

Addressing the economic impacts of climate change in Uzbekistan: challenges and strategies

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Abstract. The impacts of climate change have become increasingly evident globally. Leading climatologists attribute this phenomenon primarily to human activity, as rising greenhouse gas concentrations warm the Earth's atmosphere. Accelerating economy-wide reforms is vital to foster an environment conducive to business and investment, crucial for transitioning to a green economy. Establishing financial regulations and market-based incentives attracts investment in sustainable ventures. Additionally, sector-specific strategies, including water resource management, climate-smart agriculture, urban development, and human capital enhancement, play pivotal roles. This article delves into the urgent issue of global climate change, elucidating its environmental implications, socio-economic repercussions, and the significant threat it poses to various economic sectors. Global warming acts as a catalyst for multifaceted changes and risks, necessitating careful consideration to avert widespread disaster. Proactive measures, informed by comprehensive understanding and collaboration, are imperative for mitigating the adverse impacts of climate change and fostering a sustainable future for generations to come.

1 Introduction

Policymakers are faced with a difficult decision when it comes to addressing climate change and its potential economic consequences. The benefits of policies are uncertain and may only be realized by future generations, while the costs of implementing such policies will likely need to be shouldered immediately and may be substantial. Additionally, failing to take action could result in irreversible and potentially catastrophic consequences, with poorer countries being hit harder than their more developed counterparts. Even if greenhouse gas emissions were to cease immediately, temperatures would continue to rise for decades due to emissions that have already accumulated.

As a result, economic policymakers are increasingly acknowledging the need to implement policies that will mitigate the effects of global warming by reducing GHG emissions and adapting to the impact of emissions that have already occurred or will occur

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in the future. They also recognize that mitigation policies can have rapid and far-reaching effects. Recent studies conducted by the IMF have compared policy alternatives, such as GHG taxes, emissions trading, and hybrid schemes, to determine how these policies might affect countries' economies. Fortunately, the analysis shows that climate change can be addressed without negatively impacting macroeconomic stability and growth, nor placing undue burdens on the countries least able to bear the costs of these policies. This indicates that well-designed policies can be both effective and affordable.

2 Literature review

In the National Encyclopedia of Uzbekistan, the essence of environmental factors is described as a set of specific conditions and elements of the environment that uniquely affect the activity of organisms [11]. It is emphasized that increasing human well-being at the expense of ecological crisis will show its negative consequences shortly [14]. The only way to achieve this is to move to an environmental or green economy. Climate change also impacts households' access to food by negatively impacting transport systems, road infrastructures, and other things [13].

It is necessary to emphasize that the entire global community should be resolved [12] by working together to eliminate environmental problems from the threats that threaten the world. Because climate change affects every sphere of life from employment of the population to the tourism [3, 9, 2]. Also, global climate change, which is one of the most urgent problems of the world community, the economic consequences of climate change, the risk of artificial and social disasters as a result of global warming, the extent to which issues related to climate change have been introduced into the country's strategic development directions, and solutions to environmental problems [5] is gaining urgent importance.

3 Methodology

In the research process, global climate change, environmental problems affecting its change, economic consequences of climate change, various forms and consequences of climate change, which causes a large-scale risk, as well as a catalyst for multiple changes in many areas of economic activity, the risk of artificial and social disasters as a result of global warming, this As a result of studying the opinions of specialists, dialectical and systematic approach, comparative and comparative analysis, statistical approach and grouping methods were used.

4 Analysis and results

In recent decades, the world's population has been increasingly faced with manifestations of climate change on the planet: new ones are constantly being recorded. Weather records show the hottest summer, the longest drought, or the largest forest fire in history. The prevailing view among climatologists is that climate change is anthropogenic: as a result of human activity, in particular, the burning of fossil fuels, the concentration of greenhouse gases (GHG) is constantly increasing, heating the lower layers of the Earth's atmosphere, as well as the upper layers of the World Ocean. As a result, climate change is occurring much faster than in the past and faster than predicted. "Climate change is one of humanity's greatest threats, with far-reaching and devastating consequences for people, the environment, and economies. Climate impacts affect all regions and sectors of society" [1].

