CAPABILITIES SEQUESTRATION OF ANTHROPOGENIC EMISSIONS FROM LOW FUGITIVE SOURCES

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The author describes the ways of sequestration of anthropogenic emissions from low (fixed and mobile) fugitive sources, especially greenhouse gases (mainly carbon dioxide) and other air pollutants (aerosols, dust, etc.). Existing methods of carbon capture and storage are focused on large organized sources (power plants, steel mills, etc.). Author offers "air slagheap" schemes based on the principles of solar chimney and vortexes, catching anthropogenic emissions of road transport and other low fugitive sources.
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There is now a real place of climate change, caused mainly by anthropogenic emissions of greenhouse gases and the most carbon dioxide (CO_2) emissions from stationary and mobile sources. These reasons were justified and the ways of solving problems even in the first reports of the Intergovernmental Panel on Climate Change (IPCC) [1]. The same trends and the outlook for global development are confirmed and now in the latest IPCC reports and the reports of other competent international organizations [2].

After rigorous economic research challenges arising from climate change, it was concluded whether intensive introduction of new technologies to carbon dioxide capture and storage (CCS) in the energy sector around the world as the main instrument to counteract already ongoing processes of global climate change [3, 4].

CCS technology is already being developed and implemented in the research, pilot and industrial scale, as well as identify their future development up to 2050, when the use of CCS technologies will instead increase of CO_2 emissions in 2050 by 130% from 2005 levels to achieve reduction of CO_2 emissions to 50% [5-7].

However, Ukraine has not carried out "sequestration of CO_2 that is released during combustion of carbon-containing fuels for long-term storage, such as in geological formations" [8, p. 90]. The 2006 Energy Strategy of Ukraine up to 2030 [9] is not planned in the near future to explore, develop and deploy CCS technologies in the energy sector of Ukraine.

So now you must evaluate the possible scenarios of implementation of CCS technologies in the energy sector of Ukraine and, above all, at the enterprises of the eastern regions, where the main energy and industrial capacity of Ukraine, which emit large amounts of greenhouse gases, and there are deep geological formations, apparently suitable for purposes of long-term storage of supercritical CO_2. And evaluate the capabilities of capturing CO_2 and other anthropogenic emissions directly from the air, where do they go from mobile sources and private housing sectors.

In the early 90-ies of Ukraine was second in Europe in terms of CO_2 emissions, and in 2011 it already occupies the sixth position and tends to gradually increase that amount, while most countries have set a target for reducing CO_2 emissions in the near decade [10].

Based on the statistics of Ukraine in 2010 [11], it can be noted that more than 83% of the volume of CO_2 emissions are from stationary sources, when not taken into consideration if the CO_2 emissions from the private housing sector, which is different from the statistical requirements of the IPCC. With 74% of CO_2 emissions of the energy producing companies, metallurgical and chemical sectors. In further studies just will take into account the company.

CO_2 emission source categories that are adopted in the statistical reporting of Ukraine differ significantly from IPCC categories. Therefore, the anthropogenic emissions [8] are some other data, such as: category 1.A.1.a - Production of electricity and heat: CO_2 emissions from combustion of all fuels are 94,404 Kt, and in category 1.A.4.b - Private residential: 40,962 Kt, and in all categories of mobile combustion: 1.A.3.a,b,c,d,e and 1.A.5.b - 39,494 Kt. That is so, the private housing sector and the entire transport, which can be attributed to the low unorganized sources, where there is little opportunity to provide efficient capture and storage of pollutants and CO_2, emits almost as much CO_2 as stationary sources - thermal power plant (TPP).

A similar situation is observed in Ukraine and for pollutants emissions in 2010 [11]: stationary sources - 4132 Kt (sulfur dioxide - 29.3%; carbon monoxide - 25.7%; methane - 20.4%; nitrogen dioxide - 7.5%; non-methane volatile organic compounds - 1,6%, etc.), and mobile sources – 2546Kt (carbon monoxide - 74.1%; non-methane volatile organic compounds - 11.5%; dioxide nitrogen - 11.5%; black - 1.3%; sulfur dioxide - 1.1%, etc.).

