Mykhailo Gonchar,
CGS Strategy XXI

Methane for decarbonization

Why “Nord Streams” are bad solution for Europe's green future?

Traditionally, a reduction in greenhouse gas emissions means a reduction in anthropogenic CO2 emissions into the atmosphere. However, greenhouse gases are not only about carbon dioxide. Conventional natural gas – methane CH4 “helps” global warming much more than CO2. The CH4 potential is 25 to 84 times higher than that of CO2. Although the "lifetime" of methane in the atmosphere is 9.1 ± 0.9 years, while CO2 is about 100 years, nevertheless, it is much more "aggressive" than carbon dioxide. Instrumental measurements show that since the pre-industrial period, the concentration of CO2 has increased by 40%, and the concentration of methane - by 150%. Moreover, the “contribution” of CH4 to global warming is constantly growing. Methane emissions should be added to 33.3 billion tons of annual CO2 emissions. It is due not only to natural factors, but also anthropogenic, the industrial development of natural gas resources in the Arctic. They began to talk about harmful influences only recently and just in the context of Russia's development of the polar gas fields and the construction of gas pipelines of the Nord Stream type.

Methanization of the atmosphere: Natural and anthropogenic factors

Most of the methane in the planet's atmosphere is of biogenic origin, i.e., the release of gas during various processes of decay and decomposition of biological material. The main natural sources are associated with the emission of CH4 from wetlands, freshwater reservoirs, and oceanic space. The flow of methane into the atmosphere is fully provided by its fluxes from the earth's surface. According to scientists, the total average annual global CH4 emission averages 582 million tons (812 billion cubic meters) with a range of estimates of 503-610 million tons (701.5 - 850.8 billion cubic meters). At the same time, slightly more than 1/3 of its emission belongs to natural sources and slightly less than 2/3 to anthropogenic sources. Such volumes of methane emissions in terms of CO2 are commensurate with the volumes of the latest annual emissions. We constantly hear about the dangers of CO2 for the planet's climate, but about methane as it is, not very much.

Wetlands are the main contributors to emissions. 50% of their area falls on the countries of the Arctic region (Russia, Canada, the USA, Scandinavian countries), and the share of these countries in the natural emission of CH4 is estimated at 30-50%. Anthropogenic activity is associated with methane flows into the atmosphere during the extraction of fossil fuels - coal, oil and gas.

Today, the idea of reducing methane emissions is actively proposed, whose impact on the climate is significant, although its residence time in the atmosphere is significantly shorter than that of CO2. It is believed that if the anthropogenic emission of more

aggressive methane is reduced, then a positive reaction of the planetary climate system should manifest itself rather quickly.

And this is where the paradox emerges. Reducing methane emissions is possible only by contraction, and in the future completely stopping coal mining (methane is released during degassing of coal seams), oil (release of associated gas, containing, in addition to propane-butane fractions, the lion's share of methane) and, in fact, natural gas, which it is.

