OVERVIEW OF CLEAN AIR ACTIONS IN KYRGYZSTAN 2018-2024

Report of the Working Group on Air Quality under the Development Partners Coordination Council

Bishkek, February 2025

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Content

The review was prepared at the initiative of the members of the working group on air quality within the Development Partners Coordination Council (DPCC)[1] in Kyrgyzstan to compile information on the actions of key partners to combat air pollution in Kyrgyzstan from 2018 to 2024. The review was based on the responses of key partners in the working group, findings of key air quality surveys in Bishkek conducted by development partners, and publicly available information. It is also based on the presentations and discussions at the national multi-stakeholder dialogue[2] "Clean Air Progress Review in Kyrgyzstan: Collaborating with Partners and Initiatives for Greater Impact" held in Bishkek on 26 February 2025 and organized by the Ministry of Natural Resources, Ecology and Technical Supervision of Kyrgyzstan in cooperation with the United Nations Environment Programme and Office of the United Nations Resident Coordinator in Kyrgyzstan.

In particular, the following organizations active in the field of air quality in Kyrgyzstan provided information for this review:

- ADB - Asian Development Bank
- WHO - World Health Organization
- UNECE - United Nations Economic Commission for Europe
- CCAC - Climate and Clean Air Coalition
- IOM - International Organization for Migration
- Institute of Science Tokyo
- OHCHR - Office of the High Commissioner for Human Rights
- Public Association "MoveGreen"
- UNEP - United Nations Environment Program
- UNICEF - United Nations Children's Fund
- GIZ - German Corporation for International Cooperation
- Airband Technologies
- WB - World Bank
- FMI - Finnish Meteorological Institute
- MFA - Ministry for foreign Affairs of Finland
- KOICA - Korea International Cooperation Agency

Please note that this document is an overview and not a full report or evaluation of the partners' activities. The review is designed to draw the attention of stakeholders involved in air quality issues in Kyrgyzstan to the main aspects of the air quality situation in the country and to consolidate partners' recommendations on air pollution control for decision makers.

The report was created with the support of UNEP.

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[1] http://www.donors.kg/en/about-us

[2] Posts about the dialogue on MNRETS website: https://mnr.gov.kg/en/posts/news/rabota-nad-ulucseniem-kacestva-vozduxa-eto-dolgosrocnyi-put-ministr-m-masiev-zaversilsya-mnogostoronnii-dialog-progress-po-cistomu-vozduxu-v-kyrgyzstane; https://mnr.gov.kg/en/posts/news/mezdunarodnyi-opyt-i-lucsie-praktiki-upravleniya-kacestvom-vozduxa-zagalovok; https://mnr.gov.kg/en/posts/news/pervaya-polovina-mnogostoronnego-dialoga-progress-po-cistomu-vozduxu-v-kyrgyzstane; https://mnr.gov.kg/en/posts/news/privodim-osnovnye-tezisy-vystupleniya-na-mnogostoronnem-dialoge-progress-po-cistomu-vozduxu-v-kyrgyzstane-ministra-m-masieva; https://mnr.gov.kg/en/posts/news/startoval-mnogostoronnii-dialog-progress-po-cistomu-vozduxu-v-kyrgyzstane

1. INTRODUCTION

1.1 Context of air pollution in Kyrgyzstan

The problem of air pollution in Kyrgyzstan, especially in the capital Bishkek, has become critical in the last decade. Rapid urbanization, active development of housing construction, increased use of private motor vehicles and expansion of urban areas with predominantly coal heating have created a set of serious environmental challenges that the city continues to face to this day.

The situation is particularly aggravated in winter, when unfavorable meteorological conditions combined with increased use of coal for heating lead to the formation of smog over the city. The geographical location of Bishkek in the intermountain basin aggravates the problem, creating conditions for the accumulation of pollutants in the surface layer of the atmosphere.

The Government of the Kyrgyz Republic recognizes the seriousness of the problem and is taking systematic steps to address it. The National Development Strategy for 2018-2040[3] and the National Development Program for 2022-2026[4] set the goal of creating a safe living environment. In 2021, the first Government Plan of Comprehensive Measures to Improve the Environmental Situation in Bishkek City, Alamedin and Sokuluk Districts for 2021-2023[5] was adopted, which was then updated in 2024 as the Plan of Priority Measures to Improve Air Quality in Bishkek City for 2024-2025.[6]

Between 2018 and 2024, the international community has also actively engaged in addressing air pollution in Kyrgyzstan. Leading international organizations, including the World Bank, Asian Development Bank, United Nations agencies and other development partners have been implementing a number of significant projects in the field of air quality monitoring, development of clean transport,

[3] http://donors.kg/en/strategy/5174-national-development-strategy-of-the-kyrgyz-republic-for-2018-2040
[4] https://www.fao.org/faolex/results/details/ru/c/LEX-FAOC208595/
[5] https://www.gov.kg/ru/post/s/utverzhden-plan-kompleksnykh-mer-po-uluchsheniyu-ekologicheskoy-situatsii-v-gorode-bishkek-i-sokulukskom-alamudunskom-rayonakh-chuyskoy-oblasti-na-2021-2023-gody
[6] https://www.gov.kg/ru/post/s/utverzhden-plan-kompleksnykh-mer-po-uluchsheniyu-ekologicheskoy-situatsii-v-gorode-bishkek-i-sokulukskom-alamudunskom-rayonakh-chuyskoy-oblasti-na-2021-2023-gody

energy efficiency and introduction of clean heating technologies.

A number of reputable international organizations have conducted large-scale studies, which for the first time provided a comprehensive scientifically based understanding of the situation.

While many countries worldwide, including those in Europe and the United States, exceed the new stringent WHO recommended standards for $PM_{2.5}$ concentrations, the air pollution levels in Bishkek, especially during winter, significantly exceed not only WHO[7] guidelines but also other international norms, such as US EPA and EU limit values for air quality.

In addition, it has been revealed that air pollution has a significant negative impact on both the health of the population and the country's economy. Children, the elderly and persons with chronic diseases are particularly vulnerable groups. Socio-economic impacts include increased health care costs, decreased labor productivity and deterioration in the quality of life of the urban population.

Addressing air pollution requires a further integrated approach and concerted action by all stakeholders. Despite the steps taken, the scale of the problem requires continued systemic efforts and significant investments in improving air quality, including in the medium and long term.

1.2 Objectives and methodology of the review

This document is a comprehensive review of the progress of implementation of air quality improvement measures in Kyrgyzstan for the period from 2018 to 2024. The main purpose of the document is to review the actions taken within the framework of government programs as well as development partners' projects, and synthesize policy recommendations.

The review includes analysis of achievements and problem areas in the implementation of the program, assessment of the effectiveness of interagency coordination, as well as examination of the results of interaction with international development partners. On the basis of the analysis, specific recommendations for further action are formulated, taking into account both international experience and the local context.

The methodology of the review is based on a comprehensive analysis of a wide range of sources. First of all, these are official documents of state bodies, including reports of the Ministry of Natural Resources, Ecology and Technical Supervision, data of Bishkek City Hall, reports of the Emergency Interdepartmental Commission on Air Pollution Problems on the implementation of government plans.[8]

A significant part of the analytical base consists of studies conducted by international organizations and scientists in 2021-2024. Each of these studies, using different methodological approaches and focusing on different aspects of the problem, contributed significantly to the formation of a holistic picture of the air pollution situation and consensus on the main sources of pollution. The studies pay special attention to the analysis of technical data from air quality monitoring systems, including readings from automatic stations, sensor networks, satellite data and dispersion modeling which has been used to assess air quality distribution patterns in Bishkek.

Certain methodological limitations were taken into account in the review. In particular, this concerns the comparability of data from different sources due to differences in measurement methodologies. A significant limitation is also the incompleteness of monitoring data for some periods and insufficient data coverage of regions outside the capital. In addition, there is limited information on specific economic sectors, which

[7] https://www.who.int/publications/i/item/9789240034228
[8] https://bishkek.gov.kg/ru/post/23257

makes it difficult to fully assess their impact on air quality.

1.3 Target Audience

This review is intended for a wide range of stakeholders involved in air quality issues in Kyrgyzstan. First of all, the document is aimed at decision makers in governmental bodies. These are heads and specialists of relevant ministries and agencies, representatives of local authorities and members of parliament responsible for the formation and implementation of environmental policy, including air quality management policy.

An important target audience is international development partners, including multilateral development banks, UN agencies,bilateral donors and cooperation agencies. For them, the review may serve as a tool to guide them on ongoing projects and prioritize areas for further support.

The document is also of value to civil society organizations, including environmental NGOs, which play an important role in monitoring the environmental situation and promoting environmental initiatives. The scientific community will find in the review a list of key studies on air quality in Bishkek over the past few years.

For the general public, including local communities and the media, the review provides comprehensive and reliable information on the current air quality situation and measures taken to improve it. It promotes public awareness and more active participation of citizens in addressing environmental issues.

2. OVERVIEW OF THE MAIN AIR QUALITY TRENDS (2018-2024)

Over the period 2018-2024, several large-scale air quality studies were conducted in Bishkek by international organizations and scientific institutions[9]. Analyzing the data from these studies allows us to form a comprehensive understanding of the dynamics of air pollution in the city.

2.1 Dynamics of particulate matter concentrations PM2.5

Multiple studies have provided comprehensive data on $PM_{2.5}$ concentrations in Bishkek between 2018-2024, revealing a consistent pattern of elevated pollution levels.

The UNDP/UNEP study (2022)[10] analyzing data from 2015-2021, found significant air quality concerns across Bishkek. Through an examination of monitoring data and emissions analysis, the study revealed consistent exceedances of international air quality standards, with average $PM_{2.5}$ concentrations around 30 μg/m³. A World Bank study (2023)[11], employing advanced chemical transport modeling and comprehensive emissions data analysis, documented annual $PM_{2.5}$ concentrations of approximately 51 μg/m³.

Research by Tursumbayeva et al. (2023)[12], utilizing hourly measurements from reference-grade monitoring stations, reported annual average $PM_{2.5}$ concentrations of 36 μg/m³ in 2021. These findings are particularly significant when compared to the WHO air quality guideline of 5 μg/m³ for annual mean $PM_{2.5}$ concentrations. The consistency across multiple independent studies, despite different methodological approaches, confirms that Bishkek's air quality exceeds this health-based standard by approximately 6-10 times, representing a substantial public health challenge.


Source: ru.sputnik.kg

[9] See the list of studies at the end of the review
[10] UNDP and UNEP, 2022. Air Quality in Bishkek: Assessment of Emission Sources and Road map for Supporting Air Quality Management. Available at: https://wedocs.unep.org/handle/20.500.11822/41090
[11] WB, 2023. Air quality analysis for Bishkek PM2.5 Source Apportionment and Emission Reduction Measures, 5 page https://documents1.worldbank.org/curated/en/099110123211021470/pdf/P17087000827dd04e09d6a0d01dc0ab3c41.pdf
[12] Tursumbayeva et. al, 2023. Cities of Central Asia: New hotspots of air pollution in the world. In: Atmospheric Environment. Available at: https://www.sciencedirect.com/science/article/abs/pii/S1352231023003278

All studies note a pronounced seasonal dynamics of pollution. According to UNICEF (2023)[13] and IOM study (2023),[14] during winter months (December-January) $PM_{2.5}$ concentrations reach peak values of 150-220 μg/m³. According to ADB reports (2023)[15] and a joint UNDP and UNEP study (2022)[16] concentrations decrease to minimum values of 24-28 μg/m³ during the summer months (June- August).

The World Bank study (2023) and the Health Effects Institute report (2024)[17] note significant spatial heterogeneity of pollution. There is a steady tendency of higher concentrations in the northern districts of the city, where the indicators can exceed the average city values by 3-4 times. According to experts, this is due to the prevalence of the private sector with stove heating and terrain peculiarities.

2.2 Sources of pollution

The analysis of pollution sources shows some discrepancies in the estimates of different studies. The World Bank (2023) estimates the contribution of residential heating to $PM_{2.5}$ pollution at 29%, while the ADB study (2023) indicates 47%. The analysis of pollution sources reveals different estimates that can be explained by distinct methodological approaches, some of them focusing on total emission volumes and others analyzing ground-level pollution at breathing height. When using and comparing numbers, is also important to note the difference between the emissions (total emissions by each emission source) or the impact of different emission sources to air quality and pollutant concentrations in breathing/ground level.[18]

The transport sector is estimated by different studies to contribute between 27% and 33% of total $PM_{2.5}$. Health Effects Institute (2024) notes that nitrogen dioxide (NO_2, a key indicator of transport pollution) concentrations in Bishkek are relatively high compared to other Central Asian cities.

According to the World Bank (2023) wind-borne dust makes a significant contribution to pollution, accounting for 21% of the total pollution in $PM_{2.5}$. Emissions from Central Heating Plant and and heat boilers, according to the same study, account for 11%[19] of the total pollution.

Despite differences in quantitative estimates, all studies unanimously identify four main sources of air pollution in Bishkek: heating of residential buildings, especially those not connected to central heating; the transport sector; Central Heat and Power Plant and boiler house; and wind-blown dust.

It is important to note that different pollutants have different effects on human health. Particularly dangerous are fine $PM_{2.5}$ particles, which can penetrate deeply into the respiratory tract and bloodstream, and NO_2, which has a serious impact on the respiratory system. This points to the need to prioritize measures to reduce emissions of the most health-hazardous pollutants when developing comprehensive solutions to improve air quality.