Data on pollutants emissions coal or gas heating systems of private residential sector are not available, but it is possible to estimate these emissions by analogy with CO_2 as the order of 2 Mt.

Currently, much attention is paid to ensure the world sustainable development in the global climate change, which is mainly due to air pollution by-products of human activity. The sharp increase in the concentration of greenhouse gases leads to an increase in the average temperature of the atmosphere and of catastrophic natural events.

A significant contribution to climate change made by fugitive emissions of fine dust from low sources, which include: relocation of industrial aerosols from industrial shops, raising dust from the surfaces of construction and industrial sites, streets and roads, dust entrainment with heaps of mines and quarries and the concentration of exhaust gas at intersections in cities; volcanoes, smoke and other forest fires, etc..

The consequences of such fugitive emissions taken to fight basically just near the low sources: source itself provides the appropriate filters, if possible, the cleanup and decontamination of the neighborhood, if thrown away a harmful substance, and other similar activities

on a local scale. In some cases, are monitored for further propagation and scattering mass ejection, as well as fixing and Examination of its sedimentation followed by removal of the effects of infection territory. Usually not practical mitigation of fugitive emissions in the way of distribution, that is in the process of moving it to the atmosphere.

Although, with similar situations in the aquatic environment (eg, elimination of oil spills from tankers and wells usually starts at the source of the contamination, near it, on the open water, and ends at the shore pollution) struggle with the effects of pollution is carried out at all stages of the common pollutants.

This situation is reflected in the international strategy to counter global climate change (Kyoto Protocol is the main mechanism for limiting emissions of greenhouse gases by exposure to stationary sources of emissions) and the priorities of scientific and technological development of the European Union (in the 7th Framework Programme of the Research and Technological Development in the "Environment, including climate change" focuses on the research and development of measures to mitigate climate change by implementing CCS).

The common focus of providing pollution control equipment, which is installed on the sources of organized (planned) emissions and fugitive (emergency) emissions are considered as unforeseen events, the consequences of which could be significant or insignificant for the environment and the population. Therefore, the decision to eliminate the effects of fugitive emissions is usually postponed until the next man-made or natural disaster.

We can assume that the environmental sciences should not only examine the impact of man on nature, but also to resist this action, and we can formulate the active elements of the strategy to respond to fugitive emissions from low sources [12]:

The means of monitoring the expected (provided) emissions;

The means of monitoring unexpected (natural and man-made) emissions;

Stationary means of active influence on the expected emissions close to their sources;

Mobile means of active influence on unintended emissions as close to their sources, and their distribution;

Preventive medicine active influence on the atmosphere to maintain and improve the environment.

Have at least a limited number of elements (after the design, manufacture and testing) as part of a special service will allow us to implement measures to reduce the impact on the atmosphere of natural and man-made phenomena, energy and industrial accidents, and other forest fires, urban smog and exhaust gas concentrations , removal of carbon dioxide and other harmful components.

Development and implementation of such a strategy will not only reduce the impact on the atmosphere of risk facilities located on its territory, but also to minimize the effects of natural and man-made disasters in other countries and other countries of the world, to promote global sustainable development.

The possible application of this strategy to the problems of air that occur in large cities (for example, the city of Donetsk in the Ukraine) due to air pollution emissions from low sources, including: the emergence of smog.

We can define two types of smog: Air Pollution Transport exhaust containing nitrogen oxides, and are connected to Air Pollution Soot or Smoke containing sulfur dioxide. Necessary part of the process of formation of the first type of smog (Los Angeles smog) are photochemical reactions, in the second case (London smog) photochemical reactions may be involved in the formation of smog, but their participation is not mandatory.

In Donetsk, can form two types of smog: a factor of industrial emissions is constantly present, automobile exhaust gases contribute to the formation of the Los Angeles smog in summer, heating coal heating in the houses of the private sector was able to provoke a London smog in winter.

