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Carbon Emission and Urban Climate in Georgia

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Abstract: The GHG indicator based on the data collected in Georgia in 2015 was 17.6 mt. CO2 eq. GHG emissions are generated in 7 sectors: energy generation, transportation, construction, industry, agriculture, waste management and Forestry. Increase of CO_2 in Georgia is greatly affected by urban activities- namely exhaust fumes and poor quality of fuel. 10% of carbon dioxide in atmosphere is combustion product. All atmosphere protection operations in Georgia are regulated in the frameworks of official state program, which groups all the emissions connected with energetics, climate strategy and transport through sectors. In 2015 total GHG emission in the sector of transportation was up to 24% (Ministry of Environmental Protection and Agriculture of Georgia, 2019). In previous years (2015) transportation GHG emission was up to 68% in total. Various types of transportation data: car emission-88%, bus emission 5% and minibus emission-6%. 32% of emission falls on railway and agricultural technology. 29% falls on trucks. Characteristics of transportation GHG emissions data in Georgia up to 2023 remains the following: electricity is mostly consumed by the railway, which includes Tbilisi underground train service. Expense is only 1% of electricity. Considering basic data collected in the sector of agriculture, by 2030 increase in Agricultural emission will probably be about 40% more compared to the initial data. That is 4.63 mt. CO_2 eq. Within livestock, ruminant livestock remains main source of emissions, that is in 2015 92% of Enteric fermentation emission and 82% of emission was due to dung waste emission. These forms still remain as main sources of emission till 2030. Agricultural development is of high priority in Georgia. Strategically, main focus will be made on forming and launching the climate-oriented agricultural practices. In the future sustainable business will be the chief foundation determining a reasonable growth and development of the field of agriculture. Considering the climate change, drastic measures should be taken in order to prevent or avoid natural disasters. Vivid example of the climate change is a tragic disaster that happened in one of the regions of Georgia, Ratcha, Shovi on the 3rd of August, 2023. As a result of landslide several tons of mass almost completely covered resort Shovi. 220 people were rescued, 30 died and rescuers are searching for more victims. As survivors claim, landslide covered the surrounding area of so-called “Cottage district” in just 3-4 seconds, ruining all the infrastructure, bridges and caused death of several people. The natural disaster was a result of melting glaciers both locally and in the oceans worldwide. Global warming is responsible for such devastating disasters.

Keywords: Emission, Urban, Gases, Climate, Carbon dioxide.

1. INTRODUCTION

According to a 2020 study in Georgia conducted by the Caucasus Environmental Center (REC Caucasus) for the Environmental Development Program (UNDP), more than 91% of Georgians believe that climate change is a well-defined process that poses serious threats to life on earth. Based on the survey, 96,11% of respondents said they were most concerned about droughts and global warming brought on by climate change (Lortkipanidze, 2010; Lortkipanidze & Kheladze, 2015).

Additionally, the Shovi resort was completely devastated as a result of the tragedy that took place on August 3 of this year in the Georgian region of Ratcha. This disaster resulted the removal of 2 million tons of earth in the form of a landslide. 220 people were evacuated by helicopter, 32 people died, 30 of them were found, the search party is currently seeking for two juveniles. According to the survivors, the deadly landslide developed in 3-4 minutes, which wiped out

the bridges, buried the "district of cottages" and caused casualties. The rapidly developing landslide thoroughly destroyed the Shovi resort. The work was carried out using environmental and agro-ecological monitoring research methods (Lortkipanidze & Kheladze, 2015; Walker et al., 2007; Lortkipanidze, 2015).