2.3 Meteorological factors

Researchers pay special attention to meteorological factors which have a strong impact on air quality as they set the conditions how well and effectively the emissions are dispersed and mixed in the air. In winter in Bishkek extremely unfavorable conditions for dispersion of pollutants are formed: the average wind speed is only 2.2 m/s, and the height of the mixing layer can be as low as 100-200 meters, which is much lower than in other cities of the region. The frequent occurrence of temperature inversions creates a “dome” effect that prevents the dispersion of pollutants in the atmosphere.

[13] HEALTH AND SOCIAL IMPACTS OF AIR POLLUTION ON WOMEN AND CHILDREN IN BISHKEK, KYRGYZSTAN EXECUTIVE SUMMARY November 2022 https://www.unicef.org/kyrgyzstan/media/8116/file/Executive%20Summary%20of%20Air%20Pollution%20report.pdf

[14] IOM, 2022. Air Pollution and Its Health Impacts and Internal Migrants in Bishkek – Assessment Report. Available at: https://publications.iom.int/books/air-pollution-and-its-health-impacts-internal-migrants-bishkek-kyrgyzstan-assessment-report

[15] ADB, 2023. Bishkek Clean Air Action Plan. Available at: https://www.adb.org/projects/documents/reg-53212-001-tacr

[16] UNDP and UNEP, 2022. Air Quality in Bishkek: Assessment of Emission Sources and Road map for Supporting Air Quality Management. Available at: https://wedocs.unep.org/handle/20.500.11822/41090

[17] Health Effects Institute. 2025. Trends in Air Quality and Health Impacts: Insights from Central, South, and Southeast Asia. https://www.stateofglobalair.org/resources/report/trends-air-quality-and-health-impacts-insights-central-south-and-southeast-asia

[18] For example, energy production has high total emissions, but not as big an impact to air quality at ground level as emissions from traffic and domestic heating by coal have, as they are released to air at the human breathing level. Emissions released through high stacks typically disperse well, and impact to the breathing level concentrations is not that large, depending on the height of the stack.

[19] WB, September 2023. Air Quality Analysis in Bishkek: PM2.5 source apportionment and emission reduction measures: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099110123211021470/p17087000827dd04e09d6a0d01dc0ab3c41

2.4 Health and Economic Impacts

According to the 2022-2024 studies, the health and economic impacts of air pollution in Kyrgyzstan are more severe than previously thought. UNICEF in its 2023 study estimates 112 deaths and 3,568 lost disability adjusted life years (DALYs)[20] over the 2021-2022 period alone. Based on the estimate, children represented 22% of disease burdens attributable to $PM_{2.5}$ air pollution exposures in 2021 and efforts to reduce exposures during pregnancy and in the first year of life should be a high priority. A larger UNEP/UNDP assessment (2022) estimated total air pollution-related deaths of 4,100- 5,000 annually.[21]

An economic analysis by the World Bank (2023) estimates air pollution damages at 1.2% of a country's GDP. Studies by UNICEF and ADB (2023) provide similar estimates - about 20 million USD annually. The IOM study (2023) found that every third respondent notes health problems related to air pollution.

The gender dimension of air pollution exposure deserves special attention. The UNICEF study (2023) found that maternal exposure to air pollution during pregnancy significantly increases risks of adverse birth outcomes. The study emphasizes that pregnant women and young children are particularly vulnerable groups, requiring special protection from air pollution's harmful effects.

2.5 Socio-economic and infrastructural aspects

Studies have found a significant correlation between income level and type of heating. According to IOM (2023), 40% of low-income households use coal stoves, compared to only 17% of high-income households.

An infrastructure analysis by ADB (2023) showed that only 50% of the population is connected to district heating networks, about 10% to heating boilers, and the remaining 40% use individual heating systems. Meanwhile, the UNICEF (2023) study revealed serious problems with the energy efficiency of buildings: 59% of houses lack wall insulation, 56% lack roof insulation, and the problem is particularly acute in low-income neighborhoods.

2.6 Development of monitoring systems

There has been significant progress in air quality monitoring. While in 2018 there was only one automatic station of Kyrgyzhydromet, by 2024 the monitoring network has significantly expanded to include 50 Clarity sensors, 47 BlueSky sensors (of which 10 are indoor), 24 AirKaz sensors, 8 Purple Air sensors and 2 reference stations (Kyrgyzhydroment and US Embassy in Bishkek). According to the experts of the Health Effects Institute (2024), this expansion of the monitoring network allows to obtain more accurate data on the spatial distribution of pollution and better understand the dynamics of air quality changes in the city.

Significant changes in the air quality monitoring system occurred after the adoption of the Regulation on the Order of Implementation of Hydrometeorological Activities (Decree of the KR CM No. 592 dated November 15, 2023).[22] This regulation established the requirement for registration in the State Register of Hydrometeorological Information Producers and obligatory data transfer to the Data Fund of Kyrgyzhydromet. As a result, there was a significant reduction in the number of active low-cost sensors in the 2024-2025 heating season. The MoveGreen, one of the leaders in civil monitoring using low-cost sensors in Kyrgyzstan, dismantled all of its sensors in June 2024 for certification, and by December 2024, 24 sensors had been submitted for inclusion in the

[20] UNICEF, April 2023. Health and social impacts of air pollution on women and children in Bishkek, Kyrgyzstan at: https://www.unicef.org/kyrgyzstan/media/8101/file/Air%20pollution%20report.pdf, p.14.

[21] Institute for Health Metrics and Evaluation (IHME), 2022. Available from https://vizhub.healthdata.org/gbd-results/.

[22] Decree of the Cabinet of Ministers of the Kyrgyz Republic dated November 15, 2023 No. 592 On approval of the Regulation on the procedure for carrying out hydrometeorological activities, formation and maintenance of the State Register of hydrometeorological information producers https://base.spinform.ru/show_doc.fwx?rgn=154618

Kyrgyzhydromet registry. In the same month, the Ministry of Natural Resources Ecology and Technical Supervision of the Kyrgyz Republic conducted raids among individuals and organizations with low-cost sensors, revealing inconsistencies in the installation and operation of the equipment.[23] As a result of the inspections, 7 sensors were dismantled.[24] By February 2025, the number of low-cost sensors displayed on the popular website iqair.com was reduced to 10 sensors with data provided by individuals and organizations. The number of functioning Clarity NodeS sensors of Kyrgyzhydromet also decreased to 10 units, their data became available only on the Openmap Clarity platform[25] and the official Kyrgyzhydromet's website.[26]

[23] https://mnr.gov.kg/en/posts/news/ministerstvo-prirodnyx-resursov-ekologii-i-texniceskogo-nadzora-kr-vyyavilo-naruseniya-v-rabote-priborov-dlya-izmereniya-kacestva-atmosfernogo-vozduxa-v-g-biskek

[24] https://mnr.gov.kg/en/posts/news/prinimaemye-mery-po-ulucseniyu-kacestva-vozduxa-v-biskeke

[25] https://openmap.clarity.io/

[26] https://meteo.kg/ru/air-quality

3. OVERVIEW OF AIR QUALITY STUDIES

In the period 2022-2024, the problem of air pollution in Bishkek attracted unprecedented attention from the international community. A number of reputable international organizations conducted large-scale studies that for the first time provided a comprehensive understanding of the situation based on scientific data.

In the summer of 2021, **the American University of Central Asia** and **the OSCE Academy** conducted a study entitled **"Smog in Bishkek: Myths and Reality".**[27] An analysis of extreme cases of $PM_{2.5}$ pollution for 2019-2021 found 49 cases exceeding the 500 μg/m³ threshold, with a sharp increase from 4 cases in 2019 to 40 in January 2021. The study established a direct link between temperature inversion and cases of extreme pollution, identifying the main sources of pollution: households and buildings without central heating (with a 22% increase in emissions from coal over six years), CHP plants and motor vehicles. Rakhat Sabyrbekov, based on data collected and analyzed by AUCA, conducted calculations and found that the annual economic cost of air pollution in Bishkek ranges from 0.4% to 2.6% of GDP.

In January 2022, the **Institute of Mountain Communities Research at the University of Central Asia,** together with **Kyrgyzhydromet,** published a study on **"Impact of Climate Change and Air Pollution Forecasting Using Machine Learning Techniques in Bishkek".**[28] Using advanced machine learning techniques and analysis of 16 synoptic atmospheric processes for 2016-2020, the researchers found a significant increase in atmospheric stability and frequency of temperature inversions from 2015 to 2020. Of particular value is the identified pattern that 80-90% of days with temperature inversions occur during the heating season, and their number has doubled over the past 5 years. The study is unique in that it used the COVID-19 lockdown period (March-May 2020) as a natural experiment to assess the contribution of transportation to air pollution. The results showed a significant decrease in pollutant concentrations compared to 2019: CO by 64%, NO_2 by 75%, CO_2 by 24%, and $PM_{2.5}$ by 54%, strongly demonstrating the significant role of motor vehicles in the city's air pollution.

UNDP and **UNEP** in October 2022 presented the first comprehensive study "**Air Quality in Bishkek: Assessment of Emission Sources and Road map for Supporting Air Quality Management"**.[29] Based on analysis of 2015-2021 monitoring data of Kyrgyzhydromet automatic air quality station, development of emission inventories and pollutant dispersion modeling, the study developed three scenarios for air quality improvement until 2040. Without action, $PM_{2.5}$ emissions are projected to increase by 60 percent, NOx by 63 percent, and SO_2 by 50 percent. The moderate scenario, which includes partial conversion of CHP to gas and modernization of the vehicle fleet, would reduce $PM_{2.5}$ emissions by 30%. The active scenario envisions more radical changes that could reduce $PM_{2.5}$ emissions by 50%.

The International Organization for Migration (IOM) presented a study of the social aspects of the problem in March 2023 in **"Air pollution and its impact on the health of internal migrants in Bishkek".**[30] Covering 25 residential areas on the outskirts of the city, the study included a survey of 615 households and a series of focus groups with 250 participants. The results showed that $PM_{2.5}$ concentrations during the heating season exceed the norm by 2-3.3 times, largely due to the use of coal for heating and insufficient infrastructure development. The study also revealed that about 30% of migrants interviewed reported

[27] AUCA, OSCE Academy (2021). "Smog in Bishkek: Myths and Reality". Available at: https://auca.kg/uploads/Tian%20Shan%20Policy%20Center/TSPC%20News/AQ-AUCA-Report_final.pdf

[28] IMCR UCA (2022). "Impact of Climate Change and Air Pollution Forecasting Using Machine Learning Techniques in Bishkek". Available at: https://aaqr.org/articles/aaqr-21-11-covid2-0336.pdf

[29] https://wedocs.unep.org/handle/20.500.11822/41090

[30] IOM, 2022. Air Pollution and Its Health Impacts and Internal Migrants in Bishkek – Assessment Report. Available at: https://publications.iom.int/books/air-pollution-and-its-health-impacts-internal-migrants-bishkek-kyrgyzstan-assessment-report

a deterioration in health after moving to these areas, indicating a serious impact of air quality on the health of the most vulnerable population groups. The study also found that about 30% of interviewed migrants reported a deterioration in health after moving to these areas, indicating a serious impact of air quality on the health of the most vulnerable populations.

UNICEF in April 2023 presented a detailed analysis of the impact of pollution on vulnerable populations in the study **"Health and Social Impacts of Air Pollution on Women and Children in Bishkek, Kyrgyzstan".**[31] The study, coupled with three policy briefs, presented a detailed analysis of the situation based on an integrated approach including a rapid situational analysis, air pollution measurements, city-wide air quality assessment and economic analysis. Based on a survey of 1,007 households, the study found a fourfold difference in pollutant concentrations between the city's neighborhoods, with the highest levels in the northern neighborhoods. Drawing on the analysis, the study shows that air pollution is the single biggest environmental risk factor for premature death and ill-health in Kyrgyzstan, with ill health due to $PM_{2.5}$ air pollution primarily borne by the elderly and young children in the first days of life. The study also provided some adaptation measures and recommendations: For instance, increasing the education about the health impacts of air pollution in schools and for professional groups such as teachers in training colleges and medical professions can play a significant role in delivering messages in hard-to-reach populations.

The Asian Development Bank (ADB) developed the **Bishkek Clean Air Action Plan**[32] in August 2023. The plan proposes a comprehensive approach with implementation of 11 priority actions over 10 years, including measuring and controlling emissions, switching to cleaner fuels, modernizing public transport, improving insulation of housing, and developing active mobility. Special attention is paid to creating economic incentives for the introduction of clean technologies. The total cost of implementing all proposed measures is estimated at more than $450 million, with the largest project being the improvement of building insulation ($375 million). The plan also emphasizes the need to improve interagency coordination, develop monitoring systems and raise public awareness for successful implementation of the proposed measures.

The World Bank presented a technical study in September 2023: **"Air Quality Analysis for Bishkek - $PM_{2.5}$ Source Apportionment and Emission Reduction Measures".**[33] For the first time, a dynamic emissions map was created in combination with three-dimensional meteorological data.

