

# AIR POLLUTION MANAGEMENT IN BOSNIA AND HERZEGOVINA

October 2019



# Executive Summary

## Ambient Air Quality in Bosnia and Herzegovina

**Cities in Bosnia and Herzegovina (BiH) experience high ambient concentrations of health-damaging fine particulate air pollution in Europe.** This report is one in a series of three reports on air quality management in BiH, Kosovo, and North Macedonia. This report examines the nature and magnitude of ambient air pollution (AAP) in BiH. It provides estimates of the health burden, and economic cost associated with the health impacts, of AAP, that is, fine particulate matter (PM<sub>2.5</sub>) in BiH. It also provides an analysis of the impacts of various sources of PM<sub>2.5</sub> emissions on ambient air quality in BiH at a country level. The institutional and policy framework for air quality management (AQM) in the country is examined, including contributions of other development institutions in supporting BiH's efforts to address air pollution. Furthermore, this report presents experiences of selected countries that have applied different policy, investment, and technical interventions for air pollution, prevention, reduction, and abatement. Finally, it provides recommendations for reducing air pollution in BiH.

**BiH and people living in the Balkans and Eastern Europe are typically breathing more toxic particulate air pollution than their neighbors in Western Europe.** This is due to fewer air pollution reduction policies and more solid fuel heating and cooking (meaning many more residential wood and coal stoves) in Eastern European and Balkan countries compared to the rest of Europe. Western Europe has mostly moved away from coal-fired power plants (or at least has pledged to reduce coal consumption to meet climate goals), but in the Balkans and in Eastern Europe, they are still widely in use. In fact, the Balkan region is home to many coal and lignite-fired units and to 7 of the 10 most polluting coal-fired power stations in Europe.

**Exposure to PM<sub>2.5</sub> is particularly dangerous to human health because these particles find their way deep into lungs and the bloodstream, resulting in disease and death.** Consequently, they can cause serious health effects such as lower respiratory infections; trachea, bronchial, and lung cancer; ischemic heart disease; strokes; and chronic obstructive pulmonary disease (COPD). In addition to causing pain and suffering, premature deaths and illnesses caused by air pollution result in increased health expenditures and labor productivity losses. In BiH, annual average ambient concentrations of PM<sub>2.5</sub> are often multiple times the maximum levels allowed under BiH's air quality standards (20 µg/m<sup>3</sup>) and the World Health Organization (WHO) air quality guideline value (10 µg/m<sup>3</sup>).

## Health Burden and Economic Cost of Ambient Air Pollution in Bosnia and Herzegovina

**This report estimates that about 3,300 people die prematurely every year as a result of exposure to ambient PM<sub>2.5</sub> air pollution in BiH.** About 16 percent of this health burden is carried by Sarajevo and Banja Luka. The death toll is more than double AAP-related mortality in North Macedonia (1,600 deaths) and more than four times the AAP-related mortality in Kosovo (760 deaths). This analysis shows that 9 percent of the total annual mortality in BiH is attributable to air pollution. About 81 percent of the 3,300 AAP-related deaths in BiH are from cardiovascular diseases. The majority of AAP-related mortality occurs in people ages 50 years and older. About 68 percent of ischemic heart disease and 57 percent of strokes caused by AAP occur in people over 70 years of age. Cardiovascular diseases mostly affect people older than 65 years, suggesting that mitigation measures to reduce the health impact of air pollution in BiH should include a focus on this subgroup of the population.

**The estimated economic cost associated with mortality from exposure to air pollution in BiH is in the range of US\$1–1.8 billion, equivalent to 5.9–10.5 percent of gross domestic product (GDP) in 2016.**<sup>1</sup> The economic cost associated with the health damage from AAP in BiH is on average US\$1.38 billion, equivalent to 8.2 percent of GDP in 2016. The Federation of Bosnia and Herzegovina (FBiH) carries 67 percent of the total estimated cost burden, and Republika Srpska (RS) carries the remaining 33 percent. The estimated cost is conservative and does not include the costs associated with hospital stays, cost of illness, and loss of workdays, which would potentially increase the cost estimate if taken into account.