Along with such unpredictable events, it is crucial to have a well-thought-out long-term plan for low-emission development on earth, which is significant in Georgia. The government and scientists collaborated to create a program called the "2021 updated document (NDC)-2030" that serves as the country's main road map for the action plan that was created in response to climate-related occurrences. Georgia's 2030 Climate Change Strategy and Action Plan ("Climate Strategy and Action Plan-CSAP", "Climate Action Plan-CAP") outlines what should be done to mitigate climate change and includes a mechanism for organizing and carrying out coordinated efforts to meet the national goals. As a result, it establishes the methods to fulfill the aim of reducing greenhouse gas (GHG5) emissions in our nation by 2030. In accordance with the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), the objectives are stated in "Georgia's updated Nationally Determined Contribution" document (NDC).A long-term aim for lowering greenhouse gas emissions by 2030 is laid out in the Climate Strategy and Action Plan, for which particular initiatives are planned. Our involvement in the preparation and planning of the action plan for the Ministry of Environment Protection and Agriculture of Georgia's structures was based on scientific research data for the year 2030 compared to the data for the year 2020 using contemporary technology. This method is going to reduce carbon dioxide emissions from 1,091 mg CO2 eq to 840 mg CO2 eq by 2030 via today's technologies, and the aforementioned landfills must be closed by 2024. In Georgia, transportation emissions account for a sizable portion of emissions: studies show that only the metro and railways consume electricity in the country, which according to data from 2015 accounted for only 1% of the electricity consumed. CO2 emissions in the country, according to the preliminary forecast for 2030, according to road transport, strict environmental measures are required. There will be 13 billion vehicle kilometers of traffic in 2020. 3900 vehicle kilometres per capita is less than half of what the International Council for Environmentally Clean Transport (ICCT) expected for EU countries in 2020. According to data from 2020, private vehicles made up 70% of passenger kilometers traveled in Georgia, while 30% of those kilometers were taken by public transportation, which included railways (4%), buses (12%), minibuses (14%) and buses (12%) (Lortkipanidze, 2010; Lortkipanidze & Kheladze, 2015; Landmeyer, 2011; Walker et al., 2007).

Georgian carbon dioxide emissions are predicted to be 189 g CO2 eq/vehicle kilometer, especially for light automobiles. According to the EU emissions recommendations, new cars must emit no more than 96 g of carbon dioxide per kilometer by the year 2020 (European Commission Report, 2018). According to data from 2019, Georgia's high emissions are primarily brought on by its fleet of secondhand automobiles and out-of-date models, with more than 87% of all vehicles registered there being more than ten years old. The majority of light trucks and buses utilize diesel fuel, whereas 68% of internal combustion engine cars run on gasoline. Less than 1% of all vehicles sold are electric, which is a very modest percentage (Walker et al., 2007; Horst et al., 2020).

In terms of low-emission vehicles, hybrid vehicles make up the majority of this growth. 78% of Georgia's railway transportation is electrified. The deployment of electric buses has been criticized over the past two years in the capital city and other regional cities. It is anticipated that the transportation sector's greenhouse gas emissions will be reduced by 15% from their baseline levels by 2030 in order to achieve the objective outlined in the document of contributions outlined by the state program at the national level. According to the state's strategy, the solution to this problem is to increase the percentage of technically maintained private vehicles with low and zero emissions in the fleet which will be implemented thanks to Normative acts on technical inspection, as well as effective enforcement of stipulated fines and control of vehicles on the roads using modern technology. On this basis, emission intensity should be decreased and technically flawed and environmentally inefficient automobiles should be taken off the road (Lortkipanidze & Kheladze, 2015; Walker et al., 2007; Mardaleishvili et al., 2006; Margvelashvili, 2010).

In addition to decreasing the usage of diesel vehicles and importing outdated, ecologically unfriendly automobiles, the state's plan for minimizing transportation emissions calls for the promotion of electric vehicles. The government promises to find additional, ideal tax incentive options in order to promote the use of electric vehicles. Tbilisi will explore raising the import tariff on used light vehicles based on an economic feasibility study and improving the infrastructure for electric vehicles based on a cost-benefit analysis. A big portion of drivers are going to switch to using public transportation as a

result of the "emission standard" being implemented at the same time for imported vehicles based on cost-effectiveness analysis (engine EUR4/EUR5), which will lower transportation emissions. Since fossil fuels have a detrimental impact on greenhouse gas emissions when used in transportation, the use of environmentally friendly fuel is also recommended here. To achieve this, the proportion of energy from renewable sources—including biofuel—in the gasoline used for transportation should rise by at least 10% by 2030. To achieve this, it has been suggested that the potential of raising the gasoline tax be addressed, and that biodiesel production be supported and promoted in order to lower carbon dioxide emissions based on the development of the Tbilisi Sustainable Urban Plan (SVMP) which involves improving the parking lot and establishing a new bus network in Tbilisi, modernizing the metro and expanding its capacity, building a cable car, and instituting zonal hourly parking. 15% of baseline emissions from transportation should be eliminated. Georgia's state action plan in this regard for commercial and public buildings addresses both direct emissions, such as the direct burning of fuel for energy supply in buildings, and indirect emissions, such as the consumption of electricity in buildings and other related issues. Since Georgia has never done the building inventory and lacks engineering-related data in this area, the information is based on the data found in various research projects and papers published by the government (Lortkipanidze, 2010; Lortkipanidze & Kheladze, 2015; Chernikov et al., 2000; Ran & Sobti, 2020).