The World Bank study clearly demonstrated that achieving WHO-recommended air quality indicators (annual average $PM_{2.5}$ concentration of 5 μg/m³) requires a significant reduction in current pollution levels in Bishkek, where the annual average $PM_{2.5}$ concentration is 51.4 μg/m³. Modeling showed that no single sector or measure can provide the necessary emission reductions. For example, even the most effective single measure - a complete transition to clean heating in the residential sector - only reduces $PM_{2.5}$ concentration by 29%. Similarly, a complete transition to zero-emission transport provides a 27% reduction.

The study showed the necessity of simultaneous implementation of measures across all key sectors: transition to clean heating and improving energy efficiency in the residential sector, modernization of the transport system, transition of combined heat and power plants (CHPs) and boiler houses to cleaner fuels, as well as dust suppression and urban greening measures in city

[31] "Health and Social Impacts of Air Pollution on Women and Children in Bishkek, Kyrgyzstan" https://www.unicef.org/kyrgyzstan/media/8101/file/Air%20pollution%20report.pdf

[32] Bishkek Clean Air Action Plan https://www.adb.org/sites/default/files/project-documents/53212/53212-001-tacr-en_0.pdf

[33] Air Quality Analysis for Bishkek - PM2.5 Source Apportionment and Emission Reduction Measures https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099110123211021470/099110123211021470

management.[34] Importantly, many measures provide synergistic effects - for example, the transition to cleaner fuels in both the residential sector and energy sector not only reduces $PM_{2.5}$ emissions but also reduces CO_2 emissions, contributing to climate goals. It was also noted that implementing a comprehensive approach requires coordination between various departments, significant investments, and phased implementation of measures considering their effectiveness, cost, and social implications.

A critical academic analysis of existing approaches to pollution assessment is presented in **the study by M. Tursumbayeva et al. (2023) "Cities of Central Asia: New hotspots of air pollution in the world"**[35] in the Atmospheric Environment journal. The study emphasizes the need to revise the emissions inventory methodology in Bishkek and other Central Asian cities. The authors indicate that the current methodology, which sums all pollutants without considering their toxicity, leads to incorrect conclusions about the contribution of various sources and, consequently, to ineffective measures for improving air quality. Key recommendations of the study include: implementing separate emission assessments for each pollutant, prioritizing measures to reduce coal use, installing continuous emission monitoring systems at major sources, conducting scientifically-based research to determine $PM_{2.5}$ sources, and modernizing cleaning systems at CHPs. The study emphasizes the need to improve inter-agency coordination and use a comprehensive approach to air quality management based on scientific data.

Continuing with practical recommendations, in November 2023, **the ADB** released an analytical brief **"Tackling Air Pollution in Bishkek: A Road Map to Cleaner Air"**[36] prepared in collaboration with a wide range of international organizations, including UNEP, UNDP, IOM, the Finnish Meteorological Institute, UNICEF, GIZ, and WHO. The distinctive feature of this document lies in its inter-agency nature and comprehensive approach to situation assessment. The document presents specific sectoral recommendations covering both technical solutions (expansion of district heating, implementation of heat pumps) and measures for developing urban mobility and improving the air quality management system. Special attention was paid to financing opportunities for the proposed measures through international climate funds and carbon credits, highlighting the connection between air quality improvement and climate goals.

Regional data is presented in **the Health Effects Institute's** January 2025 report **"Air Quality and Health Impact Trends: Findings from Central, South, and Southeast Asia."**[37] The analysis showed that air pollution is among the top three mortality risk factors in the country, alongside high systolic blood pressure, dietary risks, tobacco, and high cholesterol. For every 100,000 population, there are 56 deaths related to air pollution – one of the highest rates in the region. Of particular concern is the fact that 27% of the population lives in areas where $PM_{2.5}$ levels exceed even the least stringent WHO interim target. The report also notes a positive trend: in 2021, a comprehensive Regional Strategy for Sand and Dust Storm Management in Central Asia for 2021- 2030 was developed, aimed at reducing the vulnerability of countries and communities to the impact of these natural phenomena.

The series of studies from 2022-2024 has created a solid knowledge base about the air pollution problem in Bishkek. Despite differences in methodological approaches and research focus, they all point to the critical need for comprehensive measures to improve air quality. The multilateral coverage of the problem is

[34] This study alone cites a figure of 21% of air pollution from wind-blown dust, but this has not been confirmed by other works.
[35] Cities of Central Asia: New hotspots of air pollution in the world https://www.sciencedirect.com/science/article/abs/pii/S1352231023003278
[36] Tackling Air Pollution in Bishkek: A Road Map to Cleaner Air https://www.adb.org/publications/tackling-air-pollution-bishkek-road-map-cleaner-air
[37] "Trends in air quality and health impacts: insights from Central, South and South-East Asia" https://www.stateofglobalair.org/sites/default/files/documents/2025-01/soga-asia-report.pdf

particularly valuable: from technical aspects to social impact, from short-term measures to long-term strategies. The consistency of conclusions from various organizations about key pollution sources and necessary measures creates a reliable foundation for management decisions. Meanwhile, the diversity of proposed approaches to solving the problem allows for selecting the most effective combination of measures, taking into account the local context and available resources.

4. REVIEW OF CLEAN AIR ACTIONS

4.1. Institutional Structure and Governance

In the Kyrgyz Republic, responsibility for air quality is distributed among several key government bodies. The **Ministry of Natural Resources, Ecology and Technical Supervision (MNRETS)** is the main executive body in the field of environmental protection, ecology and climate. In accordance with current regulations, the ministry is responsible for developing and implementing state policy in these areas.

In the field of air protection, MNRETS performs a wide range of functions. The ministry develops regulations and strategic documents, conducts environmental assessments, approves emission standards for pollutants and issues relevant permits. Another function authorized by the Ministry is the implementation of projects, including investment projects, to improve air quality and environmental protection. An important part of the work is maintaining the state inventory of emissions and administering payments for them. The ministry also monitors compliance with standards and other requirements of legislation in the field of air protection.

In addition to MNRETS, several state bodies are responsible for ensuring air quality and its safety for citizens and the environment in the Kyrgyz Republic, each within their established powers, including:

The **Hydrometeorological Service under the Ministry of Emergency Situations (Kyrgyzhydromet)** plays a key role in the air quality monitoring system. The organization conducts regular measurements of atmospheric pollution, analyzes the data obtained and publishes quarterly bulletins. Kyrgyzhydromet's functions also include forecasting extreme situations and maintaining a state database on air pollution.

The **Ministry of Energy**, while not directly involved in monitoring atmospheric conditions, has a significant impact on air quality through energy sector management. Its responsibilities include developing clean energy policies, regulating energy enterprises, implementing energy-efficient technologies and participating in air pollution reduction programs through modernization of energy infrastructure.

The **Ministry of Health** performs an important function in assessing the impact of air quality on public health. It analyzes data on air pollution and its health effects, especially in cities with high pollution levels like Bishkek. The Ministry conducts monitoring of pollution-related illnesses, including respiratory and cardiovascular diseases. Based on the data obtained, recommendations are developed for the population, with special attention to vulnerable groups. It also regulates hygienic standards for indoor air quality.

The **Ministry of Education and Science** can play an important role in increasing climate change education in curriculum and extracurricular activities that can help teachers and students to better understand climate change, environmental health and impacts of air pollution in schools and teacher training colleges. This is envisaged to help children and young people to take locally relevant climate action and deliver messages to hard-to-reach populations.

The **Ministry of Culture, Information, Sports and Youth Policy** is an important government entity to create opportunities for young people to engage in climate actions in line with national

priorities, together with other ministries and stakeholders.

Local self-government bodies also play a significant role in ensuring air quality. They carry out state powers in the field of environmental protection in their jurisdictions and participate in the development of environmental programs. An example of effective work at the local level is the Environmental Councils in Bishkek and Osh, which unite representatives of state and municipal bodies, public organizations, educational institutions and the expert community.

A significant step in developing the institutional structure was the Cabinet of Ministers' decision to transfer the Ministry of Natural Resources' air protection powers to Bishkek City Hall for two years starting January 1, 2024.[38] Now the capital's city hall is authorized to monitor compliance with regulations, standards, rules and other requirements for air protection, including control over the commissioning of transport within the city.

4.2. Strategic Documents and Commitments

Kyrgyzstan actively participates in international agreements and initiatives on air protection and climate change mitigation. The country joined the **UN Framework Convention on Climate Change (UNFCCC)**[39] in 2000, committing to stabilize greenhouse gas concentrations in the atmosphere and promote sustainable development. Under the convention, Kyrgyzstan regularly develops national emission reduction programs and provides reports on achieved results.

In 2003, the country took another important step by joining the **Kyoto Protocol.**[40] This agreement provides mechanisms for reducing greenhouse gas emissions, including emissions trading and joint implementation projects. Kyrgyzstan, as a country with a transition economy, gained the opportunity to participate in these mechanisms, which opened additional opportunities for attracting resources for environmental projects.

Joining the **Paris Agreement**[41] in 2016 became a significant stage in Kyrgyzstan's international climate policy. The agreement aims to keep the rise in global average temperature below 2°C, and ideally 1.5°C, compared to pre-industrial levels. Under these commitments, Kyrgyzstan presents Nationally Determined Contributions (NDCs), which specify concrete targets for emission reductions and climate change adaptation, particularly in key economic sectors - energy, transport, and agriculture.

At the regional level, Kyrgyzstan develops cooperation with other Central Asian countries within the framework of the UNECE **Convention on Long-range Transboundary Air Pollution (CLRTAP),**[42] which Kyrgyzstan has been a Party to since 2000. The Convention fosters exchange of experience, implementation of joint projects, and regular reporting on emissions.

At the national level, the main legislative act is the **Law of the Kyrgyz Republic "On Air Protection",**[43] adopted in 1999. The law regulates issues of emission reduction and air quality control. In parallel, the country develops sustainable development strategies and stimulates the implementation of renewable energy sources to reduce dependence on coal and other polluting energy sources.

4.3. Air Quality and the Sustainable Development Goals in Kyrgyzstan

Kyrgyzstan is a signatory to the **2030 Agenda for Sustainable Development**,[44] which includes the **United Nations' 17 Sustainable Development Goals (SDGs)**. These goals are designed to

[38] https://24.kg/obschestvo/287900_munitsipalnaya_inspektsiya_bishkeka_zachem_eepridumali_ichem_ona_zanimaetsya_/
[39] https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
[40] https://unfccc.int/resource/docs/convkp/kprus.pdf
[41] https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_russian_.pdf
[42] https://treaties.un.org/doc/Treaties/1979/11/19791113%2004-16%20PM/Ch_XXVII_01p.pdf
[43] https://cbd.minjust.gov.kg/216/edition/10665/ru
[44] https://sdgs.un.org/2030agenda

address global challenges such as poverty, inequality, and environmental degradation, emphasizing the interconnectedness of economic, social, and environmental well-being. Among these challenges, air pollution is a critical issue that affects multiple SDGs, making clean air initiatives essential for sustainable development in the country.

Improving air quality directly contributes to **SDG 3 (Good Health and Well-Being)** by reducing respiratory and cardiovascular diseases, leading to lower global mortality rates, particularly among children aged under five. This, in turn, enhances labor productivity, supporting **SDG 8 (Decent Work and Economic Growth),** and improves educational outcomes, aligning with **SDG 4 (Quality Education).** Additionally, efforts to reduce particulate matter pollution are crucial for **SDG 11 (Sustainable Cities and Communities),** while transitioning to sustainable energy sources advances **SDG 7 (Affordable and Clean Energy).** Indirectly, clean air policies contribute to **SDG 2 (Zero Hunger)** by mitigating ozone pollution that affects crop yields, thereby enhancing food security. Moreover, reducing air pollution helps achieve **SDG 10 (Reduced Inequalities)** and **SDG 5 (Gender Equality),** as vulnerable populations- such as children, women, and the elderly- are disproportionately affected. Since air pollution and climate change largely result from fossil fuel combustion, tackling air quality also advances **SDG 13 (Climate Action)** by promoting clean energy solutions and sustainable urban development.[45]

For air quality, two key SDGs are particularly relevant for reporting: **SDG 3 (Good Health and Well-Being)** and **SDG 11 (Sustainable Cities and Communities).** SDG 3 includes **Target 3.9,** which aims to substantially reduce deaths and illnesses caused by hazardous chemicals and air, water, and soil pollution by 2030. A global indicator, **3.9.1 (Mortality rate attributed to household and ambient air pollution),**[46] is included in Kyrgyzstan's indicator list, but its methodology for getting in-country data has yet to be developed. Kyrgyzstan has an additional national indicator, **3.9.1.1 (Mortality from carbon monoxide toxicity per 100,000 population),**[47] to track air pollution's health impacts.

Meanwhile, **SDG 11 (Sustainable Cities and Communities)** includes **Target 11.6,** which focuses on reducing cities' per capita environmental impact, particularly in air quality and waste management. The relevant indicator, **11.6.2 (Annual mean levels of fine particulate matter such as $PM_{2.5}$ and PM_{10} in cities, population-weighted),**[48] also lacks[49] a developed methodology in Kyrgyzstan.

Under the 2030 Agenda, Kyrgyzstan is required to report progress on SDGs at least every five years through a **Voluntary National Review (VNR)**. The most recent VNR,[50] published in **2020**, included only limited references to air quality. A new review is expected in **2025**, which presents an opportunity for a more comprehensive assessment of air pollution's impact and mitigation efforts in the country.