**To better understand the health impacts of AAP on its population, BiH needs to strengthen health statistics and harmonize country reporting with international systems of disease classification.** Notably, the government could strengthen data collection and reporting on mortality by individual disease or cause, attributable to AAP. This will facilitate ready estimation of health impacts of AAP and strengthen the knowledge and information base for decision making to reduce air pollution. It will also enable the country to assess its progress in reducing premature mortality from AAP. Furthermore, the government should strengthen the health information system countrywide and make it consistent with the International Statistical Classification of Diseases and Related Health Problems. Collection and reporting of data such as bronchitis prevalence for children, COPD in adults, hospital admissions for cardiovascular and respiratory illness, and lost workdays could be strengthened to support analysis of morbidity associated with exposure to AAP. Lastly, the government should develop and strengthen capacity for conducting environmental health risk assessment to analyze health effects associated with stationary emission sources, for example, industrial facilities.

## Key Sources of PM<sub>2.5</sub> Exposure

**Source apportionment analysis conducted in this report indicates that at a country level, the residential sector is the largest source of exposure to harmful PM<sub>2.5</sub> associated with the burning of solid fuels in homes.** Further analysis would be needed to better understand the role of other sources and hot spots, which could be more important at the local level. This study provides a first quantitative country-level apportionment of sources of PM<sub>2.5</sub>. Additional sources of exposure to PM<sub>2.5</sub> include energy, transport, industry, agriculture, and others. Being a country-level study, this report recognizes that contributions of specific sources may vary by geographical area and that pollution may be more localized in hot spots with some sources being more dominant than others. To better understand the source structure at the local level, for example, in a city or urban area, specific source apportionment studies will be needed and require comprehensive and accurate emissions inventories and reliable air quality monitoring data.

**The dominant share of PM<sub>2.5</sub> pollution originates within the geographical boundaries of BiH, which underscores the need for the government to take concerted and committed action to tackle air pollution.** The contribution of transboundary sources (about 20 percent) to AAP in the country is considerably less than domestic sources (about 65 percent). The advantage of this is that the country has direct control over the selection, implementation, and timelines for the actions that need to be taken to achieve a significant impact in improving ambient air quality. Collaborative or regional approaches will, however, be needed to address AAP that is imported from neighboring countries.

**The analysis points to a clear need to develop a comprehensive and accurate emissions inventory for BiH that covers various sectors and prioritizes the residential sector to improve estimation of emissions**

---

<sup>1</sup> This cost estimate does not include Brčko District (BD).

**and strengthen effectiveness of interventions to reduce AAP.** Uncertainties related to activity and fuel use data and use of waste in the residential sector need to be addressed. In the transport sector, uncertainties related to vehicle age and imported used vehicles will also need to be addressed to improve completeness and accuracy of emission inventories.

**Notwithstanding the significant health impacts and cost of AAP, monitoring efforts in the country focus primarily on the less harmful PM<sub>10</sub>.** Furthermore, monitoring data have many shortcomings, notably poor levels of completeness of air quality monitoring data. This report found that many monitoring stations only measure PM<sub>10</sub>, but there is a need to monitor PM<sub>2.5</sub> at all stations. The available monitoring data for PM<sub>2.5</sub> are often incomplete due to many stations not monitoring at all or not consistently monitoring PM<sub>2.5</sub>.

**Given the widespread practice of burning solid fuels in homes as well as coal for power generation in BiH, monitoring efforts should be expanded to include the measurement of chemical species and constituents of particulate matter (PM)** (for example, elemental carbon, organic carbon, and sulfates), which are associated with combustion processes and have been associated with adverse effects on human health. In addition, monitoring efforts should include measurement of precursors of PM<sub>2.5</sub> including sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), ammonia (NH<sub>3</sub>), and non-methane volatile organic compounds (NMVOC); black carbon (BC) (a constituent of PM, which also has climate warming properties); and toxic heavy metals such as lead.