Significant contribution to the formation of smog making unfavorable weather conditions (for a year of weak winds repeatability is 30%) and especially temperature inversions (move the inversion prevents dispersal of emissions from high sources - the steel industry and power plants, and surface inversion contributes to the accumulation of harmful substances entering into the atmosphere from low emission sources - cars, mines and waste heaps), the frequency of which the annual average of about 20%, and winter increases to 40%. Summer often increase air pollution through waste heaps (of 125 waste dumps are burning more than 30), and motor vehicle exhaust, which every year becomes more and more.

The maximum concentration of nitrogen dioxide in Donetsk is usually observed in the summer. In summer, when strong surface inversions at night and clear skies in the afternoon, the conditions for the photochemical reactions and the formation of smog. And as in connection with climate change occurring in Donetsk recently quite dramatically increases the average summer temperature is reduced and the average winter temperature, it increases the likelihood of both the Los Angeles smog in summer and in London smog in winter.

The proposed method of dealing with smog can be attributed to the implementation of the strategy of active response to environmental pollution [12], which is now starting to be embodied in various independent projects, which are usually attributed to geo-engineering of environmental atmospheric phenomena. Some of these funds are already in development, and mock trials, for example:

"Artificial trees" that should replace billboards on highways and U.S. clean air, capturing CO_2 along with other greenhouse gases and harmful car exhaust fumes in the natural movement of air flow [13]. The effectiveness of these devices will depend on wind direction and speed, which is a significant disadvantage. Now proposed design with the injection of air from the atmosphere, which includes the significant additional cost of energy as opposed to the original version, when only funded the construction of the device;

"Wind wall" being built in Canada, and will consist of more than a hundred powerful stationary fan, which directs the flow of air in the system for CO_2 capture. [14] This design requires significant financial costs to both the construction and operating costs.

Also, in these devices does not

provide pre-treatment of the incoming air in them from aerosols, dust and soot that are in high concentrations in the air of industrial areas.

Given the above experience, consider the situation that exists with smog in Donetsk: the main factor in the appearance of smog in the city center are motor vehicle exhaust, and other sources of air pollutants only complement the composition of the smog. Historically, this arrangement of streets and parks in the city of Donetsk, that the formation of smog in the main streets and intersections, located on high ground, it flows and is concentrated in the recreation areas - parks, which are concentrated in the lower reaches near the basins.

On the busiest intersections where road constantly formed "plug", it is proposed to establish a system of forced recovery vehicle emissions, other air pollutants and CO_2 – "Air Slagheap" (AS).

This AS will have some pre-treatment units and air unit for CO_2 capture, which are located away from the roadway, and from which comes tapered exhaust pipe system dirty air from the top of the cone and supply of high-speed jets of air inside the cone.

Such a device will have several pre-treatment units and air unit for CO_2 capture, which are located in the side of the roadway and out of which a cone-shaped exhaust pipe system dirty air from the top of the cone and the supply of high-speed jets of air inside the cone. Clipped from the apex rises more than 100 meters of pipe diameter of 10 meters, which, together with a glass cone on street corners and glass tunnels along the streets actually forms a "Solar Chimney" [15], which is equipped with a horizontal wind turbine that will provide energy units clean air and CO_2 capture.

In addition, to improve the efficiency of wind turbines in the design of the cone provides for the deployment of aerodynamic elements to ensure the creation of artificial vortex [16].

To trap smog arbitrary areas, and to eliminate the effects of man-made and natural disasters, to develop mobile construction land and air-based, which will provide job effects "Solar Chimney" and "Artificial Vortex" in the open air and in the free space of the atmosphere.

In addition to its direct functional purpose - cleaning the air of smog and CO_2 capture design AS can be used for commercial and tourism purposes in addition to its relevant lift equipment, trading platforms, an observation deck on top of the cone as a "glass ball", lighting and musical accompaniment and etc.

Proposed use of active methods of exposure to certain environmental objects in order to improve the quality of these objects (in this case, Donetsk - the surface layer of the atmosphere) will adapt to the impacts of climate change - increasing average summer air temperature and lowering of the average winter temperature in the industrial impact. We hope that the developed design Tues stakeholders to find financial support for further research and put into practice to improve air quality in cities and combat climate change.

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