4.4. National Strategies and Programs

Air protection in the Kyrgyz Republic is regulated by national legislation. Article 49 of the **Constitution of the Kyrgyz Republic** guarantees every citizen the right to a favorable ecological environment while simultaneously imposing an obligation to protect nature.

Within the framework of the **National Development Strategy for 2018-2040**[51] and the **National Development Program until 2026**[52] Kyrgyzstan aims to create a safe living environment by 2040. This includes protecting the population from negative impacts, including

[45] https://www.cleanairfund.org/news-item/sustainable-development-goals/
[46] https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/indicator-3.9.1-mortality-rate-attributed-to-household-and-ambient-air-pollution
[47] https://sustainabledevelopment-kyrgyzstan.github.io/3-9-1-1/
[48] https://www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5
[49] https://sustainabledevelopment-kyrgyzstan.github.io/11-6-2/
[50] https://hlpf.un.org/sites/default/files/vnrs/2021/26459VNR_2020_Kyrgyzstan_Report_English.pdf
[51] https://cbd.minjust.gov.kg/430002/edition/1095562/ru
[52] https://www.gov.kg/ru/programs/16

environmental ones, through the implementation of early warning principles about risks and threats.

A significant step forward was the adoption in 2021 of the first **Government Plan of Comprehensive Measures to Improve the Environmental Situation in Bishkek, Alamudun and Sokuluk Districts for 2021-2023**.[53] The plan included 43 specific measures across various areas: planning and urban development, green space development, waste management, heating and thermal supply, public transport and urban mobility, as well as air quality monitoring and control activities.

In 2024, the plan was updated and adopted as the **Priority Measures Plan for Improving Air Quality in Bishkek for 2024-2025**.[54] The new version contains 32 points focused on key areas: heat and power supply and fuel quality, construction and design, gasification, transport infrastructure, information and educational activities, greening, control and monitoring, and solid waste management.

To ensure effective implementation of the plan, an **Interdepartmental Commission**[55] was created under the chairmanship of the Minister of Natural Resources, Ecology and Technical Supervision. The Deputy Chairman of the commission is the Vice Mayor of Bishkek for the housing and communal services sector. The commission includes representatives of all relevant ministries and state agencies at the level of deputy heads, ensuring a high level of interdepartmental coordination and operational decision-making. The commission conducts regular monitoring of plan implementation with quarterly reports.

4.5. Measures Implemented by the Government of the Kyrgyz Republic

According to the quarterly report of the Interdepartmental Commission on the implementation of the Government Plan, presented to the Presidential Administration in February 2025, significant progress has been made in implementing the planned measures. During the reporting period, the Interdepartmental Commission held more than 20 meetings, demonstrating a systematic approach to addressing air pollution.

Kyrgyzhydromet under the Ministry of Emergency Situations of the Kyrgyz Republic plays a key role in monitoring air quality in the country. The organization's monitoring system is based on a traditional network of 14 observation posts located in key cities - Bishkek, Osh, Kara-Balta, Tokmok, and Cholpon-Ata. Of these posts, 13 use manual sampling methods, one station is equipped with an automatic system that meets EU standards. In 2020, Kyrgyzhydromet received 50 low-cost Clarity NodeS sensors from the Asian Development Bank. Data from these sensors is published in real-time on the official Kyrgyzhydromet web portal (www.meteo.kg) and other international platforms.

The Ministry of Health of the Kyrgyz Republic established an interagency working group which, with support from international experts and partners, developed a methodology for calculating the Air Quality Index (AQI) for Kyrgyzstan. The methodology is based on recommendations from the US Environmental Protection Agency and has been adapted to local conditions. As a result of the group's work, a unified scale was created to assess air quality based on $PM_{2.5}$ and PM_{10} concentrations, including four pollution categories with corresponding color coding and recommendations for the public. This methodology standardizes the approach to

[53] https://www.gov.kg/ru/post/s/utverzhden-plan-kompleksnykh-mer-po-uluchsheniyu-ekologicheskoy-situatsii-v-gorode-bishkek-i-sokulukskom-alamudunskom-rayonakh-chuyskoy-oblasti-na-2021-2023-gody
[54] https://cbd.minjust.gov.kg/57-19094/edition/3149/ru
[55] https://cbd.minjust.gov.kg/219631/edition/1260561/ru

informing the population about health risks from air pollution and facilitates evidence-based decision making at both government and individual levels.

In the area of gasification and heating, in cooperation with "Gazprom Kyrgyzstan," 23,127 houses in 52 residential areas of Bishkek were connected to natural gas. As of 2024, 49 settlements have been gasified, covering over 52,000 households, with more than 37,000 homes (71%) successfully connected to the gas network. The number of gas subscribers in Bishkek increased by 16,470 in 2024 alone, growing from 244,530 to 261,037. Natural gas consumption in residential areas has shown remarkable growth, increasing 20-fold from 2.2 million m^3 in 2018 to 43.0 million m^3 in 2024.

To ensure the accessibility of gasification, special preferential lending programs were implemented in partnership with "Eldik Bank" and "Ayil Bank." A significant program allocating 1 billion soms for gas connections and equipment purchases was established, offering subsidized loans at 8% interest. As of 2024, 254 consumers in Bishkek and Chuy Oblast have received loans totaling over 32 million soms through this program.Thanks to these measures, coal consumption was reduced by 58 thousand tons.

Work has also been completed on converting 93 municipal boiler houses to alternative energy sources, with 62 operating on gas, 20 on electricity, 1 on steam and 10 using electric convectors by 2024.

Changes have also occurred in Bishkek's transport system with the delivery of 1,000 environmentally friendly buses. In total, 1,292 new environmentally friendly buses have been introduced to Bishkek: 1,000 funded by the republican budget, 120 from the local budget, 124 from the European Bank for Reconstruction and Development (EBRD), and 48 from the German Development Bank. Existing minibuses have been redirected to serve hard-to-reach routes in remote residential areas. Each new bus replaced approximately 4 diesel minibuses, resulting in a reduction of diesel fuel consumption by more than 100 tons daily. This reorganization has reduced diesel fuel consumption by more than 100 tons daily.

With the support of the city administration and private sector investors, Bishkek has developed infrastructure for electric vehicles, including the installation of 44 electric charging stations of various capacities throughout the city. This expansion of charging infrastructure supports the growing number of electric vehicles in the capital, which has reached 3,394 registered electric cars as of early 2025, representing an important step toward reducing transport-related air pollution.

The shift toward compressed natural gas (CNG) as fuel has created significant economic and environmental benefits. With diesel costing 73 som per liter compared to CNG at 29.5 som per cubic meter, the Bishkek municipality saved approximately 1.3 billion som in 2024. Nine CNG filling stations operated by Gazprom Kyrgyzstan now serve the growing fleet of gas-powered vehicles, with CNG usage projected to increase 700% over the next five years. This transition is estimated to have reduced emissions equivalent to 33,000 tons of diesel fuel (approximately 6,000 tons of emissions).

To improve the road situation, restrictions were introduced from April to October 2024 on the movement of trucks weighing over 18 tons on municipal roads. Separate work is being conducted on designing and preparing working documentation and approvals for the construction of multi-level parking facilities.

Regular raids are conducted using gas analyzers to check harmful emissions from vehicle exhaust gases. Also, in January 2025, Bishkek City Hall launched a pilot project to evaluate the effectiveness of catalysts developed by Qingdao

State University (PRC) for further distribution and emission control.

Important reforms are taking place in the energy sector. Since 2024, the Central Heating Plants (CHPs) of Bishkek and Osh cities have been transferred to city management (based on approval from both the Bishkek City Council and the Jogorku Kenesh). There are plans to convert Bishkek's CHP to natural gas, but additional funding needs to be secured. It's worth noting that work has been completed on converting 22 municipal boiler houses in Bishkek to gas.

Environmental control has been significantly strengthened through coordinated enforcement efforts. In 2024, the Municipal Inspection of Bishkek conducted extensive oversight, checking 81,694 entities regarding prohibited burning practices, which resulted in 256 protocols and fines totaling 2,928,500 soms. The same authority inspected 346 bathhouses and saunas, finding that 245 were using coal while only 29 operated on gas or electricity; operations of 76 non-compliant facilities were terminated.

In parallel, the Environmental and Technical Supervision Service of the Ministry of Natural Resources, Ecology and Technical Supervision conducted targeted inspections of 133 business entities in Bishkek pursuant to Article 230 of the Code on Offenses, issuing 119 protocols with fines amounting to 2,576,600 soms.

Nationwide, the Environmental and Technical Supervision Service of MNRETS carried out a total of 1002 inspections of business entities throughout 2024, addressing 1247 violations that resulted in fines amounting to 25.256 million soms.

The BSL, which had been burning for a decade and contributing significantly to air pollution, has been completely extinguished. This intervention alone has reduced smog by an estimated 10-15%, according to official assessments. Air quality tests in residential areas near the landfill have confirmed improvement following the extinguishing operations. In December 2023, waste burning at the BSL was completely localized.This reforestation effort has since expanded, with 3,000 tree seedlings now planted, creating a 5-hectare forest area on the former landfill site.

Changes have been achieved in waste management. In October 2023, specialized ecological equipment for burning textile waste without harmful emissions into the atmosphere (an incinerator) with a capacity of up to 20 tons of waste per day was installed at the Bishkek Sanitary Landfill (BSL). 1,160 sewing workshops now have formal contracts for waste disposal, and specialized vehicles purchased for each district to collect textile waste.

One of the key developments was the signing of an investment agreement on March 29, 2024, with Junxin Huanbao KG Invest LLC for the construction of a waste-to-energy plant. The project is valued at 95 million USD, with construction beginning in July 2024 and an estimated completion time of two years. Currently, infrastructure preparation and specialist training are being finalized.

4.6. Comprehensive Development Programs

In 2024, the Ministry of Natural Resources, Environment and Technical Supervision together with the Ministry of Finance, with support from the World Bank, launched a large-scale project "Air Quality Improvement in the Kyrgyz Republic." [56] The project is financed through a concessional IDA WB loan of $50 million with a 50-year repayment period, a 10-year grace period, and a zero interest rate. The project implementation period is 7 years (2024-2030), with the project officially starting on June 6, 2024.

The project includes four main components:

[56] https://projects.worldbank.org/en/projects-operations/project-detail/P177467

1. Strengthening Air Quality Management Systems (budget: $9.1 million)

- Installation of 11 automatic and modernization of 8 manual monitoring stations
- Procurement of probe equipment for monitoring air quality, temperature, and atmospheric inversions
- Construction of a modern environmental laboratory for the Department of Environmental Monitoring
- Launch of a mobile laboratory for operational emission analysis
- Creation of an Air Quality Data Processing Center with IT infrastructure
- Development of a cadastre and registry of pollutants with a GIS system

2. Support for the Implementation of Environmentally Clean Heating Solutions (budget: $32.3 million)

- Development of the market for alternative heating sources (heat pumps, solar panels, energy-efficient electric systems)
- Providing access to financing for various segments of private households
- Support for local manufacturers and suppliers of environmentally clean technologies
- Implementation through a revolving mechanism at two levels: through the Ministry of Finance of the Kyrgyz Republic and participating financial intermediaries (banks)

3. Urban Greening Improvement (budget: $7.1 million)

- Creation of a pilot green belt to reduce dust pollution (cascade greening)
- Improvement of the irrigation system with the introduction of water-saving technologies
- Restoration of observation wells for groundwater monitoring
- Provision of special equipment and tools for "Bishkekzelenstroi" Municipal Enterprise
- Development of a section on greening, irrigation, and water protection zones as part of the Bishkek City Master Plan until 2050

4. Project Implementation Support (budget: $1.5 million)

- Financing the activities of project implementation units at relevant ministries
- Ensuring procurement, financial management, environmental and social risk management
- Organization of monitoring and evaluation of project results

Key beneficiaries of the project are the Bishkek City Hall (including "Bishkekzelenstroi" Municipal Enterprise and "Bishkek Glavarchitektura" State Institution), the Ministry of Natural Resources, Environment and Technical Supervision of the Kyrgyz Republic (including the Department of Environmental Monitoring and the Service of Environmental and Technical Supervision), as well as the Ministry of Emergency Situations ("Kyrgyzhydromet" State Service).

The project aims to achieve several Sustainable Development Goals, including SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

5. SUPPORT FOR AIR QUALITY INITIATIVES FROM INTERNATIONAL PARTNERS

During 2018-2024, a wide range of projects and initiatives aimed at improving air quality were implemented in Kyrgyzstan. International development partners, in close cooperation with government bodies, carried out several significant interventions in key sectors.

5.1. Household Heating

The household heating sector received substantial support through several major projects. The **German Society for International Cooperation (GIZ)** implemented a clean heating technology program with a budget of 346,964 USD in 2022-2023. In cooperation with Bishkek City Hall, five demonstration heat pumps using innovative water-to-water heat exchange technology were installed. The project not only demonstrated the technical feasibility of transitioning to modern heating systems but also created a foundation for further scaling of this experience.

The **International Organization for Migration (IOM)** made a significant contribution through the implementation of two interconnected projects with a total value of 600,000 USD. The first project (2021-2023) focused on raising awareness among migrants about air quality issues and housing energy efficiency. The second project (2023-2025) moved to practical implementation, providing renovation for 12 houses with the integration of energy-efficient components.[57] It is particularly important that these projects take into account the socio-economic aspects of the problem, working with vulnerable population groups.

