main culprit in global warming.

But at the same time, they forget about methane, and yet it has a 25–30 times stronger greenhouse effect. True, it is necessary to take into account the classification of greenhouse gases into short-lived and long-lived. And methane lives in the atmosphere for 12.5 years, while carbon dioxide lives for centuries and even millennia.

That is why greenhouse emissions are measured more often not in tons, but in conventional units of CO2 equivalent, for which such a criterion as the global warming potential is used. It reflects the relative increase in atmospheric radiation caused by an increase in the atmospheric content of a given greenhouse gas by 1 ton compared to one ton of CO2 over time.

Usually it is 100 years, it is on this interval that methane exceeds CO2 by 25 times. If we take a shorter period of time, then the difference can grow up to 85 times. The methane topic is directly related to the oil and gas industry. One such example was given by Mikhail Yulkin. We are talking about satellite images, which show that the pipe belonging to Gazprom is "floating".

From this, a conclusion was drawn about the anthropogenic nature of methane leakage into the atmosphere. However, representatives of domestic mining companies do not consider this method to be correct, and the release of methane into the atmosphere is associated with the thawing of permafrost.

The situation is made even more confusing by the fact that when assessing methane leakage, a calculation method is used, rather than direct observations, when leaks are not measured, but are actually "assigned" based on the methodology.

But in this case, this, as well as shooting from satellites, is not the best solution, the general director of CarbonLab LLC believes. Priority should be given to point observations, especially since there is now equipment on the market that allows you to detect leaks remotely. In this case, it will be possible to determine with great certainty the origin of methane in the atmosphere.

Indeed, a large amount of methane is emitted in a "natural" way, due to the melting of permafrost. But the quotation marks here are not accidental; in the final analysis, the main reason is also related to human activity. However, there is an important caveat here, it no longer falls on the "carbon balance" of a company that is engaged in mining in a particular area.

In general, the issue of reducing methane emissions at the international level was first raised so seriously at the conference in Glasgow. It was decided to reduce methane emissions by 30% by 2030, which will reduce the temperature rise on the planet by 0.2 degrees by 2050. This document was signed by representatives of more than 100 countries, Russia is not among them.

Another way to reduce emissions and achieve carbon neutrality is to offset the emissions produced in one sector by reducing them in another. This can be achieved through investments in renewable energy, energy efficiency, or other low-carbon clean technologies. The EU Emissions Trading System (ETS) is an example of a carbon offset system.

Another example of an initiative to reduce emissions is the carbon frontier adjustment mechanism, which will apply carbon prices to imported goods from countries that are less climate ambitious. This should prevent companies from moving production out of the EU to countries with less stringent greenhouse gas emissions regulations.

The Commission is due to propose this carbon levy in 2021.

One of the first in the list of CO2 emissions for 2020 are such countries as China, USA, India, Russia, Japan, etc.

List of countries by CO2 emissions in megatons for 2020:

- China – 9899.3;
- USA – 4457.2;
- India – 2302.3;
- Russia – 1482.2;
- Japan – 1027.0;
- Iran – 678.2;
- Germany –604.9;
- Republic of Korea – 577.8;
- Saudi Arabia –570.8;
- Indonesia –545.4.

The presented list does not end with these countries, it is much longer, according to the indicators, you can see the dynamics in a positive direction, that emissions in 2020 are already significantly lower than in 2018 for many of the listed countries.

The process of assessing the carbon footprint is based on a product life cycle analysis and, in accordance with the international standards of the ISO 14040 series, includes four stages.

Step I. The goals and scope of the product carbon footprint analysis should be formulated. The purpose of the assessment is to quantify the impact that a particular product (good, service, activity) has on global warming by taking into account the amount of significant emissions of all greenhouse gases throughout the life cycle of the product. Depending on the strategic objectives of the company and the expectations of stakeholders, a specific goal statement can be chosen. For example, informing the buyer about the carbon neutrality of products or about their compliance with a certain environmental category in terms of the size of the carbon footprint established by the state, regional or industry climate program. The scope of the carbon footprint assessment includes (Smirnova, 2012.):

- defining the boundary of the product system, including the physical boundaries within which the product life cycle is carried out, the stages and processes within the life cycle selected for the assessment of the carbon footprint;
- selection of a functional unit - the final quantitative measure of a product or process, to which the volume of greenhouse gas emissions is reduced;
- determination of requirements for the composition and quality of data, including a list of greenhouse gases to be taken into account, measurement error, external sources;
- determination of the period of time during which the product system does not undergo significant changes that affect the quantitative assessment of the carbon footprint;
- choice of calculation methodology;
- decision to include specific emissions/removals of greenhouse gases, for example, due to changes in land use, forest management and agricultural land management;
- the content of the report and other final documents on the quantitative assessment of the carbon footprint of products.

Stage II. The main step in assessing the carbon footprint of products is the inventory analysis of the life cycle. It identifies processes at each stage of the life cycle that generate significant greenhouse gas emissions. For each process, inputs and outputs of materials, fuels and energy are analyzed and emissions are calculated. This step collects emission data from the supply chain (mining, transportation and pre-treatment of raw materials, energy production) and downstream stages of the product life cycle (use, disposal, final waste disposal). At the same time, companies use external information that can be obtained under contracts with suppliers or collected through analytical research.

Stage III. The carbon footprint is quantified throughout the entire life cycle. Greenhouse gas emissions data are expressed in common units, which are traditionally tons of CO2e, and are adjusted to the functional unit of the product system.