According to regional electrical efficiency standards, the state should use the developed certification methods. The required bylaw normative actions should be created and approved, and construction projects for thermal insulation of the buildings' surrounding structures should be prepared. The Georgia Law "On Energy Efficiency of Buildings" mandates that by 2030 any newly constructed structure that is subject to certification will have achieved 100% energy efficiency. 100% of (incandescent) lights will be replaced by energy-efficient lamps in residential and commercial buildings starting in 2023 as a consequence of a very significant step taken in the tax regulation that the government presented alongside the information campaign regarding these types of lights. The use of solar energy and energy-efficient stoves being promoted, which will lower greenhouse gas emissions, along with the replacement of inefficient light bulbs in public buildings. This gives people and legal entities an incentive to put into place a mechanism that rewards them for buying solar water heating systems for their own homes, businesses, and other facilities. It is crucial to educate staff members regarding energy efficiency issues to the highest professional standards (Lortkipanidze & Kheladze, 2015; Lortkipanidze, 2010; Zhorzholiani & Gordadze, 2010).

In recent years, the growing demand for tourism in Georgia needs to be promoted. One of the Georgian government's priority focuses is the expansion of the tourism industry. By developing and promoting energy-efficient practices and sustainable development, the area should be promoted. In this direction, carbon dioxide-free buildings are of the utmost importance. By supplying alternative energy sources, this is intended to increase the energy efficiency of residential buildings, hence fostering the growth of ecotourism in Georgia. This course of action is consistent with the country's program submitted to the Green Climate Fund of Georgia. Environmental industry is a sector that reflects the emissions produced in the industrial sector as a result of processes developed from the use of industrial energy, such as emissions produced by direct fuel combustion, directly at the sites of industrial activity, and also indirect emissions produced as a result of the consumption of electricity, the generation of which took place outside the implementation of industrial activity. In comparison to the predicted amount of baseline emissions, the industry reform seeks to reduce emissions by 5% on a national scale. The main goal is to reduce the level of greenhouse gas emissions caused by energy consumption - by replacing industrial facilities with an energy-saving dry method of cement production and equipping the nitric acid production enterprise with modern technology to guarantee elimination of 95% of N2O emissions. By 2030, the amount of reduced emissions from the production of cement and nitric acid is 571 kt CO2-eq, with cement 352 kt CO2-eq and nitric acid 416 kt CO2-eq, a system for studying emission factors and data management in the industry sector should be developed (Oniani et al., 2006; Mardaleishvili et al., 2006; Walker et al., 2007).

Our field of interest for inclusion in the research was represented by the sectoral priority of agriculture. It should be mentioned that according to the accumulation of emissions from agriculture in the direction of climate change, we should first consider the directions of animal husbandry and farming - from energy consumption in manure management, intestinal fermentation, agricultural soils, fisheries and forestry. Emissions from agricultural soils include direct emissions from: use of synthetic and organic nitrogen fertilizers, decomposition of agricultural residues, pastures and fenced pastures. Indirect emissions come from atmospheric deposition, nitrogen leaching, and the power use of high-speed

vehicles such as agricultural machinery (Margvelashvili, 2010; Mardaleishvili et al., 2006; Odum & Barrett, 2005; Lortkipanidze, 2015).

The state will promote climate-smart agricultural technology and services in order to achieve our goal of developing low-carbon agriculture on a national level. In order to accomplish this, it is required to: 1) reduce greenhouse gas emissions from agriculture, and for this, the nutritional quality of 20% of cattle should be improved as much as possible. The resulting greenhouse gas emissions will be reduced by enteric fermentation. 2) provide sustainable management of soil and pastures and promote the introduction of sustainable practices in the feeding regime of domestic animals. The state should take into account that the objective will be implemented for farmers in order to conserve the biodiversity of pastures and lower the cost of care for cattle for all farmers working in the field: The expense of veterinary care for the owner of small livestock should be provided free of charge. Farmers that raise animals are given the opportunity to switch their equipment for intensive grass production. A sustainable windbreak system is a crucial step in creating a climate change-resistant ecosystem. It is crucial to develop a multifunctional windbreak and agroforestry system (mWAE) that would improve agricultural production in areas like horticulture and prevent soil erosion. This process will reduce carbon emissions (Shetekauri et al., 2007; Lortkipanidze, 2010).