The **Korea International Cooperation Agency (KOICA)** conducted a preliminary study in 2023 to initiate the Air Quality Improvement Project (2025-2028, USD 10 million) in 2025. KOICA aims to focus on public facilities and plans to replace existing coal boilers with heat pumps and solar systems in approximately 20 schools and kindergartens in the Chui region. To minimize costs, the project will utilize existing indoor radiators and pipes. By introducing a system that combines solar energy and heat pumps, KOICA seeks to significantly contribute to air quality improvement by reducing greenhouse gas emissions.

5.2. Transport Sector

A large-scale project for the electrification of urban transport is being implemented under the leadership of the **Asian Development Bank (ADB)**. The project, scheduled for 2022-2027 with a budget of 50.65 million USD, aims at comprehensive modernization of the capital's transport system.[58] In close cooperation with the city hall, ADB is working on the procurement of 120 electric buses and creating the necessary infrastructure, including charging stations and maintenance systems. Special attention in the project is given to developing a pilot green corridor in the city center with dedicated bus lanes and bicycle paths. The project was approved in November 2021 and successfully launched in December 2022. Its implementation aims to significantly reduce $PM_{2.5}$, PM_{10}, and NOx emissions in the city's atmosphere.

The **United Nations Human Settlements Programme (UN-Habitat) and the United Nations Environment Programme (UNEP)** complement these efforts through a sustainable urban mobility project (2024-2026) with a budget of 50,000 USD, aimed at strengthening the capacity of Bishkek City Hall in urban mobility planning. Special attention is paid to understanding the relationships between transport planning and air quality in the city.

[57] https://kyrgyzstan.iom.int/stories/empowering-sustainable-living-green-solutions-housing-challenges-kyrgyzstan
[58] https://www.adb.org/projects/54123-001/main

The **Korea International Cooperation Agency (KOICA)** is implementing the Electric Vehicle Transition Project for Public Service Fleet to Realize Green Mobility in Kyrgyzstan from 2024 to 2027 with a budget of USD 11 million to respond to climate change and establish a safe and inclusive transportation environment. The project will provide Electric Vehicles(EV) and chargers to public institutions and develop an EV monitoring system for post offices. Additionally, KOICA plans to establish the EV Conversion Implementation Plan for Public Institutions and conduct capacity-building for green mobility.

5.3. Air Quality Monitoring and Assessment

The air quality monitoring system has seen significant development thanks to coordinated efforts of government bodies, international partners, and the civil sector.

The **Finnish Meteorological Institute (FMI)** has provided sustained support for air quality monitoring development in Kyrgyzstan through three consecutive projects funded by the Ministry

for Foreign Affairs of Finland (MFA). The initial **FINKMET** project from 2014 to 2017 (574,000 USD) established Bishkek's first automatic multicomponent monitoring station ($PM_{2.5}$, PM_{10}, NOx, SO_2, CO) and developed Kyrgyzhydromet staff capacity in station operation and maintenance. The **FINKMET second** phase during 2018-2020 (520,000 USD) strengthened quality assurance processes and implemented the first pilot version of the SILAM air quality forecasting model.

Launched in 2024 with a budget of 1.042 million USD, the ongoing **FINKMET III** project focuses on modernizing automatic air quality monitoring stations, starting the ozone (O_3) measurements in the station, and implementing advanced analysis through a comprehensive source apportionment campaign. The project includes upgrading monitoring equipment, operationalizing the SILAM air quality forecasting tool, and conducting systematic $PM_{2.5}$ sampling with chemical analysis to identify major pollution sources, directly supporting evidence-based air quality management in Bishkek.

From October 2020 to September 2023, **MoveGreen NGO** implemented the regional project "Building Air Quality Management Capacity in Central Asia" with support from the U.S. Department of State, aimed at strengthening the air quality monitoring system in the Central Asian region. The project installed a network of 36 low-cost air quality monitoring sensors in various cities across the country, providing comprehensive air pollution data for the first time not only in Bishkek but also in other regions. A significant outcome was the creation of the regional Air Quality Central Asia (AQCA)[59] dialogue platform, uniting 34 organizations from Central Asian countries to jointly address air pollution issues.

Within the **Almaty-Bishkek Economic Corridor** initiative, **ADB** made a significant contribution to developing the air quality monitoring system. In December 2020, ADB provided Kyrgyzhydromet with 50 Clarity Node-S sensor devices worth 90,000 USD for measuring particulate matter and nitrogen dioxide in Bishkek. Further strengthening of monitoring capacity was provided through the "Strengthening Regional Health Security in Kyrgyzstan" project (30 million USD), aimed at improving infrastructure and capacity of Kyrgyzhydromet reference laboratories.

UNEP and UN-Habitat, with funding from the UN Development Account and in partnership with MoveGreen NGO and "Ornithology" NGO, are implementing the project "Nature-based Solutions for Enhancing Resilience to COVID-19 and Urban Air Pollution" (2022-2025) with a budget of

[59] https://aqcaplatform.asia/

144,000 USD. Within the project, in partnership with UNDP and the Finnish Meteorological Institute, a study on air quality in Bishkek was published (see above), technical recommendations for deploying low-cost air quality monitoring sensors[60] were developed, and recommendations for using nature-based solutions to improve air quality were created,.[61,62] The project supported the organization of annual AQCA platform conferences in 2022 (Bishkek), 2023 (Astana), and 2024 (Almaty), as well as the participation of Kyrgyz government bodies in these conferences and other key regional events on air quality policy. Thanks to project support, a roadmap for transitioning to an Air Quality Index in Kyrgyzstan was developed, and thematic sessions on air quality were held at the "Life in Kyrgyzstan" conference in 2023 and 2024.

The **United Nations Economic Commission for Europe (UNECE)** implemented a series of interconnected projects to develop the emission inventories system, as emission reporting is an obligation under the UNECE Convention on Long-range Transboundary Air Pollution. The first project, completed in June 2018 with a budget of 50,000 USD, laid the foundation for creating national emission inventories. The project ensured successful submission of national emission inventories for 2018 and preparation of the first Informative Inventory Report. The project helped improve national experts' skills in emissions reporting.

The second UNECE project, implemented in 2020-2021 with a budget of 45,000 USD, focused on specialist training.[63] During the project, 8 training videos were created and training sessions on using QGIS software for spatial analysis of emission data were conducted.[64] The third project, completed in October 2023 with a budget of 50,000 USD, provided comprehensive assessment of emissions for the period 1990-2022 and preparation of an updated Informative Report.[65]

The **World Health Organization (WHO)** made an important contribution through a project to strengthen capacity in health risk assessment, implemented in December 2023 with a budget of 30,000 USD.[66] The project provided training for 30 specialists (20 from Kyrgyzstan and 10 from Kazakhstan) in working with the AirQ+ tool,[67] significantly improving understanding of the connection between air pollution and public health.

Airband Technologies demonstrated an innovative approach to transport pollution monitoring by implementing a pilot project for mobile air quality monitoring from November 2023 to January 2024. Together with MoveGreen NGO and with UNEP support, the company successfully tested the installation of mobile air quality sensors on Bishkek's public transport. The sensor testing results aligned with the overall pollution picture registered by the monitoring station and network of low-cost sensors.

The Institute of Science Tokyo and **Osh State University** are preparing to launch a large-scale project for 2025- 2030 with a budget of 3 million USD.[68] In cooperation with MNRETS and Kyrgyzhydromet, the project plans to create a modern air pollution assessment system based on satellite data and organize a research center. The project plans to install measurement equipment and train government personnel and researchers, which should significantly improve the coverage and accuracy of air pollution assessment in the country.

In December, 2024, **UNICEF** with the MOH and Osh city Mayor's office jointly launched a pilot project on exposure reduction to air pollution in Osh regional hospital and kindergarten. The project is aiming to measure $PM_{2.5}$ reduction by installing air purifiers and air recuperators in these facilities during the heating season. Pregnant mothers and children including disabled children will benefit significantly from the project and the

[60] https://aqcaplatform.asia/analytics/53
[61] https://aqcaplatform.asia/investigate/25
[62] https://aqcaplatform.asia/investigate/27
[63] https://unece.org/environmental-policy/events/workshop-emission-inventories-1
[64] https://unece.org/environmental-policy/events/workshop-air-pollutant-emission-inventories-kyrgyzstan
[65] https://unece.org/info/events/event/380059
[66] https://www.who.int/europe/news-room/events/item/2023/12/04/default-calendar/strengthening-capacities-in-assessing-health-risks-of-air-pollution-in-kyrgyzstan-and-kazakhstan--who-training-workshop
[67] https://www.who.int/tools/airq
[68] https://www.jst.go.jp/global//english/kadai/r0602_kyrgyz.html

project is aiming to produce evidence that proves the concept. The project will continue to be implemented this year and will release the final report by December, 2025.

UNICEF, in coordination with the Ministry of Natural Resources, Ecology, and Technical Supervision, is organizing RCOY (Regional Conference of Children and Youth) Central Asia and Afghanistan 2024 in Bishkek to amplify youth voices in shaping a sustainable future, with a focus on air pollution and its impact on vulnerable groups including women's and young people's health. The Regional Youth Statement developed during RCOY has been integrated into the Global Youth Statement, emphasizing environmental health and disease prevention. This statement will also be presented at COP29 by youth delegates in collaboration with the Ministry of Culture, Information, Sports, and Youth Policy.

5.4. Legal Support

The Regional Office of the UN High Commissioner for Human Rights (OHCHR) for Central Asia began work on air quality in 2024, introducing a human rights perspective and examining the relationship between air quality, the right to a clean, healthy and sustainable environment, and the right to health with focus on the groups at risks (children, women, elderly, persons with disabilities). The organization monitors and supports environmental activists in their engagement with international human rights mechanisms (Treaty Bodies, Special Procedures, Universal Periodic Review, and the Aarhus Convention Secretariat). OHCHR has been monitoring the case on the cancellation of trolleybuses (emission free public transportation) in Bishkek city. OHCHR is currently conducting a comprehensive legal analysis of air quality regulation in Kyrgyzstan.

5.5. Strengthening Technical Capacity and Implementing Information Campaigns

As part of raising public awareness about air quality issues, the regional project "Building Air Quality Management Capacity in Central Asia," implemented by **MoveGreen** with support from the U.S. Department of State from October 2020 to September 2023, made a significant contribution. An important component of the project was strengthening Kyrgyzhydromet's institutional capacity through a series of professional seminars and international experience exchange with KazHydromet. The project also conducted a large-scale social media campaign that reached over 2.8 million views, substantially increasing public awareness about air pollution issues.

During 2022-2024, international organizations and government bodies implemented a comprehensive program to strengthen institutional capacity and raise public awareness in the field of air quality.

WHO focused on developing professional competencies in assessing the impact of air pollution on health. In December 2023, the organization conducted specialized training for 30 specialists from Kyrgyzstan and Kazakhstan on working with the AirQ+ tool, significantly strengthening the region's capacity in health risk assessment.

UNECE made a significant contribution to developing the technical capacity of specialists through a series of training events, supporting the country in fulfilling its obligations under the UNECE Convention on Long-range Transboundary Air Pollution. Creating eight training videos and conducting practical training on using QGIS software substantially improved national experts' skills in emissions data analysis.

The **Climate and Clean Air Coalition** implemented training programs for decision-makers, paying special attention to the benefits of low-carbon technologies and their role in improving air quality. Educational events were supplemented with practical recommendations for implementing new technologies and improving the regulatory framework.

UNEP, with support of the “Ornithologiya” association, conducted a nationwide information campaign as part of the nature-based solutions and air quality project (2022-2025). The campaign contributed not only to raising public awareness and by initiative of the Bishkek Mayor’s Office, it helped launch piloting of green facades in Bishkek. In partnership with the UN Resident Coordinator's Office in Kyrgyzstan and ADB, UNEP supported MNRETS's initiative in conducting a TV information campaign on air pollution issues during the 2023-2024 heating season, reaching over 3.5 million viewers nationwide.

UNICEF's study (2023) revealed significant gaps in public awareness about modern technologies: 63% of respondents noted a lack of knowledge about solar panels, 72% about heat pumps. In response, the organization developed targeted educational programs to improve the population's technical literacy regarding energy-efficient solutions. UNICEF study on MICS 2023 revealed that only 23 percent of households use clean energy for heating, lighting and cooking.

UNICEF initiated a collaboration with Kyrgyz Medical Institute of Continued education to adapt WHO/UNICEF training modules on environmental health into Kyrgyzstan context. The work was completed in December, 2024 preparing for training of trainers who will educate family doctors and PHC workers on environmental health including air pollution. Actual training of health workers will commence in 2025 targeting to train 700 health workers within 3 years. UNICEF is supporting the National Public Health Institute to conduct Situation analysis of Environmental health in Kyrgyzstan to estimate the burden of diseases related to environmental health including air pollution.

GIZ implemented a large-scale information campaign reaching 200,000 people. Creating ten educational videos about air quality helped the population better understand the relationship between energy efficiency and air pollution. Practical demonstrations of heat pump operations supplemented theoretical information, showing real possibilities for using modern technologies.