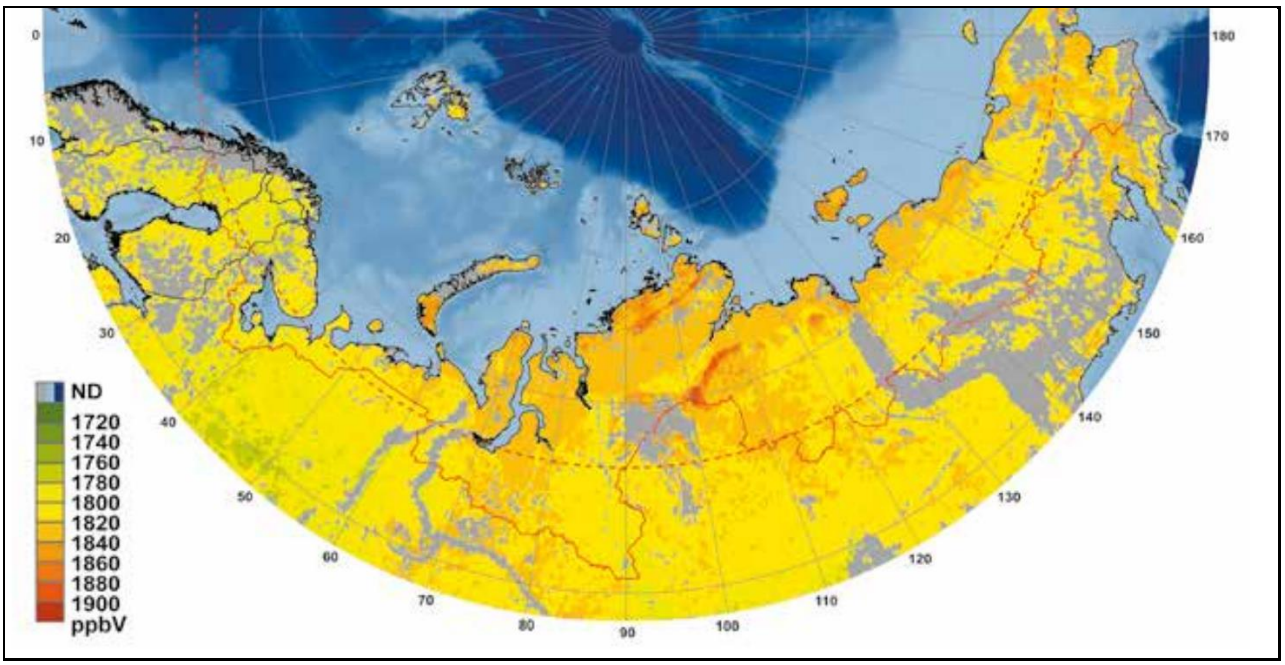
Yamal bomb

A review of Western and Russian sources on the emission of methane into the atmosphere of the planet from the territory of Russia shows that scientists are sounding the alarm about the emission of methane from the Arctic territories.

The total assessment of the volumes of methane emissions from the Russian territory consists mainly of emissions from the surface of waterlogged areas (~ 50%) and losses during the extraction and transportation of natural gas, oil and coal (about ~ 30–40%). The total CH4 emission from the territory of Russia is estimated at 40-45 million tons per year (56-63 billion cubic meters), of which the CH4 emission from waterlogged areas is estimated at ~ 21 million tons per year (29 billion cubic meters), the rest (26-34 billion cubic meters) is anthropogenic emission.

However, these data were obtained based on studies carried out in the period of 2000-2011. That is, during the period of early commercial development of the Yamal fields by Gazprom and Novatek and before the commissioning of the first Nord Stream and the Yamal LNG project. What does the flow and development of Yamal have to do with it? The large-scale technogenic interference in the very unstable natural system of the Arctic tundra, which differs from the southward located forest-swamp plain of Western Siberia, has happened and is taking place.

A feature of Yamal is the saturation of the permafrost layer with methane hydrates. Methane hydrates are extremely unstable ice-like mixtures of methane and water which are created and exist at temperatures below + 4C and pressures above 20 atmospheres. Global warming destabilized the permafrost in the Arctic, it began to thaw, along with it, permafrost deposits of methane hydrates began to degrade, releasing large volumes of methane into the atmosphere. Of course, the hypothesis of a “methane hydrate bomb” (also called a “methane hydrate gun”) as a self-reinforcing chain process: an increase in ocean temperature - an increase in methane emission from hydrates - an increase in the greenhouse effect - an increase in water temperature in the ocean - an even greater destabilization of hydrates and the release of gases, - is still a hypothesis. Nevertheless, according to the data of satellite sounding of Yamal, 1667 thermokarst lakes (TKL) with 1860 bottom zones with numerous craters of methane emissions were revealed on it. An unambiguous relationship has been established between the zones of increased methane concentration in the atmosphere with the areas of the greatest distribution of the TKLs.



Levels of anomalous concentration of methane in the atmosphere over the territory of Yamal and other Arctic regions of Russia (based on Earth remote sensing data)
http://www.arctica-ac.ru/docs/journals/39/degazaciya-zemli-v-arktike-genezis-prirodnoy-i-antropogennoy-emissii-metana.pdf

Kayrros, the leading global industrial and climate watchdog platform based on information from the European Space Agency (ESA), whose Sentinel satellites monitor the Earth, estimates that methane emissions data relied on over the past years and decades are too low. Much more methane emissions were found. Global methane emissions to the atmosphere in 2017 increased by 9% compared to the period 2000-2006.

In addition, one should consider such a phenomenon as cryovolcanism, which manifested itself quite recently and was discovered precisely on Yamal. The explosion of the cryovolcano releases into the atmosphere a huge amount of methane from thawed methane hydrate strata in the permafrost zone.

Evgeny Chuvilin et al. / Geosciences, 2020.
https://nplus1.ru/news/2020/06/04/conceptual-models-of-gas-accumulation

Russian scientists, on the other hand, especially note the fact that local anomalies in the concentration of methane in the atmosphere over Yamal are due to the increased

technogenic emission of methane in the zones of active gas production and transportation. The fact of great importance is that man-made anomalies are comparable in level with natural ones, created by zones of gas emissions of thermokarst lakes with craters and cryovolcanoes. The reasons for the formation of large anomalies in methane concentration have a geological basis, but their origin is often of a technogenic nature - the development of gas fields and the construction of industrial infrastructure.