**PM<sub>2.5</sub> emissions are not expected to decline markedly under existing policies due to the burning of solid fuel for heating.** Using the Greenhouse Gas-Air Pollution Interactions and Synergies (GAINS) model to simulate emission scenarios up to 2030 and generate country-level source apportionments, this study found that if effectively enforced, the existing environmental and air quality policies are expected to deliver a strong decline in the emissions of SO<sub>2</sub> and NO<sub>x</sub> but will not have major impacts on primary PM<sub>2.5</sub> emissions, as current energy projections do not foresee major shifts away from fuelwood combustion in household stoves and boilers. Furthermore, since the contributions from the power sector will decline significantly, the residential sector will remain the dominant PM<sub>2.5</sub> emission source.

**Furthermore, while the existing policies should lower concentrations in large parts of the country to levels around the health-based WHO guideline value, concentrations in urban areas will remain high and in violation of the WHO guideline value.** In hot spots, ambient concentrations may exceed WHO guideline values by up to a factor of 3, mainly due to the persistence of fuelwood burning for heating.

**While it would be technically feasible through measures in the residential sector to bring ambient PM<sub>2.5</sub> concentrations in most of the country, including cities below or slightly above the PM<sub>2.5</sub> guideline value, full implementation of all measures will be challenging and require strong government commitment.** Relevant measures would require (a) early compliance of all new household stoves and boilers burning fuelwood with the stringent standards of the Ecodesign Directive of the European Union (EU); (b) replacement of the oldest existing installations; and (c) assurance of adequate quality of fuelwood, through burning of only dry fuelwood and proper storage of fuelwood. Such changes would require strong financial and governance mechanisms for their realization.

## **Policy and Institutional Aspects of Air Quality Management in Bosnia and Herzegovina**

**BiH's continued efforts to improve AQM are underscored by programs and projects undertaken both by domestic institutions and with support of external agencies to address air quality and progress in harmonizing country environmental legislation with EU legislation.** This progress notwithstanding, the institutional and policy framework for AQM in BiH is characterized by the existence of different legal and planning instruments in each jurisdiction. Environmental legislation was highly harmonized across the FBiH, RS, and BD in the early 2000s, when each of the jurisdictions had adopted similar packages of environmental laws. With each of the entities FBiH, RS, and BD being ultimately responsible for AQM over their territories, this leads to at least duplication of administrative structures that conduct the same line of work. As a result, the country has three separate legal frameworks, organizational structures, and air quality networks.

**BiH's constitution does not provide for the establishment of a country-level environmental protection ministry or agency, which is important for effective tackling of air pollution.** To improve AQM outcomes at a country level, the Ministry of Foreign Trade and Economic Relations (MOFTER) and the Inter-Entity Coordination Body for the Environment could be strengthened to enhance consolidation and coordination between the FBiH, RS, and BD on air quality issues. Such coordination should be backed by legislation and include priority-setting criteria, clear accountability mechanisms that cover relevant stakeholders across jurisdictions, monitoring and evaluation of outcomes, mechanisms for conflict resolution, and social-learning mechanisms to promote continuous improvement of the coordination. Although time intensive and requiring adequate budgetary and human resources, coordination is logical to effectively tackle air pollution at a country level. With respect to the Inter-Entity Coordination Body for the Environment, legislation in all jurisdictions should be harmonized in their definitions of the function and composition of the body. Some areas where such coordination is needed include (a) establishing a clear institutional mandate for in-country and international reporting of air quality data for the country and (b) data sharing on air quality.

**Formal mechanisms of vertical and inter-sectoral coordination are also needed to effectively tackle air pollution at a country level.** Although some informal coordination takes place among the organizations responsible for air pollution management in the FBiH, RS, and BD, it is not a substitute for institutional coordination. Vertical coordination, that is, between the constitutional entities and lower levels of government, in all jurisdictions should be reinforced by establishing clear procedures and mechanisms for air quality data sharing and gradually for a broader range of topics such as alignment of strategies and plans, as well as enforcement. Efforts to align legal and policy frameworks at different levels of government should be guided by the shared aspiration to fully transpose the EU acquis. Similarly, inter-sectoral coordination needs to be bolstered, particularly between environmental authorities and other sectors including health as well as transport, industrial, energy, urban development, and agriculture, whose activities affect air quality. Inter-sectoral coordination should include a focus on defining agendas and priorities related to air quality across sectors with inputs from different sectors, development of monitorable and time-bound targets to guide the design and implementation of interventions, and monitoring and evaluation of effectiveness.