IOM made a significant contribution to working with vulnerable population groups. The social media information campaign reached more than 324,000 views. An important component was strengthening institutional capacity: 43 government officials received training on air quality and healthy urban development issues. IOM has actively engaged internal migrants in the National Programme for the Development of a

Green Economy 2024-2028, advocating for their inclusion in relevant national action plans. Recognizing their vital role in the energy-efficiency sector, IOM promotes sustainable solutions that integrate migrant communities into the country’s green transition. To raise awareness and ensure wider accessibility to energy-efficiency knowledge, three instructional videos were published on YouTube, along with a series of informative articles promoting sustainable practices to a broader audience. Through these efforts, IOM continues to advocate for sustainable solutions that empower internal migrants and vulnerable populations, reinforcing their role in national energy-efficiency initiatives.

Public Foundation UNISON is implementing the project "Promotion of Inclusion of Internal

Migrants in Green Renovations in Kyrgyzstan" from October 2023 to June 2025 with support from the IOM Development Fund in partnership with the Ministry of Labor, Social Security and Migration of the Kyrgyz Republic. The project focuses on improving living conditions and raising awareness about green construction among migrant women and their families. The project includes developing climate-resilient building reconstruction designs, providing technical assistance, conducting educational campaigns, and implementing green solutions in households.

6. INTERACTION MECHANISMS

To ensure effective implementation of air quality improvement projects in Kyrgyzstan, a comprehensive system of interaction has been created, covering two key directions: coordination between international partners and government bodies, and interaction between partners themselves, which allows for ensuring coordination of actions, effective use of resources, and achievement of maximum results in implementing set tasks.

6.1. Coordination Mechanisms with Government Bodies

In Kyrgyzstan, a system of interaction between international partners and government bodies on air quality issues has been formed. Each organization has built its own mechanisms for working with relevant government structures.

UNECE maintains direct communication with the Ministry of Natural Resources, Ecology and Technical Supervision through the National Focal Point for the Convention on Long-range Transboundary Air Pollution for developing emission inventories and preparing national reports.

IOM interacts with government bodies (Ministry of Labor, Social Security and Migration; State Agency for Architecture and Construction; Bishkek City Hall; Ministry of Health) through regular meetings and joint working groups.

WHO works with the Ministry of Health within the framework of a signed 7-year Country Cooperation Strategy. One of the directions of this work is Climate Resilience and Chemical Safety.

UNICEF works closely with the Ministry of Education and Science and the Ministry of Culture, Information, Sports and Youth Policy in promoting climate change education and youth climate action, including the social and health impact of air pollution on children and the capacity development of teachers, students and young people on adaptation behaviours.

UNEP coordinates its activities through regular meetings, joint working groups, and policy dialogue. The organization works with the Ministry of Natural Resources, Ecology and Technical Supervision, Kyrgyzhydromet, and Bishkek City Hall.

OHCHR monitors the situation around the right to a clean, healthy and sustainable environment (clean air) and supports environmental activists in their engagement with human rights mechanisms (Treaty Bodies, Special Procedures, Universal Periodic Review and Aarhus Secretariat).

ADB holds regular meetings on the urban transport electrification project with representatives of Bishkek City Hall. These meetings ensure prompt resolution of emerging issues and coordination of actions for developing electric transport infrastructure.

GIZ coordinates its work with Bishkek City Hall through a complex of mechanisms: regular meetings, joint working groups, technical consultations, and policy dialogue.

FMI coordinates its work by participating in the donor coordination meetings, joint workshops, seminars and policy dialogue. FMI cooperates currently with the Agency on Hydrometeorology under the Ministry of Emergency Situations of the Kyrgyz Republic (Kyrgyzhydromet), UNEP and WB.

The Institute of Science Tokyo and Osh State University interact with government bodies

through regular meetings, joint working groups, and technical consultations. The Institute and the university cooperate with the Ministry of Natural Resources, Kyrgyzhydromet, and the Ministry of Health. KOICA closely cooperates with the Ministry of Natural Resources, Ecology and Technical Supervision, Kyrgyzhydromet, as well as Chui's Alamedin and Sokuluk districts for the Air Quality Improvement Project. Additionally, for the Green Mobility Project, KOICA collaborates with the Ministry of Economy and Commerce and Kyrgyz Pochtasy.

6.2. Interaction Mechanisms Between Development Partners

Air Quality Working Group within the Development Partners Coordination Council

The Development Partners Coordination Council (DPCC) was created to expand information exchange between donors, government institutions, and civil society institutions, promoting strengthened cooperation and formation of a common vision of Kyrgyzstan's priorities. By strengthening coordination at the national level, DPCC adds value to existing sectoral and thematic coordination groups rather than replacing them. It does not take on decision-making functions regarding individual donor programs but promotes constructive dialogue and improved aid management.

Among DPCC's thematic working groups, there is a special group on environment, climate and disaster risk reduction, co-chaired by the United Nations Development Programme (UNDP) and German Society for International Cooperation (GIZ). Recognizing the growing importance of air pollution issues, the United Nations Environment Programme (UNEP) - an active member of this group - proposed creating a specialized working group on air quality in 2022. With active support from development partners, the group was officially established in 2023, with UNEP and the Asian Development Bank (ADB) serving as co-chairs and secretariat.

Operating at the technical level, the working group brings together development partners and expert observers involved in air quality issues. As of February 2025, its members include UNEP, World Bank, ADB, UNICEF, GIZ, UNDP, UNICEF, WHO, OHCHR, IOM, US Embassy, Osh State University, Institute of Science Tokyo, Korea International Cooperation Agency (KOICA), European Bank for Reconstruction and Development (EBRD), Swiss Embassy, Duke University, United States Agency for International Development (USAID), UN Resident Coordinator's Office (UN RCO), United Nations Economic Commission for Europe (UNECE), UN-Habitat, Climate and Clean Air Coalition (CCAC), and Forum for International Cooperation on Air Pollution (FICAP). Observers include the Finnish Meteorological Institute, Unison Group, Airband Technologies, and MoveGreen NGO. The group meets every two months to coordinate efforts, leverage synergies, and generate knowledge to support Kyrgyzstan's clean air initiatives.

Since its establishment, the group has demonstrated high engagement and effectiveness in facilitating improved project development and information exchange, leading to more effective air quality improvement activities. A significant achievement of the group was the publication in November 2023 of the policy brief "Tackling Air Pollution in Bishkek: A Roadmap for Improving Air Quality"[69] which summarizes the main findings of numerous studies. In the same month, the document was officially presented to MNRETS.

[69] Tackling Air Pollution in Bishkek: A Road Map to Cleaner Air https://www.adb.org/publications/tackling-air-pollution-bishkek-road-map-cleaner-air

7. RECOMMENDATIONS FOR FUTURE ACTIONS

The recommendations presented below are based on development partners' responses to a survey conducted in January 2025, as well as information presented in development partners' studies (see above). The below is a compilation of recommendations structured by sector, with cross-cutting recommendations on air quality management, monitoring and assessment presented first. As of 2024, some of these recommendations are already being implemented by the government in partnership with a variety of stakeholders, however, they are still included in the list to demonstrate the breadth of policy actions recommended to be taken (including on a continuous basis) to address air quality issues in Kyrgyzstan. Measures presented within this part of the report can have different impacts on air quality and it is therefore suggested that they are thoroughly studied and their costs and benefits are analysed before implementation.

7.1 Strengthening Current Measures

7.1.1. Air Quality Management

1. Air Quality Management

- **Strengthening the management system**: Improve air quality management at all levels (national and local) based on international best practices.
- **Integrated national strategy and action plans:** Develop a long-term (10-15 years) multi-sectoral air quality management strategy with specific measures at national and local levels, as well as medium-term action plans to support strategy implementation. The strategy should prioritize measures to reduce emissions of the most health-hazardous pollutants, while addressing several polluting sectors.
- **Integration with climate policy**: Integrate air quality improvement measures into climate change strategies, as many air quality improvement measures also contribute to reducing greenhouse gas emissions.
- **Standards modernization**: Update national air quality standards in accordance with WHO recommendations (guidelines) with interim targets.
- **Cooperation with local authorities**: Provide local authorities with greater powers and mandate for effective air quality management at the local level.
- **Intensifying actions in other cities**: Expand air quality improvement efforts to other major cities such as Osh, Jalal-Abad, Karakol, Talas. Each city exceeding acceptable pollution levels should develop its own air quality improvement plan.
- **Vulnerable groups participation**: Include groups at risk (women, children, elderly people, people with chronic diseases) in the development and implementation of air quality improvement plans through meaningful public participation and consultations.
- **Support for public and private initiatives**: Develop interaction with civil society and private organizations to stimulate air quality projects.

2. Legislation and Regulation

- **Updating air quality legislation**: Adopt and implement legislation corresponding to international best practices in air quality legislation, taking into account the local context.
- **Revision of environmental permit system**: Improve the system of environmental permits and emission standards for stationary and non-stationary pollution sources.

3. Communications and Awareness Raising

- **Communication strategy:** Create a communication strategy for disseminating information about air pollution, especially in emergency situations (e.g., during peak pollution periods).
- **Information campaigns**: Launch a large-scale information campaign about air pollution's health impacts, its sources, and emission reduction measures.
- **Public education**: Develop and distribute audiovisual materials about air quality for schools and educational institutions, include these issues in school curriculum.
- **Mobile notifications**: Implement an air pollution warning system with recommendations for citizens on reducing exposure (e.g., wearing masks, closing windows).
- **Internet platforms and media**: Disseminate air quality information through social networks and mass media to reach the widest possible audience.

7.1.2. Air Quality Monitoring and Assessment

1. Expanding and Improving the Monitoring Network

- **Installing automatic stations**: Install more automatic, multicomponent monitoring stations in different parts of the country, minimum 5 automatic air quality stations in , one rural background station (automatic), and at least one automatic monitoring station in each regional center for regular and accurate collection of data on main air pollutants.
- **Creating a wide monitoring network**: Develop and facilitate public air quality monitoring networks in all Kyrgyzstan cities using low-cost sensors, especially in large cities and remote areas.
- **Using mobile monitoring**: Deploy mobile monitoring stations to cover larger territories and identify local polluted zones, for example, along roads and in industrial areas.
- **Calibration laboratory**: Organize a laboratory for sensor calibration and ensuring measurement accuracy in Kyrgyzstan. Prepare a plan to establish a national reference laboratory (NRL) for air quality monitoring in Kyrgyzstan (to ensure the traceability, comparability and quality assurance) for air quality monitoring in Kyrgyzstan.
- **Improving data quality**: Strengthen the data quality assurance system by training personnel and implementing data verification procedures.

2. Information Platform and Data Accessibility

- **Creating a data exchange platform**: Develop open online platforms (Internet portals, mobile applications, etc.) for public access to air quality and pollution data to ensure transparency and public awareness.
- **Availability of past and current data:** Air quality monitoring data should be made available for the population in easily understandable format in real time. Historical air quality data should be available to the use of research organisations, authorities, consultants, companies, industries and any other interested stakeholders.

3. Emissions and Modeling

- **Creating an emissions registry**: Develop a detailed emissions registry that will include information about emissions from transport, industry, heating, and other pollution sources.
- **Emission inventories:** Maintain a team of experts for compiling the national emission inventory and preparation of reporting to international Conventions such as The **Convention on Long-Range Transboundary Air Pollution** often abbreviated as CLRTAP. It is implemented by the European

Monitoring and Evaluation Programme (EMEP), directed by the United Nations Economic Commission for Europe (UNECE).

- **Pollution impact modeling:** Establish systems for modeling pollutant dispersion, evaluate different sources' impact on air quality and public health.
- **Source-level emissions monitoring**: Conduct emissions monitoring at the source level (e.g., household stoves, transport, enterprises) to accurately assess each source's contribution to air pollution.
- **Ensuring standards compliance**: Create an effective system for monitoring environmental standards compliance, including remote emission testing and monitoring of polluting facilities' activities.

4. Source Apportionment

- **Periodic pollution source assessment**: Develop methodology for identifying and periodically updating data on main pollution sources to build priority policy measures based on this data.
- **Using data sources**: Collect data on fuel use in various sectors (heat and power, transport, household heating) for more accurate assessment of emissions and their sources.

5. Control and Compliance with Emission Standards

- **Ensuring data quality**: Develop data quality control systems, including the use of standards and international practices to ensure information reliability and accuracy.
- **Monitoring and reporting**: Implement a continuous air quality monitoring system and require local authorities to submit annual plan implementation reports.

6. Research and Impact Assessment

- **Developing scientific research**: Increase funding for air quality-related research for more accurate data and effective solutions.
- **Evaluating measure effectiveness**: Develop a system for evaluating the impact of implemented air quality improvement measures to verify their effectiveness and adapt strategy based on obtained data.

7.1.3. Household Heating

1. Ban on Coal Heating and Transition to Environmentally Friendly Sources

- **Long-term coal ban**: Introduce a ban on coal heating systems starting from 2035, considering the creation of a subsidized financing system for installing heat pumps and other eco-friendly solutions. Such a ban should be announced well in advance to leave time for households and enterprises to make necessary investments.
- **Coal boiler replacement**: Replace coal boilers with more efficient and cleaner technologies, such as heat pumps and gas heating, especially in private homes and residential quarters where coal is used for heating.
- **City gasification**: Accelerate the process of connecting residential areas to gas heating with development of a special program for district gasification, with the possibility of obtaining subsidies and preferential tariffs for households.
- **Replace coal with alternative sources**: Gradually convert residential heating to cleaner alternatives such as heat pumps and electric heating using renewable energy.