Russian experts from Skolkovo warn that unpredictable gas emissions from permafrost are dangerous phenomena in the zones of construction and operation of engineering structures. Local officials from the Yamalo-Nenets Autonomous Okrug share these concerns. The Minister of Natural Resources of the Yamalo-Nenets Autonomous Okrug, Alexander Kalinin, admitted that if the soil loses its ability to carry infrastructure and industrial facilities, the consequences will be dire.

Thus, we can conclude that the activity of Russian gas producers in Yamal, primarily of Gazprom, is a detonator of a “gas hydrate bomb”. It has already been stepped on, but no one knows when it will explode. But the first explosion has already occurred - just 4 km from the Bovanenkovo-Ukhta gas pipeline in 2014.

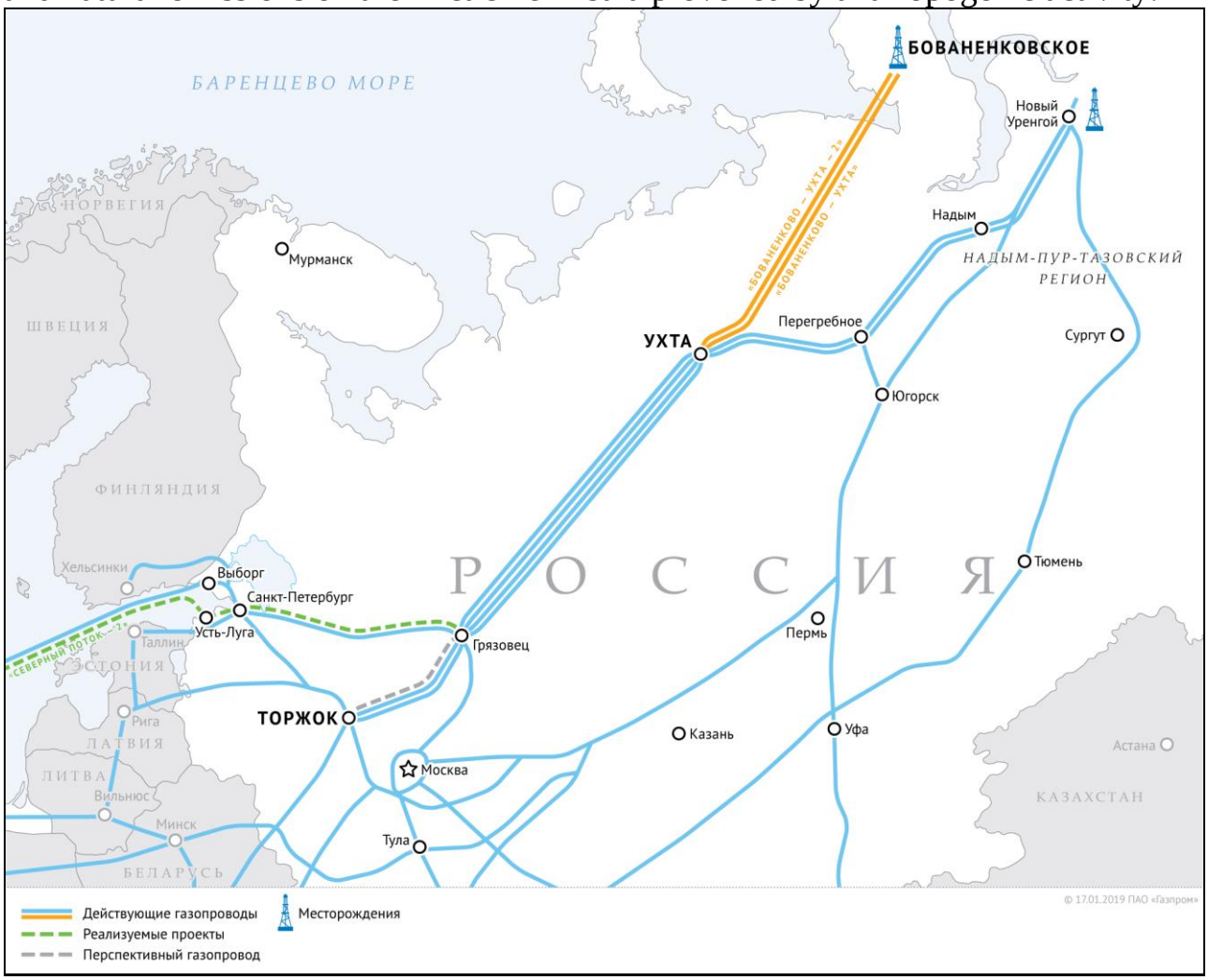
The crater of the cryovolcano, which arose 4 km west of the Bovanenkovo – Ukhta gas pipeline feeding the "Nord Stream". http://www.sib-science.info/ru/heis/v-epitsentre-ledyanogo-17092018

Nord Streams: False Paths to Climate Neutrality.