In the field of agriculture, it is crucial to do scientific research on the soil's bioclimatic conditions. The state plans to conduct research in this area and to promote the introduction of climate-adapted agricultural crop practices for the determination of climate-smart agricultural activities (CSA) through promotion and awareness-raising campaigns. Under the circumstances of global warming, developing appropriate agro-cartograms in accordance with agro-climatic conditions, where the reduction of carbon emissions will be a significant problem. According to cost-benefit analyses and other data, this will enhance the proportion of climate-smart technologies and/or initiatives in government and donor agricultural programs (Lortkipanidze, 2010; Margvelashvili, 2010).

As a result, future predictions call for an increase in production and the growth of large-scale commercial agriculture, from which it is expedient to incorporate sustainable business practices that will have an impact on emissions levels. Current and future plans for our nation's agriculture to be more productive and fertile will result in an increase in greenhouse gas emissions on the one hand, but will also result in a reduction in emissions over time by raising livestock that is incredibly productive (CAP), in accordance with ongoing research and the climate action plan (Lortkipanidze, 2010; Lortkipanidze & Kheladze, 2015; Walker et al., 2007).

2. CONCLUSION

1. As part of the nation's climate action strategy, cost-benefit research on emissions reduction in pet feeding and manure management will be designed and put into practice as the most popular form of climate-wise agricultural practices.

2. According to a survey by the Caucasus Environmental Center, 96.11% of Georgians think that climate change endangers life on earth, which was proved by the "Shovi flood disaster" that occurred there on August 3. Human casualties and the destruction of "Resort Shovi" were results of the unfolding events. It is crucial that ecologists from Georgia and other countries participate in the "Shovi" resort's rehabilitation operation.

3. Representatives of the local population, environmental non-governmental organizations, local governments, and agro-ecologists who will attend the work process of developing waste processing techniques based on new technologies should collaborate with local municipalities in order to fulfill the statement presented by the state program in Georgia by 2030, which envisages the reduction of carbon dioxide emissions in the suburbs surrounding large cities over landfills.

4. In order to reduce CO2 emissions in Georgia, the possibility of processing paper recycling and composting of green plant residues of biodegradable waste should be created.

5. Georgia's natural resources, including its water sources, are contaminated by domestic and other agricultural mineral and organic waste, making it important to keep animal farms, beekeeping operations, and flood fisheries separate from irrigation systems. The Law of Georgia "On Environmental Protection" and the Law on "Plant Protection and Pesticides" both regulate the establishment of a waste management system that will reduce CO2 emissions in this direction.

6. In accordance with the environmental protection legislation of Georgia, there are opportunities to reduce carbon emissions, which, along with the strengthening of the scientific research base of the sector, need to be upgraded with modern equipment of scientific research laboratories with the support of international organizations.

7. The goal is only achievable with the proper selection of woody and bushy kinds, suitable distribution, and proper growth and development. Long-living and quickly expanding forest plantations are required to achieve a certain goal. The row rule states that plants such as trees and bushes should be spaced apart in parallel rows. More than two kinds should not be planted consecutively. Linear planting of trees and shrubs provide a windbreak, one main variety is planted in the forest strips, and several other species are planted in the watershed. Bushy kinds are typically placed in the bank row, if necessary.

8. In 2020, more than 91% of Georgians, according to a survey by the Caucasus Environmental Center (RECCAUCASUS) in collaboration with the European Union and the Environmental Development Program (UNDP), believe that climate change is a well-defined process and poses a threat to life on earth. This belief is supported by the Shovi disaster, which occurred on August 3 with landslide events. By granting funding from the United Nations and other donor organizations, it is significant to support the collaborative work of scientists, researchers, geologists researching the earth, soil scientists, etc. from the Black Sea countries. It is crucial to hold the "Forum of Scientists and Researchers of the Black Sea Countries," which will convene every two years to discuss the effects of global warming in the participating nations (alternatingly serving as the host nation).

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