Many countries consider climate change one of the most critical global challenges of our century. The problem of climate change is being intensively developed worldwide under the

coordination of the Intergovernmental Panel on Climate Change (IPCC). Global climate change has become one of the most pressing problems in the world economy and politics. Climate change, from the point of view of its impact on the global economy, not only represents a large-scale natural hazard but is also a catalyst for multidirectional changes in many sectors of economic activity. Associated with the lack of fresh water, the food problem, natural disasters, migrations, as well as the prospects for the development of several key industries (energy, transport, construction, agriculture), climate change is closely intertwined with the tangle of global economic processes [8].

By the middle of the 20th century. Humanity faces the emergence and rapid development of an environmental crisis on planet Earth. Global environmental problems are associated with anthropogenic impacts on the natural environment, such as climate change, depletion of the ozone layer, deforestation, and desertification. There are fewer and fewer areas on the planet with undisturbed or slightly disturbed ecosystems. These are Canada and Russia (north and Asian) in the northern hemisphere, the Amazon basin, a significant part of Australia in the southern hemisphere, and still the World Ocean [10].

The current level of anthropogenic loads on the biosphere due to humanity's economic development and the rapid growth of the planet's population has approached a crisis and, according to international estimates, threatens irreversible consequences for the world community. Global problems as sources of crises are becoming increasingly acute [10]. In today's era of globalization, along with vast and essential tasks to deepen social and economic reforms in our country, our planet's future and humanity's fate in the current era primarily depend on issues related to the prevention of global climate changes and nature protection.

Climate change is significant for the future development of Uzbekistan. A changing climate threatens the country's natural capital, agriculture, land, and water productivity and increases the risk of natural disasters. By the end of this century, the average air temperature in Uzbekistan is expected to exceed the world average significantly. The average air temperature may increase by 4.8 °C by the 2090s above the 1986-2005 baseline. In the near term, the economic cost of the physical impacts of climate change will be 1% of GDP by 2030, with the immense effect on agriculture, followed by negative impacts on water and biodiversity and labor productivity and increased weather-related risks.

In particular, speaking recently at a briefing at the headquarters of the Organization, UN Secretary-General A. Guterres said, "The era of global warming is over; the era of global boiling has arrived". At the same time, in his report "Our New Agenda," he identified three planetary crises: climate change, loss of biodiversity, and pollution of the planet. These problems do not bypass Central Asia, which today is increasingly feeling the consequences of global warming. Thus, according to new estimates by the Intergovernmental Panel on Climate Change, since 1850, global temperatures have increased by an average of 1.1°C. At the same time, in Central Asia, its growth exceeded the world average, amounting to 2.2°C. [15].

The consequences are already evident today, and experts suggest the situation will only worsen in the coming period. The main reason for this is the intense melting of glaciers. Snow and ice covers, which form up to 50% of the annual flow of the main water arteries of Central Asia - the Amu Darya and Syr Darya rivers, have decreased by more than 30% over the past 70 years. In the next 20 years, their flow is expected to decrease by 15%, water availability per capita will decrease by 25%, and agricultural yields by 40%. Over the past 20 years, the per capita water supply in Uzbekistan has reduced from 3 thousand cubic meters³ to 1.5 thousand cubic meters³, that is, 2 times;

Secondly, changes in the hydrological cycle entail a significant increase in natural disasters. Statistics show that out of 126 cases of natural disasters recorded in 2011-2022, 46% were caused by earthquakes, 27% by floods, 13.5% by landslides, 8.7% by solid winds, 1.6% by wildfires, 0.8 % by avalanches, etc.