2. Improving Building Energy Efficiency

- **Building insulation and modernization:** Improve house and building insulation to reduce heating needs and lower carbon dioxide emissions. Implement grant programs for insulating old buildings.
- **Stricter energy efficiency standards for new buildings:** Enforce strict building codes for insulation, air-tightness, and ventilation for all new residential and commercial buildings.
- **Retrofit of old buildings:** Implement retrofit programs for old buildings to improve their energy efficiency, including roof, floor, wall insulation, and installation of more efficient windows.

3. Investment in Alternative Heating Technologies

- **Heat pumps**: Promote heat pump implementation in private homes, as they provide up to 4.2 kW of heat for each 1 kW of electricity and are more efficient than coal and gas boilers.
- **Development of geothermal and air heat pumps**: Implement geothermal heat pumps that work effectively in cold climates, and consider using air heat pumps for southern areas of the city.
- **Electric heating**: Develop programs for transitioning to electric heating using renewable energy sources (e.g., hydropower), which minimizes carbon dioxide emissions and increases energy efficiency.

4. Development of Central Heating Network

- **Modernization and expansion of district heating network**: Reconstruct and expand the existing central heating network, especially in densely populated areas, using large heat pumps and minimizing emissions through waste heat utilization.
- **Reducing coal dependence**: Replace coal boilers in the central heating system with gas or electric ones to reduce pollution during the heating season.

5. Financing and Subsidies for Households

- **Household support**: Implement financing mechanisms for households to replace coal boilers with more environmentally friendly solutions such as heat pumps and other alternatives. This can be implemented through grants, subsidies, or preferential loans.
- **Using "pay-as-you-save" mechanism**: Introduce programs where households can pay for heat pump use based on savings obtained from reduced energy consumption.
- **Housing insulation program for vulnerable populations**: Develop housing insulation projects for vulnerable families and provide them with affordable heating solutions.

6. Educational Campaigns

- **Raising awareness**: Conduct large-scale information campaigns aimed at raising public awareness about the importance of energy efficiency and environmentally friendly heating solutions.
- **Energy efficiency training**: Organize seminars and training for the population, construction companies, and local authorities to ensure knowledge of modern standards and technologies in heating and energy efficiency.

7. Emissions Management and Tax Policy

- **Taxes and Subsidies:** Use taxation as a tool to incentivize the transition to more environmentally friendly heating technologies, such as heat pumps, and to discourage the use of coal and other polluting fuels.

- **Support for Environmentally Clean Solutions:** Implement tax benefits and subsidies for households transitioning to cleaner heating technologies and improving energy efficiency.

8. Transition to Gas Heating

- **Accelerating Gas Transition:** Develop a plan for city and settlement gasification, which will significantly reduce pollution from coal heating. This includes creating subsidies for households and deploying appropriate infrastructure.

7.1.4. Energy Sector

1. Transition from Fossil Fuels to Renewable Energy Sources

- **CHP Modernization:** Implement wastewater heat recovery systems and geothermal heat pumps to reduce thermal load on combined heat and power plants. This may also include the development and implementation of electrostatic filters to improve air quality.
- **Transition to Gas Fuel:** Consider transitioning coal-fired CHPs to natural gas to reduce sulfur (SO_2) emissions and improve air quality. However, it should be considered that this will lead to dependence on gas imports, which may be risky in an unstable geopolitical situation.

2. Development of Renewable Energy Sources

- **Support for Renewable Energy:** Actively develop solar and wind power plants, and use hydropower as the main source of electricity. Make it possible to purchase electricity from renewable energy sources under the Feed-in Tariff (FIT) system. This will ensure sustainable energy supply and reduce dependence on fossil energy sources.
- **Public-Private Partnerships:** Develop public-private partnership mechanisms to stimulate investments in renewable energy, which will attract private investment in green energy and create new jobs.

3. Transition to Electric Vehicles

- **Improving Power Supply Reliability:** Increase power system capacity to meet growing electricity demand due to increasing numbers of electric vehicles. It is necessary to invest in power grid modernization to reduce load and ensure stability during winter periods.

4. Reducing Emissions from Coal Power Plants

- **Development of CHP Emission Standards:** Implement strict environmental emission standards for coal-fired CHPs to reduce air pollution and improve environmental sustainability of the energy sector.

5. Financing and Support Mechanisms

- **Creating Financial Mechanisms to Support Clean Technologies:** Develop financing mechanisms such as subsidized loans, microfinancing, and tax benefits to enable households and companies to afford transitioning to clean energy alternatives such as heat pumps and solar panels. Carbon credit sales can be considered as additional measures to attract finance.
- **Subsidy Programs for Poor Population:** Provide subsidies and interest-free loans for low-income households that cannot afford transitioning to environmentally friendly heating technologies without government support.

6. Pilot Projects and New Technology Implementation

- **Clean Energy Pilot Projects:** Launch pilot projects for implementing alternative energy sources, such as air-source heat pumps, to study their effectiveness and comparative costs. These projects can serve as models for further scaling in the country.
- **Development of "Clean" Alternative Zones:** Introduce coal-free zones in certain city districts where transition to gas heating and other clean energy sources will occur. This may also include creating incentives for households to afford such transitions.

7.1.5. Transport

1. Emission Inventory and Assessment for the Transport Sector

- **Improve Availability of Transport Data:** More disaggregated data needs to be collected and made available on the types and age of vehicles, including with and without catalytic converters.
- **Emission Testing Study:** Studies need to be conducted to assess emissions from transport and their impact on the concentration of pollutants.

2. Public Transport Development

- **Increasing Public Transport Speed**: Develop a strategy to increase average bus speeds, including through the creation of dedicated bus lanes along major highways. This will improve travel times and increase transport system efficiency.
- **Vehicle Modernization**: Replace all old diesel buses and minibuses with cleaner models such as gas and electric buses. This will help reduce $PM_{2.5}$ and NOx emissions and improve the environmental situation in cities.
- **Creating "Green" Transport Corridors**: Develop and implement projects to create corridors for environmentally friendly transport, including electric buses and bicycle lanes. This will reduce the number of private cars on roads and improve the atmosphere in cities.

3. Promotion of Non-Motorized Mobility

- **Development of Bicycle and Pedestrian Infrastructure**: Create and expand sidewalks, bicycle paths, and convenient pedestrian crossings along major urban highways. This will reduce dependence on private cars and increase the share of active transport in the city, helping to reduce emissions and improve citizens' health.

4. Vehicle Modernization and Regulation

- **Ban on Catalytic Converter Removal**: Introduce legislative measures prohibiting the removal of catalytic converters and other methods that reduce the effectiveness of vehicle emission controls.
- **Transition to EURO Standards**: Update vehicle regulations to meet modern environmental standards, such as EURO standards, ensuring reduction of harmful emissions.
- **Mandatory Technical Inspections**: Introduce mandatory technical inspections for all vehicles, with mandatory checking of emission control systems. This will ensure vehicles are functioning properly and reduce harmful emissions into the atmosphere.

5. Traffic Management

- **Traffic Optimization and Traffic Light Synchronization**: Implement traffic management systems to optimize traffic, including traffic light synchronization and improved road markings. This will reduce congestion, improve public transport movement, and reduce emissions from private vehicles.

- **Dedicated Bus Lanes**: Creating dedicated bus lanes throughout the city will improve traffic flow and reduce travel times. Sections with existing dedicated lanes should be expanded and optimized to increase their efficiency.

6. **Creating Low Emission Zones**
   - **Introduction of Low Emission Zones in Cities**: Create urban zones with restricted access for high-emission vehicles, encouraging the use of more environmentally friendly modes of transport such as electric vehicles and bicycles.
   - **Restricting Car Traffic During Peak Pollution Periods**: Introduce restrictions on private vehicle movement during high pollution days, reducing emissions and improving air quality.

7. **Using Innovative Approaches**
   - **Incentives for Replacing Old Vehicles**: Introduce programs incentivizing the replacement of old and inefficient vehicles with more modern ones with better environmental characteristics. This may also include support for vehicle recycling programs.
   - **Development of Transport Demand Model**: Develop a Transport Demand Model (TDM) that will enable planning and implementation of transport development policy, including analysis of traffic flow impacts on air quality and emissions.

8. **Development of Alternative Transport Modes**
   - **Support for Electric Vehicle Development:** Develop infrastructure for electric vehicles, including charging stations, and implement tax benefits and subsidies for electric vehicle buyers.
   - **Increasing Public Transport Share:** Expand the number of public transport units, improving its accessibility and convenience. This will help reduce the number of private cars on roads and decrease air pollution.

9. **Research and Monitoring**
   - **Studying Traffic Flow Impact on Air Quality**: Develop a methodology for assessing the impact of changes in traffic flows on city air pollution levels. This will enable accurate planning of measures to improve air quality in the transport sector.
   - **Continuous Emissions Monitoring**: Implement a system for monitoring emissions from vehicles, including through annual emission reports. This will help timely identify and eliminate pollution sources.

10. **Educational and Information Campaigns**
    - **Climate change education:** Incorporate themes around the impact of air pollution and environmental health into school curriculum across different subjects from primary to secondary education levels.
    - **Education about Public Transport and Active Movement Benefits**: Launch information campaigns to raise awareness about the benefits of using public transport, bicycles, pedestrian routes, and electric scooters. This will help reduce dependence on private cars and improve the environmental situation in the city.
    - **Educational Campaigns**: Conduct information campaigns for the population about the necessity of technical inspection and compliance with emission standards, explaining its role in improving air quality. Young people can act as change agents to promote locally relevant climate action and deliver environmental messages widely to communities.

7.1.6. Waste Management

1. Development of Waste Management Infrastructure

- **Investments in Waste Collection Improvement**: Invest in modernizing waste collection processes, including expanding coverage to all settlements, including city outskirts, to prevent waste burning. It's important to ensure regular collection of solid waste, especially organic materials such as leaves and household waste.
- **Development of Separate Waste Collection Infrastructure**: Introduce mandatory separate waste collection for all waste categories (metals, glass, plastic, paper) to minimize volumes sent to landfills. Also develop a waste recycling system with the creation of waste processing complexes, which will reduce the amount of waste subject to disposal.

2. Prohibition of Waste Burning

- **Ban on Open Waste Burning**: Introduce strict prohibitions on solid waste burning (including textile burning), backed by fines and enforcement measures. This should become a priority in addressing air pollution from waste burning, especially in populated areas and near landfills.
- **Preventive Measures to Reduce Waste Burning in Homes:** Develop and implement programs to ensure timely garbage collection and installation of garbage bins in residential areas, which will help reduce the need for waste burning for heating.

3. Composting and Biogas Production

- **Development of Composting System**: Introduce systems for collecting and processing organic waste for composting. This will reduce methane formation during organic matter decomposition in landfills and decrease atmospheric pollution.
- **Biogas Production from Organic Waste**: Develop infrastructure for collecting and processing organic waste into biogas, providing an additional energy source and helping reduce waste volume.

4. Development and Implementation of New Waste Processing Technologies

- **Construction of Waste Processing Plant**: Creation of modern waste processing complexes and implementation of waste-to-energy technologies. Consider building waste-to-energy plants that meet environmental standards and will supply the city with electricity and heat.
- **Waste Sorting at All Stages**: Include mandatory sorting, recycling, and composting at all stages of the waste management system to improve material recycling and reduce waste sent to landfills.

5. Creating an Effective Legislative and Regulatory Framework

- **Legislative Measures to Ban Plastic Products**: Introduce a ban on the use of plastic plates, utensils, and bags in public places such as shops and restaurants to prevent the use of these materials for heating in homes and burning in bathhouses and private houses.

6. Investments in Environmentally Safe Landfill Management

- **Landfill Management and Fire Prevention:** Implement ventilation systems at new landfills to avoid spontaneous combustion. Take measures to eliminate fires at existing landfills.
- **Assessment of Landfill Emissions:** Conduct chemical characterization of emissions from landfills to determine their impact on health and environment, enabling development of more effective pollution reduction measures.

7. Public Education

- **Educational Campaigns on Separate Waste Collection**: Conduct mass information campaigns to educate the population about the importance of separate waste collection and composting. This will help raise awareness about proper waste sorting and how it contributes to improving the environmental situation.
- **Support for Waste Recycling Initiatives**: Include local communities and private companies in recycling and waste disposal initiatives to motivate the population to participate in improving the waste management system.

8. Waste Monitoring and Reporting

- **Landfill Emissions Monitoring System**: Introduce a system of continuous monitoring of emissions from landfills and processing facilities to assess their impact on air and public health. This will help take timely measures to eliminate pollution.
- **Waste Recycling Reporting**: Regular reporting on waste recycling and disposal will help track progress in waste management and improve the system at all levels.

7.1.7. Healthcare

1. Research and Data on Air Pollution Health Impacts

- **Conducting Air Quality and Health Relationship Studies**: Conduct additional scientific research focusing on studying air pollution's impact on public health, emphasizing data on pollution-related diseases. This will help form a more accurate picture of population health and improve medical diagnostics.
- **Health Impact Modeling**: Implement modeling systems to assess air pollution's impact on public health using monitoring data.
- **Development and Implementation of National Air Quality Standards**: Based on scientific research, develop and implement national air quality standards that align with WHO recommendations, including levels for the most dangerous health pollutant - $PM_{2.5}$. This will help officially establish standards for monitoring and regulating air pollution.