**In the short term, MOFTER and the Inter-Entity Coordination Body for the Environment could focus efforts on further harmonization of the legal framework across jurisdictions, transposing outstanding air quality-related EU Directives, and filling gaps in legislation.** Harmonization should cross all the building blocks of AQM, including the legal and policy frameworks related to air quality monitoring, emissions inventories, and analysis of air pollution, organizational frameworks, public participation, and

enforcement. Vertical harmonization of legislation should also take place. With respect to EU Directives, areas that could be addressed by the government include harmonization of timelines for achieving ambient air quality standards for specific pollutants. In addition, the government could focus on full transposition of EU legislation that relates to (a) sulfur content of liquid fuels; (b) the National Emissions Ceilings Directive; (c) control of volatile organic compounds from petrol storage and distribution; (d) petrol vapor recovery during refueling of ore vehicles at service stations; and (e) limit values for industrial emissions for new plants. In addition, development of air quality strategies of each jurisdiction should include formal mechanisms of coordination between the FBiH, RS, and BD to ensure that strategy implementation processes are complementary and synergistic. In addition, legislation on environmental inspections for air pollution sources is lacking and should be developed.

**There is a need to scale up the adoption of air quality plans (AQPs) at the local level.** The impacts of air pollution are most profoundly experienced at a local level. Government support to local levels of government for the development of AQPs is crucial. While cantons of Sarajevo and Una-Sana have developed plans, it is important to scale up the preparation of AQPs to other cantons and municipalities in the country. The AQPs should take a comprehensive approach, which includes the development of emissions inventories, reliable air quality monitoring, understanding of the contributions of different sources to local air pollution, understanding of health impacts of air pollution, and identification of economically effective interventions for reducing air pollution. To this end, capacities of cantons and municipalities could be strengthened so that they can develop emissions inventories; obtain reliable time series of air quality monitoring data; and conduct air quality modeling, source apportionment studies, laboratory analyses, health impact analyses, and economic effectiveness analyses of alternative air pollution reduction interventions needed to underpin and inform the design and implementation of AQPs.

**BiH should take specific measures to build on the legal framework to reduce pollution from stationary and mobile sources.** Some of the specific areas that should be addressed include (a) taking time-bound steps to bring standards for liquid fuel quality, including gasoline, heavy fuel oils, and gas oils, into compliance with EU legislation for the entire country; (b) introducing more stringent standards for solid fuel quality for use in households (the current legislation requires that coal for use in households must have a total sulfur content of less than 2.5 percent by weight and allows municipalities to adopt more stringent standards; by way of comparison, in Ireland coal sold for home heating must have a sulfur content no greater than 0.7 percent by weight); (c) starting with large facilities, closing loopholes that allow stationary sources to operate without the necessary pollution control equipment and in violation of air emissions standards; and (d) building on the country's efforts to introduce measures to restrict imports of vehicles that do not meet Euro 4 standards—additional measures could be taken to revisit and issue country-level regulations establishing mandatory monitoring and inspection programs, to better link the price of annual Eco tests to the emission characteristics (Euro) of the vehicle, which would incentivize vehicle owners to undertake the tests and to replace old vehicles with less polluting ones. Recent consultations by MOFTER on a proposed decision on temporary suspension and reduction of duties on imported new vehicles with a view to promoting imports of new, particularly electric, vehicles should be consolidated and take into account distributional impacts of proposed policy actions.