Up to 3 million residents of Central Asia suffer annually from natural emergencies. In Uzbekistan, natural disasters annually affect an average of 1.4 million people. And they caused damage of almost \$3 billion. Overall, worsening water stress and increasing aridity will harm biodiversity, rangelands, and livestock production and increase respiratory disease and other risks.

These climate impact factors, along with the growth of the population and economies of countries, entail negative economic and social consequences for Uzbekistan and the entire region, threatening water, food, and energy security and exacerbating environmental problems. Already today, every minute, 9 square meters of the region's fertile area turns into desert. It is predicted that by 2050, climate change-induced reductions in water resources in the Amu Darya and Syr Darya basins could lead to a drop in regional GDP by 11%. By the same time, according to forecasts, up to 2.4 million “climate migrants” may appear in Central Asia, who will move to regions that are prosperous in this regard.

The country can also play an essential role in contributing to global efforts to reduce greenhouse gas emissions. This opens up new opportunities for domestic growth and mitigates the risks posed by international efforts to achieve net zero emissions, as set out in the Paris Agreement. The country's initial target, based on Nationally Determined Contributions, was to reduce greenhouse gas emissions per unit of GDP by 10 percent by 2030 from 2010 levels. However, recognizing the importance of reducing emissions led to an increase in this target to 35 percent in the updated Nationally Determined Contributions (NDCs) in October 2021. According to Uzbekistan's first two-year interim report under the UN Climate Change (2021) Hadley Convention (UNFCCC), in 2017, Uzbekistan's total greenhouse gas emissions amounted to 189 million tons of CO₂ equivalent.

According to the decision of the 20th session of the Conference of the Participants of the Hadli Convention on Climate Change of the Republic of Uzbekistan and based on the national conditions and sustainable development goals, taking into account the transition of the country to a development model with economical use of resources, the contributions intended to be determined at the national level for the period up to 2030 (MMBKH) identified and presented.

The Republic of Uzbekistan plans to strengthen measures and efforts to combat climate change from a long perspective until 2030 to reduce the specific emission of greenhouse gases per unit of GDP by 10% from the level of 2010 by 2030 (MMBKH, 2017). In October 2021, the Republic of Uzbekistan presented its Updated Nationally Determined Contributions (NDCs), aiming to increase its commitments and reduce greenhouse gas emissions per unit of GDP by 2030 from 10% to 35% of 2010 levels (NDC1, 2021).

Uzbekistan also ratified several documents that partially consider climate change response measures, adaptation, and mitigation processes in economic sectors, including the Kyoto Protocol and the Paris Agreement within the framework of the UNFCCC. In August 2020, the implementation of the project on the development of the sector and regional adaptation plans (MMR) for the country, financed by the Green Climate Fund (GCF) as part of the “Readiness Enhancement Program”, began. This project aims to strengthen institutional and technical capacity to iteratively develop MMR and implement climate change adaptation measures into Uzbekistan's national and local planning and budgeting processes. The National Adaptation Plans developed for Uzbekistan are aimed at achieving the following final results:

- strengthening the coordination mechanism for planning intersectoral climate change adaptation measures and implementation of adaptation measures and actions at different levels;

- strengthening the statistical database and determining the issues of adaptation to climate change as priorities for planning and budgeting at the national, sectoral, and regional levels;

Financing climate change adaptation measures and developing an investment strategy for Uzbekistan. This project focuses on the sectors most sensitive to climate change (agriculture, water management, health, construction of energy-efficient buildings, and emergency management) and three target areas (the Republic of Karakalpakstan, Bukhara, and Khorezm regions), climate change adaptation measures and aimed at simplifying the planning of actions and their corresponding budgeting process. As part of the project, it is planned to develop climate change adaptation plans at the scale of five sectors and the scale of three regions by November of this year.

Although the Government of Uzbekistan has consistently improved its national climate change strategies and plans over the past five years, it still needs an integrated strategic framework for climate change. Climate change action consists of Presidential decrees, laws, government decisions, sector strategies, and plans. However, these provisions are scattered in many documents (59 laws, 50 Presidential decrees, and about 200 resolutions) that can be considered to be related to climate change to some extent.