As is commonly believed in Gazprom and the German federal government, one of the strong arguments in favour of the Russian projects Nord Stream and Nord Stream 2 (and Gazprom in 2018 also talked about Nord Stream 3) is the increased use of natural gas as a transitional fuel to achieve the goals of decarbonization and climate neutrality

of the EU. CO2 emissions from burning gas are on average one third less than emissions from burning coal or oil products.

Gazprom and its supporters in Europe never tire of singing the praises of Nord Stream's low greenhouse gas emissions. Of course, nothing gets into the atmosphere from a sealed underwater pipe with a length of more than 1200 km; CO2 and CH4 emissions occur only at compressor stations on the Russian and German coasts, where gas is used as fuel for their operation. But the total effect should be assessed not along the Baltic section of the Russian gas route to Europe, but along the entire route from Yamal to the Czech Republic, that is: Bovanenkovo - Ukhta - Gryazovets - Ust-Luga - Greifswald - German-Czech border, 4700 km long, with dozens (!) gas compressor stations burning natural gas. But the most important thing is the emission of methane into the atmosphere in Yamal and along the route - both of man-made origin (leaks) and natural emissions on the Arctic Peninsula provoked by anthropogenic activity.



Map of the route Bovanenkovskoye - Ukhta - Gryazovets - Ust-Luga - Nord Stream 2
https://www.gazprom.ru/f/posts/58/242195/map_bo-uh-tor_st_r19-01-17.png


Compressor stations of the Bovanenkovskoye - Ukhta gas pipeline in the Yamal tundra
https://www.vedomosti.ru/business/articles/2017/01/19/673576-gazprom-bovanenkovo-uhta
https://www.gazprom.ru/f/posts/04/751520/bovanenkovo-uhta-kompr-stantsiya.jpg

Experts of the International Energy Agency singled out Russia as a country where the official estimates of methane emissions are too low. In fact, Russia is one of the largest methane emitters in the world. This is recorded by ESA satellite monitoring.

A slight reduction in CO2 emissions in Germany due to the greater use of gas from supplies by Russian flows will come back to haunt with additional CH4 emissions in Yamal. Considering that methane is ten times more aggressive than carbon dioxide, the effect looks questionable. Loud cuts in CO2 emissions with tacit acceptance of increased emissions of the more aggressive CH4 is a false path to achieving the goals of the Green Pact for Europe. The earthly atmosphere is the same as over Germany and over Yamal. Thus, the arguments of the supporters of Nord Stream 2 about the environmental friendliness of the project are at least incorrect, but to put it bluntly, they are false.

In the context of the described realities, the further development of the Yamal deposits by Russia is a global environmental crime. And this applies not only to Gazprom, which is developing 32 fields on the peninsula. Novatek is also developing its production there at the Tambey group of fields with subsequent liquefaction and export of gas in the Yamal LNG project, and is implementing the Arctic LNG 2 project. Gazprom plans to raise gas production in Yamal from the current level of just under 100 billion cubic meters per year up to 360 billion cubic meters.

But even now, even according to the official environmental reports of Gazprom, leaving aside doubts about its objectivity and completeness, in recent years, a steady dynamic of growth of CO2 and CH4 emissions is visible. Moreover, CH4 emissions are many times higher than CO2 emissions, especially in the gas transportation sector. Considering the greater “aggressiveness” of methane compared to CO2, this means that the positive effect of reducing CO2 emissions in Europe will be completely “eaten away” by the negative effect of increasing volumes of CH4 and CO2 emissions in Yamal and along the route of gas transportation to the EU!

We need a global initiative to ban the development of fossil resources (coal, oil, gas) in the circumpolar regions of the planet, where they lie under a layer of permafrost

saturated with methane hydrates. And above all, in the Russian Arctic. And above all - in Yamal. It is clear that such a ban will be ignored by Russia. Then it is necessary to introduce an additional tax on gas imported by companies from EU countries through Russian flows in an amount that will make investments by Russian and foreign companies in Yamal deliberately unprofitable.

By the way, the authors of a study from the German Institute for Economic Research (Deutsche Institut für Wirtschaftsforschung) believe that in order to achieve the EU's climate goals, it is necessary to halve the share of gas in the energy balance by 2030, and completely abandon it by 2040. The “anti-gas” approach is also shared by the participants of the S4F (Scientists for the Future) movement, created in 2019 in Germany, Austria and Switzerland. In their 2021 report, they note that, given methane leaks from the extraction and transportation of natural gas, expanding its use could have as negative a climatic impact as the use of coal.

Therefore, Nord Stream 2, with its 50-year life cycle, is not only redundant in this context, but also harmful in the above context. Any negotiations with Russia on the topic of combating global climate change should begin with a demand to stop increasing gas production in Yamal and abandon plans to develop new hydrocarbon fields in the Arctic. The Nord Stream 2 project must be shut down as a priority measure.