**BiH could expand the menu of instruments for AQM beyond 'command-and-control' instruments.** In addition to strengthening the existing 'command-and-control' regulations, the different jurisdictions might consider developing economic instruments that have been used to reduce air pollutant emissions more efficiently and effectively in other countries such as taxes, fees, pollution charges, tradable permits,

or pricing policies. In the FBiH, environmental fees and taxes are in use. However, fees for stationary sources could be updated and indexed to avoid erosion by inflation over time. To this end, third-party verification is needed of reported emissions used for computation of fees. For mobile sources, there is a need to better link fees to vehicle use and maintenance, in addition to technology-related parameters currently used to calculate fees. In addition, incentives for people to replace old vehicles with new, cleaner cars should be strengthened. Furthermore, as the government considers the reduction of duties on new imported vehicles, it would be important that adequate incentives are also put in place to discourage importation of old, polluting vehicles. In RS, the government should expedite efforts to establish a system to operationalize the amendments to the environmental protection law adopted in 2017, which introduced the first set of environmental economic instruments. Similarly, opportunities may exist in BD to develop economic instruments, which are currently lacking.

**BiH could enhance the efficiency of its environmental funds in supporting air pollution reduction.** Both the FBiH and RS have established environmental funds: the Environmental Fund of the FBiH and the Environmental Protection and Energy Efficiency Fund of RS. To strengthen the effectiveness of these funds in addressing air pollution, the respective funds could further improve criteria used for prioritizing and selecting projects or activities to which funds are allocated and enhance transparency related to the allocation of proceeds from fees to specific projects that reduce air pollution. For example, criteria could be incorporated that target activities that will have the most significant effect on reducing health impacts or the cost of environmental degradation due to air pollution.

**There is a need to strengthen agencies with responsibilities for AQM at all levels and provide them with adequate resources.** A priority for strengthening AQM consists of building capacity to design and implement AQM policies, including recruiting a higher number of specialized personnel in all agencies responsible for AQM-related tasks. Strengthening institutional capacity to enforce existing air quality standards is a pressing priority. To that end, sustained, higher resource allocation and strong government commitment will be key. In some instances, outsourcing of these functions to specialized firms or research organizations may be more efficient. Technical capacity of existing institutions could be strengthened through partnerships with research centers to conduct applied research, improve local and regional models, and create centers of excellence in the country on AQM.

**Putting in place measures to strengthen enforcement of regulations related to AQM, particularly at the local level, is crucial for improving the effectiveness of the government's efforts to tackle air pollution.** There is a need to strengthen inspection at the municipal level, increase the number of inspectors, and provide them with training and resources to conduct field investigations. Also, there is a need to build capacity for third-party verification of emissions reported by polluters. Given the prominent role of domestic heating in air pollution, efforts should be made to legally allow for household inspections to be conducted, to further strengthen such inspections, and increase public awareness, targeted to households, on air pollution and low-emission practices for household heating. Tested approaches to reinforcing compliance and enforcement include public disclosure of emitters' environmental compliance, judicial action, and increasing fines and expanding the range of sanctions for noncompliance, potentially including civil, judicial or administrative, as well as criminal enforcement on legal representatives of a polluting body.

**Current air quality monitoring efforts can be improved through investments in more robust systems for air quality monitoring, data analysis, data quality control and assurance, data management, and**

**capturing of emission sources.** Efforts to establish a reliable air quality monitoring network should prioritize a focus on pollutants that are critical to health and increased geographic and time series coverage, notably of PM<sub>2.5</sub>. In BD, monitoring efforts, which currently focus on total suspended particulates (TSP), could shift toward PM<sub>2.5</sub>, the more scientifically valid health-based indicator of PM. Additional ways to strengthen the current monitoring program include establishing a centralized depository of air quality data collected across the country and building the capacity within the relevant agencies in the FBiH, RS, and BD to carry out modeling and speciation efforts. Given that multiple institutions are involved in operation and maintenance of air quality monitoring networks in the country, it is important to have harmonized methodologies for sampling and analyses and standard operating procedures for operation and maintenance of monitoring stations to improve their operation as well as data quality and completeness. Furthermore, quality assurance and quality control (QA/QC) of data collected or generated at monitoring stations is vital, and there should be official written procedures for formatting, storage, and QA/QC of such data. These procedures should be harmonized across all constitutional entities to facilitate country-level assessments of air quality. Similarly, QA/QC procedures for maintenance and calibration of analytical instruments should be documented and harmonized across the country and include the practice of inter-laboratory calibration. It is recommended that the government sustains momentum on the ongoing efforts to establish a reference laboratory in the country.