The Government of Uzbekistan needs a targeted and comprehensive climate change strategic document that provides a strategic management framework. However, some laws regulate environmental protection and the use of renewable energy sources.

The Law of the Republic of Uzbekistan, "On Nature Protection", defines the legal, economic, and organizational foundations of environmental protection and rational use of natural resources and is aimed at ensuring the proportional and harmonious development of relations between man and nature and the protection of ecological systems. Relations in the development and use of renewable energy sources in Uzbekistan are regulated by the Law of the Republic of Uzbekistan, "On the Use of Renewable Energy Sources", which came into force in 2019.

Currently, the Government is developing the Environmental Code and the "Limitation of Greenhouse Gas Emissions" draft law. The Environmental Code protects natural resources through basic principles such as polluter charging (financial responsibility for environmental damage and restoration) and public participation (citizens should be informed of ecological risks and consulted on projects that affect their environment). To introduce or strengthen the principles supporting fair use, many legislative acts aim to unify the scattered norms into coherent legislation. The Law "On Limitation of Greenhouse Gas Emissions" seeks to establish the basis of the economic regulation and other activities that cause this emission in the country to reduce greenhouse gases further.

To harmonize and improve the current laws and regulatory documents, the Government of Uzbekistan may consolidate and simplify the current legal documents into a single legal document by evaluating the possibilities of introducing new principles or adapting them to international standards. Since 2017, three strategic policies have determined the prospects, goals, final results, goals and objectives, strategic approaches and measures to achieve them, and policy directions that will be introduced into strategies for sectors and specific issues in Uzbekistan since 2017. the document was accepted.

The first of them is the Strategy of Actions for the further development of Uzbekistan in 2017-2021, which outlines the necessary systematic measures to mitigate the negative impact of global climate change and the drying up of the Aral Sea on the development of agriculture and the lifestyle of the population. However, the following two documents - the development strategy of New Uzbekistan for 2022-2026 and the strategy "Uzbekistan – 2030"- contain a hundred goals and about four hundred measures. It is the effective implementation of "green" technologies in the fields of economy, ecology and environmental protection; development of "green" energy; increase energy efficiency; introduction of monitoring and evaluation system in the field of "green" certification, environmental marking and social change; improvement of the ecological environment in cities and districts; Implementation of the nationwide project "Green Space"; covers the main issues related to increasing the area of

forests and strengthening their protection to reduce the negative impact and adapt to climate change.