Stage IV. Interpreting the results is the final step in quantifying your carbon footprint. In accordance with the goals and objectives of the study, conclusions are formulated. In particular, conclusions can be drawn regarding (Porfiriev, 2019):

- compliance of the carbon footprint with industry norms, benchmarks and/or certain environmental categories;
- the effectiveness of the fulfillment of quantitative obligations in the field of reducing greenhouse gas emissions;
- meeting stakeholder expectations.

Many companies have already begun to compare their CO2 emissions per unit of output with other businesses, and if they are smaller, use this information as a competitive advantage. If this is not the case, in the coming years they will have to look for ways to reduce greenhouse gas emissions - to increase energy efficiency, use "green" types of energy, and finance compensatory measures.

In the latter case, it is assumed that the "surplus" of CO2 emissions can be entrusted to forest ecosystems, which will absorb it from the atmosphere and turn it into wood as a result of photosynthesis. This carbon will no longer contribute to global climate change, but rather help trees grow. But in order for this option to work, the area of forests must increase, they must be taken care of and protected, because any forest fire in a few days can destroy all the competitive advantages of the goods of a large company.

If greenhouse gas emissions are very high, a company may ask another company or even the government, which is better at managing forests, to help get rid of the excess. Of course, you will have to pay for this, and such a system is called greenhouse gas trading.

Even the clothes we wear, which the workers made in a factory powered by electricity from burning the same minerals (coal, gas or oil), but there is a very small chance that these factories are powered by clean energy from a hydroelectric or nuclear power plant , and every year this probability increases. For heating and lighting your home, coal or gas is also burned somewhere. Even the garbage you throw away almost certainly ends up in a landfill where methane is produced, or is burned to form carbon dioxide as well. Everything that is emitted by our consumption remains in the atmosphere, forming our carbon footprint. The carbon footprint itself is the amount of CO2 equivalent (methane, nitrous oxide and other greenhouse gases, which are also converted into carbon dioxide using special formulas) that enters the atmosphere due to your activity (Zhuravleva, 2017).

The main share of the carbon footprint falls, of course, on the basic sectors of the economy: energy, chemical industry and metallurgy. The concentration of carbon dioxide in the air is increasing year by year. Ministries of the environment and federal tax authorities in many countries have been trying for about a decade to resolve the issue of regulating industries that bring the largest carbon footprint and reducing this very footprint. For example, by 2025 the European Union plans to introduce a so-called "carbon" tax. It will be added to the cost of a particular product (service), based on the carbon footprint left by the production of this product. This will “undermine” many industries that are simply forced (due to their unfavorable location) to pay this tax on the basis that electricity from unsustainable power plants is involved in the production of their goods or services. An example of such a situation is aluminum, which is produced at the Irkutsk Aluminum Plant. The participation of green electricity reduces its cost for consumers from the EU (the place where the carbon footprint tax will be introduced), which will lower its cost and “pull” producers with “dirty” energy from the market.

But some companies today do not need the so-called "government kick" and are themselves trying to reduce their carbon footprint. And such an example is the notorious Google. Most recently, CEO Sundar Pichai said that Google has completely neutralized its carbon footprint from the company's inception. It is worth noting that already in 2007 the company managed to become carbon neutral, that is, by this year they were able to reduce their carbon emissions to zero and switch to absolutely environmentally friendly technologies and energy sources. Cosmetics giant L'Oreal has also taken the path of self-reducing its carbon footprint. The company has launched a afforestation program in Thailand in areas where rice is grown for the company to produce rice oil. According to Alexandra Palt, Sustainability Manager at L'Oreal, the company has adjusted its production processes by increasing the share of sustainable supplies of renewable raw materials, bringing it to 100% already by this 2020, despite the pandemic and the global crisis. For each raw material, L'Oreal conducted a detailed analysis of the social and environmental conditions of its production in order to decide on the possible reduction and reorientation of production, the introduction of new technologies in these production facilities that would simultaneously reduce the carbon and environmental footprint along the entire supply chain, while while providing additional environmental or social benefits to local farmers and residents. An example is a water-saving technology program for 1,500 Indian farmers who supply L'Oreal with guar gum. But what can ordinary people do to reduce their coal.

4 CONCLUSIONS

The road to the maximum reduction of greenhouse gas emissions is a one-way road. Its ultimate goal of a zero carbon footprint is to be achieved by 2050. The exact date may change as we move along, including due to unforeseen circumstances like the COVID-19 pandemic, but the world's largest economies are determined to achieve it.

The oil and gas industry is an essential element and participant in the process of achieving net-zero greenhouse gas emissions. Measures to support compliance with the goals of the Paris Agreement will have elements of a carrot in the form of concessional financing, but will mostly manifest

themselves in the form of a stick - tax and tariff measures. This will affect global competition in energy-intensive industries and, above all, in the oil and gas industry, but will not change the already emerging trend towards energy transition and new economic structures, where the role of the oil and gas sector will inevitably decline (Nikoláeva, 2018).

Nevertheless, the oil and gas sector will remain the most important industry for the coming decades, so the most appropriate response of the global and Russian energy industry to the challenges of climate change would be to constantly improve energy efficiency, prioritize the development of renewable energy sources and invest in the latest technologies, including energy conservation and capture and storage technologies. CO2.

A particular problem for Russian oil and gas enterprises may be the problem of melting permafrost and the release of methane, a greenhouse gas with an extremely high activity. If these risks materialize, then the problem of tariff barriers and taxation of hydrocarbons imported from Russia will seem like a slight misunderstanding (Migunov, 2020).

So, now we can say with confidence that the carbon footprint is definitely an important factor in the production and consumption of certain goods (services). The trend towards reducing the carbon footprint will affect not only production technologies, but also the market itself and competition between manufacturers, bringing forward those who are really taking steps to improve the environmental situation on our planet.

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