## Interventions to Reduce Exposure to Ambient Air Pollution

**Addressing air pollution effectively in BiH will require policy, institutional, and investment interventions in various sectors, including residential and transport whose activities affect air quality.** Some interventions that the government may consider include the following:

- **Residential.** The government could develop a large-scale program to substitute traditional stoves with more efficient ones. It could start with implementing a pilot program in the short term. Lessons from such a pilot, and other existing initiatives, could be taken into account to inform the development of a possible large-scale stove replacement program. In many countries, similar programs have been implemented with targeted subsidies for project beneficiaries who cannot afford to pay the full costs of substituting their stoves with cleaner alternatives. An awareness program would help educate the public on the purpose of stove replacement, low-emission stove use, and available resources for households and promote adoption of clean stoves in households. Additional measures such as expanding district heating could be developed over the medium to long term. Selection of interventions such as restrictions on burning of solid fuels in households, increased gas connections, expansion of district heating, and energy efficiency measures such as those contemplated in the Sarajevo Cantonal Environmental Action Plan should be based on analysis of the benefits and costs of alternative interventions. Furthermore, the distributional impacts of alternatives should be well understood to ensure that they do not disproportionately burden poor households.
- **Mobile sources.** Despite its apparently small share of pollution, transport is known to be highly locally polluting and should be addressed. Current standards for fuel quality allow high sulfur content up to 350 ppm for diesel and 150 ppm for gasoline compared to the 10 ppm limit on sulfur content required by EU legislation. BiH has taken measures to restrict imports of vehicles that do not meet Euro 4 standard and has recently been consulting introduction of temporary suspension of duties on imported new vehicles, to promote importation of new and electric vehicles.

However, if the disincentive to import old, polluting vehicles is not sufficiently strong, it may have limited impact on reducing air pollution. Additional measures that the government could consider include (a) revision of fuel quality standards to make them more stringent; (b) putting in place of additional economic incentives to replace older vehicles with more modern, cleaner vehicles; (c) stricter enforcement of measures to reduce importation of old, polluting vehicles, including the requirement for inspections at the point of entry; (d) putting in place of mandatory monitoring and inspection programs that are strictly enforced; and (e) inclusion of criteria related to vehicle use and maintenance in parameters for ECO tests for vehicles. Further strengthening and expansion of the public transport in urban areas, in particular using environment-friendly vehicles, could additionally help decrease pollution from mobile sources.

- **Stationary sources.** Starting with large facilities, there is a need to close loopholes that allow stationary sources to operate without the necessary pollution control equipment and in violation of air emissions standards. The legal framework could be tightened to ensure that the sanctions for facilities operating without a valid environmental permit, and facilities that exceed their approved emissions levels, are clear and commensurate with the damage they cause. In addition, enforcement of sanctions would need to be strengthened. Also, the government could provide financial incentives for smaller industrial undertakings to strengthen AQM. Additional measures that are available to control emissions from stationary sources include setting consumption caps to gradually reduce coal use; incorporating new technologies for desulfurization, denitrification, and dust elimination; setting more stringent emission control standards for coal-fired plants; and setting resource and energy conservation goals targeted at resource-intensive industries. However, it would be important to assess whether the benefits of these interventions would outweigh their costs.

## Learning from International Experience in Tackling Air Pollution

**Addressing air pollution effectively requires strategic, integrated approaches and solutions that are appropriate to the specific city or geographical context and various actors.** A single sector or institution cannot solely undertake the extensive work involved in AQM given its cross-cutting nature. Experiences from other countries that are making progress in tackling air pollution show that an integrated approach is required. By supporting these countries, the World Bank has demonstrated its ability to play an integrative role through bringing together and fostering dialogue between, and engagement of, various country and international stakeholders and supporting crucial analytical work to inform investments and policy and institutional actions for AQM.