2. Raising Awareness Among Medical Workers and Population

- **Educational Programs for Medical Personnel**: To improve understanding of air pollution risks and its health impacts, organize educational courses and training for medical workers, including doctors and nurses. Programs should include information about diagnosing air pollution-related diseases and using appropriate international codes (e.g., ICD-10).
- **Public Information Campaigns**: Regular information campaigns targeting the population should spread knowledge about air pollution's health hazards and protective measures (e.g., using air purifiers or selecting better quality coal for heating).
- **Development and Implementation of Air Quality Index**: Develop an air quality index that will provide the population with current air condition information and recommendations for health protection during pollution periods.

3. Integration of Air Pollution into National Strategic Plans

- **Integration of Healthcare Policy into Air Quality Policy**: Integrate healthcare policy with main air quality policy.

- **Including Air Pollution in Strategic Measures Against Non-Communicable Diseases:** Integrate air pollution as a risk factor for NCDs into the national strategic plan for NCD prevention and control. This will enable more effective consideration of air pollution's impact when developing disease prevention programs.

4. Development of Monitoring System and Data Quality Improvement

- **Improving Epidemiological Surveillance of Air Pollution-Related Diseases**: Develop and implement a monitoring system for air pollution-caused diseases using improved data. This should include systematic collection of morbidity and mortality data related to air pollution, and improving data quality using more accurate classification (e.g., using ICD-10 codes).
- **Development of Electronic Resources for Awareness Raising**: Create online resources with audiovisual materials and authoritative information about air pollution's health impacts and best practices for mitigating these impacts. These resources can target a broad audience, including youth groups, to raise awareness and change population behavior.

5. Improving Access to Medical Services for Migrants and Unregistered Residents

- **Developing Access to Medical Services for Unregistered Migrants**: Improve access to medical services for internal migrants without permanent registration, enabling timely assistance and treatment of air pollution-related diseases.

6. Support and Development of "Healthy City" Initiatives

- **"Healthy City" Concept**: Support the "Healthy City" initiative aimed at improving the urban environment, reducing air pollution, and enhancing urban residents' quality of life. This may include creating green zones, developing environmentally friendly public transport, and increasing local community awareness about health risk reduction methods.
- **Youth Initiatives for Awareness Raising**: Expand youth group participation in health and environmental issues, including conducting youth summits aimed at raising awareness about air pollution harm and possible mitigation measures.

7. Improving ICD-10 Coding Quality and Health Monitoring

- **Improving Disease Coding Quality**: Accelerate transition to accurate disease coding using the ICD-10 system for proper diagnosis of air pollution-related diseases. This will provide more accurate data for further planning and monitoring.
- **Development of Long-term Data Quality Improvement Plans**: Develop plans for improving data quality in the long term, including using modern technologies for collecting data about diseases and their connection to air pollution.

7.1.8.Nature-Oriented Solutions and Urban Planning

1. Urban Greening as a Dust Mitigation Measure

- **Planting Trees and Shrubs in Residential Areas:** Implementing regulations that mandate the planting of trees and shrubs near residential buildings will help create green barriers that reduce dust levels in the air and improve the overall ecological situation. Greening contributes to better air quality, lower temperatures, and increased aesthetic appeal of the city.
- **Encouraging Water Use for Irrigating Green Spaces:** Instead of imposing fines, incentives for

using water to irrigate green areas should be considered. This could include benefits for citizens who utilize rainwater or rainwater harvesting systems, which also promotes ecosystem resilience and reduces water expenses.

- **Creating Green Barriers:** Investing in the establishment of green zones and barriers along roads will help reduce dust.

2. Investigating the Potential of Greening to Reduce Air Pollution in Bishkek

- **Assessing the Impact of Greening on Air Quality:** Research to evaluate the contribution of greening to reducing air pollution (especially $PM_{2.5}$) and carbon dioxide (CO_2) in Bishkek should be an essential part of the city's environmental policy. This will help identify the most effective locations for planting trees and shrubs, as well as optimize the distribution of green areas for maximum impact on pollution reduction.
- **Developing a Green Belt Around the City:** Creating a green belt around the city will provide additional protection against pollution, creating an ecological shield and reducing the impact of dust and harmful emissions from outside. Green zones around the city will also help improve climatic conditions, prevent erosion, and create natural barriers against air pollutants. While greening does not directly reduce emissions, it can effectively decrease the concentration of dust and other particles in the air. Vegetation absorbs dust, acts as windbreaks, and helps improve air quality by reducing the effects of $PM_{2.5}$ and CO_2 on public health.

3. Enforcing Building Codes and Standards

- **Enforcing Building Codes and Environmental Standards:** There is a need to enforce all urban planning regulations with a focus on environmentally friendly and sustainable construction. In particular, new standards should be implemented to limit emissions from construction processes, including dust and other solid particles, and promote the use of energy-saving technologies and materials. It is also essential to introduce an emission reduction strategy based on transportation planning to help lower air pollution during construction.
- **Building Regulations to Prevent Dust and Solid Particle Emissions:** New standards should include enforcement of strict measures to minimize construction dust, such as using special filters, wet cleaning of construction sites, installing dust barriers, and using dust-proof materials.

All these recommendations are aimed at systemic changes in the specified sectors and require close coordination between various government agencies, international organizations, and local communities. Successful implementation of the proposed measures requires long-term planning, adequate funding, and continuous monitoring of the effectiveness of the decisions made.

7.2. Coordination Among Stakeholders

Organizations propose the following actions to enhance interaction among various participants in the process:

- Creation of a specialized team within the relevant ministry for inventorying emissions;
- Increasing the number of positions for air quality specialists in state and municipal bodies;
- Development of inter-agency cooperation for effective data collection on air pollution;
- Strengthening coordination with climate departments through the Air Quality Management Exchange (AQMx)[70] platform to build capacity;
- Partnership with research institutions and utilization of international experience;
- Systematic consideration of air quality issues in the Jogorku Kenesh and city keneshes;
- Coordination of stakeholders under the oversight of the Presidential Administration;
- Organization of regular meetings and political dialogues involving all stakeholders;
- Joint development of air quality projects with development partners;
- Exploration of climate financing opportunities for integrated projects in climate and air quality (especially in dealing with short-lived climate pollutants);[71]
- Strengthening interaction between UN agencies and development banks;
- Enhancing connections between government partners and other stakeholders;
- Creation of an effective platform for knowledge and experience sharing among all stakeholders;
- Improving the implementation of the Aarhus Convention for open access to air quality data;
- Continuing the work of the Inter-Agency Commission with accountability to the Presidential Administration and regular meetings.

[70] https://aqmx.org/

[71] Black coal, methane, tropospheric ozone and chlorofluorocarbons: https://www.ccacoalition.org/content/short-lived-climate-pollutants

LINKS AND USEFUL MATERIALS

Key Studies on Air Quality in Bishkek

- American University of Central Asia, 2021. Smog in Bishkek: Myths and Reality. https://auca.kg/uploads/Tian%20Shan%20Policy%20Center/TSPC%20News/AQ-AUCA-Report_final.pdf
- UNDP and UNEP, 2022. Air Quality in Bishkek: Assessment of Emission Sources and Road map for Supporting Air Quality Management. https://wedocs.unep.org/handle/20.500.11822/41090
- IOM, 2022. Air Pollution and Its Health Impacts and Internal Migrants in Bishkek – Assessment Report. https://publications.iom.int/books/air-pollution-and-its-health-impacts-internal-migrants-bishkek-kyrgyzstan-assessment-report
- Mountain Societies Research Institute, University of Central Asia, 2022. Impact of Climate Change and Air Pollution Forecasting Using Machine Learning Techniques in Bishkek. https://aaqr.org/articles/aaqr-21-11-covid2-0336.pdf
- UNICEF, 2023. Health and social impacts of air pollution on women and children in Bishkek, Kyrgyzstan. https://www.unicef.org/kyrgyzstan/media/8101/file/Air%20pollution%20report.pdf
- ADB, 2023. Regional: Integrated and Innovative Solutions for More Livable Cities Bishkek Clean Air Action Plan. https://www.adb.org/projects/documents/reg-53212-001-tacr
- ADB, 2023. Analytical brief: Tackling Air Pollution in Bishkek: A Road Map to Cleaner Air. https://www.adb.org/publications/tackling-air-pollution-bishkek-road-map-cleaner-air
- Tursumbayeva et. al, 2023. Cities of Central Asia: New hotspots of air pollution in the world. In: Atmospheric Environment. https://www.sciencedirect.com/science/article/abs/pii/S1352231023003278
- WB, 2023. Air Quality Analysis in Bishkek: $PM_{2.5}$ source apportionment and emission reduction measures. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099110123211021470/p17087000827dd04e09d6a0d01dc0ab3c41
- Health Effects Institute. 2025. Trends in Air Quality and Health Impacts: Insights from Central, South, and Southeast Asia. Boston, MA. Health Effect Institute. https://www.stateofglobalair.org/resources/report/trends-air-quality-and-health-impacts-insights-central-south-and-southeast-asia

Useful Materials

- International Knowledge Platform on Air Quality Management – Air Quality Management Exchange Platform (AQMx): https://aqmx.org/
- Guide to Air Quality Management (UNEP and Coalition for Climate and Clean Air): https://aqmx.org/content/explaining-curated-guidance
- Guide on Ambient Air Quality Legislation (UNEP and Coalition for Climate and Clean Air): https://www.unep.org/resources/publication/guide-ambient-air-quality-legislation-air-pollution-series
- Guide for Celebrating International Day of Clean Air for Blue Skies (UNEP): https://www.cleanairblueskies.org/get-involved/practical-guide
- WHO global air quality guidelines: particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide: https://www.who.int/publications/i/item/9789240034228

- Clean Air, Healthy Children: An Agenda for Action. Protecting Children from Seven Deadly Sources of Air Pollution (UNICEF): https://www.unicef.org/media/162641/file/7_Deadly_Air%20Pollution%20for%20Children%20Policy%20Brief.pdf.pdf
- Technical Recommendations for Using LCS Sensors for Air Quality Monitoring in Kyrgyzstan: https://aqcaplatform.asia/analytics/53
- Presentations from the First AQCA Conference on Air Quality: https://aqcaplatform.asia/analytics/35
- Presentations from the Second AQCA Conference: https://aqcaplatform.asia/analytics/30
- Presentations from the Third AQCA Conference 2024: https://aqcaplatform.asia/analytics/51

Seasonal and Annual Reports on Air Quality by MoveGreen

- Seasonal Air Quality Report for Bishkek (Autumn 2020): https://aqcaplatform.asia/analytics/40
- Seasonal Air Quality Report for Bishkek (Winter 2020-21): https://aqcaplatform.asia/analytics/39
- Seasonal Air Quality Report for Bishkek (Spring 2021): https://aqcaplatform.asia/analytics/38
- Seasonal Air Quality Report for Bishkek (Summer 2021): https://aqcaplatform.asia/analytics/37
- Seasonal Air Quality Report for Bishkek (Autumn 2021): https://aqcaplatform.asia/analytics/36
- Seasonal Air Quality Report for Bishkek (Winter 2021-22): https://aqcaplatform.asia/analytics/34
- Seasonal Air Quality Report for Bishkek (Spring 2022): https://aqcaplatform.asia/analytics/33
- Seasonal Air Quality Report for Bishkek (Summer 2022): https://aqcaplatform.asia/analytics/32
- Seasonal Air Quality Report for Bishkek (Autumn 2022): https://aqcaplatform.asia/analytics/31
- Seasonal Air Quality Report for Bishkek (Winter 2022-2023): https://aqcaplatform.asia/analytics/25
- Seasonal Air Quality Report for Regions and Major Areas of Kyrgyzstan (Winter 2022-2023): https://aqcaplatform.asia/analytics/29
- Annual Air Quality Report for Bishkek 2022-2023: https://movegreen.kg/2023/09/12/godovoj-otchet-po-kachestvu-vozduha-2022-2023-gg/
- Seasonal Air Quality Report for Major Cities and Regions of Kyrgyzstan (Spring 2023): https://aqcaplatform.asia/analytics/23
- Seasonal Air Quality Report for Bishkek (Spring 2023): https://aqcaplatform.asia/analytics/24
- Seasonal Air Quality Report for Bishkek (Summer 2023): https://movegreen.kg/2023/10/05/sezonnyj-otchet-po-kachestvu-vozduha-v-bishkeke-leto-2023-g/
- Seasonal Air Quality Report for Regions and Major Cities of Kyrgyzstan (Summer 2023): https://movegreen.kg/2023/10/05/sezonnyj-otchet-po-kachestvu-atmosfernogo-vozduha-v-krupnyh-gorodah-i-v-oblastyah-kyrgyzstana-leto-2023-g/
- Annual Air Quality Report for Major Cities of Kyrgyzstan — Bishkek, Osh, Jalal-Abad for 2023: https://movegreen.kg/2024/07/15/godovoj-otchet-po-kachestvu-atmosfernogo-vozduha-v-krupnyh-gorodah-kyrgyzstana-bishkek-osh-dzhalal-abad-za-2023-g/