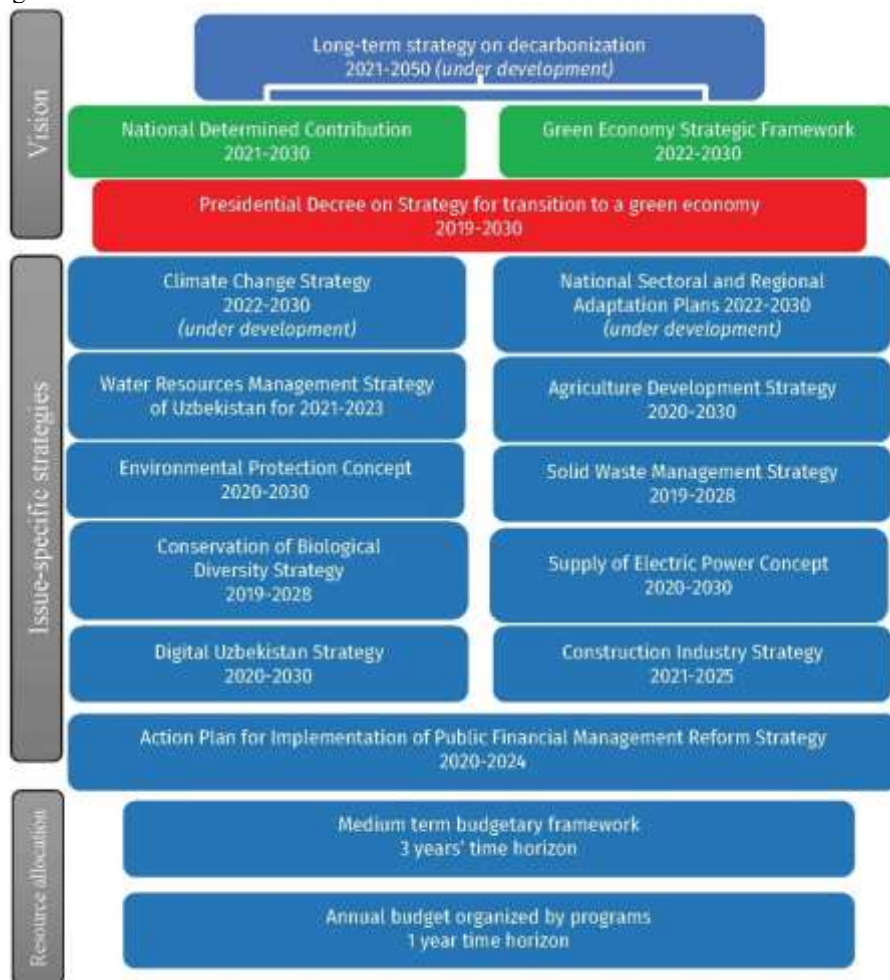


Fig. 1. National and sectoral planning of green growth and climate change policy [16]

Uzbekistan's climate change and green growth policy is guided by strategies combining long- and medium-term perspectives with more detailed plans (Figure 1). Conceptual documents adopted by the Government over the past few years include environmental protection until 2030 and the transition strategy to a “green” economy until 2030. Their main goal is to mitigate and adapt to the effects of climate change by reducing emissions and pollution, encouraging the rational use of water resources, supporting the introduction of environmentally friendly technologies, increasing renewable energy sources, increasing waste collection and removal services for the population, improving energy efficiency and is to reduce the use of carbohydrates.

The strategy for the transition to a “green” economy until 2030 defines the main directions of action by ensuring the fulfillment of the obligations of the Paris Agreement. The strategy includes electricity, thermal energy, oil and gas, chemical industry, renewable energy sources, building and construction materials, transport, water management, agriculture, forestry, regulation and processing of solid household waste, the introduction of “green” technologies, sets priorities in areas such as education, science, “green” economy and support

for the transition to “green” investments. Each region has its strategy and concept, which includes plans and actions to adapt to climate change and mitigate its effects.

Uzbekistan has taken steady steps towards a low-carbon economy but still has a long way to go. Uzbekistan's Nationally Determined Contributions aimed to mitigate the effects of climate change by reducing greenhouse gas emissions. Nationally Determined Contributions recognize the need for long-term structural reforms to transition to a low-carbon economy.

Table 1. Pollutants released into the atmosphere in the Republic of Uzbekistan (thousand tons).

Regions	Years						Changes in 2022 compared to 2017	
	2017	2018	2019	2020	2021	2022	+,-	%
Republic of Karakalpakstan	37,7	34,0	37,2	28,9	31,4	21	-16,7	55,7
regions:								
Andijan	15,8	15,9	14,3	11,5	4,9	17	+1,2	107,6
Bukhara	63,8	74,8	69,1	37,1	44,7	36	-27,8	56,4
Jizzah	5,2	11,8	4,3	3,4	2,9	27	+21,8	5,2 times
Kashkadarya	165,7	152,2	140,4	128,1	132,3	116	-49,7	70,0
New	44,1	49,9	43,6	48,4	68,6	42	-2,1	95,2
Namangan	15,9	15,2	15,8	15,0	23,9	7	-8,9	44,0
Samarkand	37,2	52,1	44,2	52,7	39,4	39	+1,8	104,8
Syrdarya	3,2	5,1	6,9	6,5	7,1	7	+3,8	2,2 times
Surkhandarya	59,6	60,5	47,8	71,8	45,7	49	-10,6	82,2
Tashkent	302,9	336,6	397,9	430,0	425,5	438	+135,1	144,6
Ferghana	60,1	53,2	49,6	50,5	46,5	49	-11,1	81,5
Khorezm	9,2	7,1	7,2	6,8	7,2	5	-4,2	54,3
Tashkent city	33,1	15,3	74,5	33,7	28,6	21	-12,1	63,4
TOTAL	853,5	883,7	952,8	924,4	908,7	874	+20,5	102,4

Source: Authors calculation based on the data of the Statistics agency under the president of the Republic of Uzbekistan / www.stat.uz

According to the data presented in Table 1, the volume of pollutants released into the atmosphere in the republic was 853.5 thousand tons in 2017. By 2022, this indicator has increased by 20.5 tons or 2.4%. Analyzing by regions, the increase of pollutants released into the atmosphere during 2017-2022 occurred the most in Jizzakh (2.2 times) and Syrdarya (2.2 times) regions. During these years, Andijan (+1.2 tons) and Samarkand (1.8 tons) regions accounted for the amount of pollutants released into the atmosphere.

According to this indicator, the share of the Tashkent region is the highest; it was 35.5% of the total in 2017 and 50.1% in 2022. As a result of the organization of ecological production in the rest of the republic and the introduction of waste-free innovative technologies into production processes, the amount of pollutants released into the atmosphere during 2017-2022 has decreased significantly. Effective measures to adapt to climate change can bring triple dividends to Uzbekistan. First, they will help prevent negative impacts such as land degradation caused by climate change. Secondly, the measures taken will lead to economic benefits, such as increased food security and improved health of natural landscapes. Thirdly, their implementation will lead to environmental benefits in reducing greenhouse gas emissions.

5 Conclusions

Economy-wide reforms: the current reform program should be accelerated to create an enabling business and investment environment, as well as conditions for the development of the private sector, which has a key role in the transition to a green economy. Establishing

monitoring, reporting, and impact assessment mechanisms to facilitate the implementation of climate and green projects is recommended. Developing a financial and investment regulation system will be a critical factor in attracting investment in environmentally sustainable projects. It is recommended to introduce market-based incentives to reduce emissions, including a carbon tax;

energy sector: The transition to a greener growth model and improved energy security in Uzbekistan requires widespread adoption of energy-efficient technologies, the elimination of subsidies for gas, electricity, and heating, as well as the use of gas primarily for power generation and the industrial sector. It is essential to continue developing a competitive renewable energy sector and invest in energy infrastructure development;

management of water resources and irrigation systems: to improve water resource management in Uzbekistan in changing conditions, widespread introduction of water-saving technologies is necessary; implementing agricultural policies that encourage climate change adaptation and mitigation measures, such as efficient use of water resources; transferring management of irrigation systems to the private sector; introduction of flexible water distribution mechanisms; further modernization of irrigation and drainage infrastructure, as well as water accounting systems;

agriculture and land management: to attract investment in climate-smart agriculture, it is essential to strengthen mechanisms to guarantee the rights of land tenants, including local farmers; improve soil conservation practices; scale up climate-smart agriculture; and also develop a clear road map supported by an investment plan, for the implementation of the above measures;

Improving air quality, urban development, and public transport: Uzbekistan will benefit significantly from developing a comprehensive program to enhance the quality of air, creating green master plans for cities, developing urban mobility plans, and improving the efficiency of public transport services. These measures will not only help reduce greenhouse gas emissions but will also contribute to the adaptation of cities to climate change;

human capital development: Uzbekistan needs to continue developing the national social protection system to ensure the interests of the most vulnerable groups in the face of risks associated with climate change. Improving citizens' basic and technical skills within the framework of education and retraining systems will prepare them for work in new areas of employment created within the framework of the green economy.

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