**The design and implementation of economically effective interventions to successfully reduce air pollution must be underpinned by a sound foundation of analytical work to inform the selection of priorities and interventions and to set realistic and achievable air quality targets.** As may be seen from the Peru and Mongolia examples, such analytical work also provides a platform around which various relevant stakeholders, including, among others, the government (across different sectors and different levels of government), think tanks, academia, the private sector, and donor agencies, can engage and come to informed conclusions about possible interventions and implementation of an appropriate air pollution reduction program. The government could consider setting interim air quality targets for ambient air quality concentrations of PM<sub>2.5</sub> and understanding how various pollution contributors can

engage in actions to achieve the set target, as part of a phased approach for bringing ambient PM<sub>2.5</sub> concentrations down.

**Conducting in-depth analytical work is often time intensive and could span several years, requiring adequate budgetary resources.** It is recognized that in many contexts, the severity of air pollution and its health impacts as well as public pressure on government and city officials to act may call for interventions in the immediate to short term to reduce air pollution. In such cases, a city could consider applying reasonable interventions and policy options that would help alleviate air pollution in the short term such as restricting pollution from known stationary sources or traffic restrictions. However, such short-term actions are unlikely to be able to effectively reduce air pollution in the long term, in particular where air pollution sources are many and varied, and cannot replace a strategic and integrated approach involving rigorous analytical work and engagement of various relevant stakeholders across different sectors (e.g. environment, energy, transport, economy, agriculture etc.), development partners, academia, and others, to inform design and implementation of economically effective interventions for sustained or long-term air pollution reduction.

**BiH, together with neighboring countries, could establish a knowledge platform for collaboration on transboundary air pollution.** Although most of the pollution in BiH is from domestic sources, the transboundary contribution is important (at 20 percent). To maximize the synergies between similar or shared air quality-related problems, BiH could consider setting up, together with neighboring Balkan countries, a Balkan Knowledge Platform on transboundary air pollution. The knowledge platform could begin with coordination and knowledge sharing on technical aspects related to transboundary air pollution and gradually broaden the scope to collaboration on measures to address transboundary pollution based on experience and knowledge gained through interaction on the platform.

**Benefit-cost analysis should be used to provide an informed basis for prioritizing and selecting interventions to reduce air pollution from different sectors.** The interventions for tackling air pollution in different sectors are generally well-known, for example, promoting cleaner fuels, implementing district heating, and introducing transportation interventions. However, it is important that economically effective interventions are selected, which have a benefit-to-cost ratio greater than 1. In other words, the health benefits of an intervention—that is, avoided cost of premature mortality and morbidity—should be greater than the cost of implementing the intervention. It is recognized that such analysis should take into account existing policy and operational constraints that could foreclose or limit the implementation of certain air pollution reduction interventions.

**The experiences of different cities around the globe show that in addition to technical interventions, a menu of instruments, including market-based, economic, and command-and-control instruments, are needed to effectively reduce AAP.** Examples from Peru, Mongolia, and China illustrate the types of interventions that have had a strong impact on reducing air pollution, over different time frames, and may provide useful lessons for BiH as it strives to reduce air pollution. Cities in the aforementioned countries have successfully used a variety of instruments in their efforts to reduce air pollution, including market-based instruments, economic instruments, command-and-control instruments, investments in technical interventions, and policy and institutional reforms.

**It is important that strategies and interventions to reduce air pollution do not disproportionately burden poor and vulnerable groups of people.** Poor people are more likely to drive older, polluting vehicles. Poor people are also more likely to burn cheap and highly polluting fuels for domestic purposes.

Therefore, policies that prohibit the use of old, polluting vehicles in favor of newer, clean vehicles could incorporate financial or other suitable incentives for poorer people to comply with the policies. Similarly, programs to promote replacement of polluting stoves with clean, efficient stoves should incorporate incentives that will help low-income households’ transition to burning cleaner fuels. It would be important to take into account distributional and social impacts of a ban on coal heating, if implemented, on affected populations in different income groups. Poverty and social impact analysis could be used to understand distributional impacts of policies to reduce air pollution to ensure that the poor and vulnerable are not disadvantaged by actions resulting from those policies.

**Several development partners are supporting BiH’s efforts to reduce air pollution, and stronger in-country coordination could help optimize this support.** The technical assistance of development partners (for example, the World Bank, WHO, U.S. Embassy in Sarajevo, Government of Sweden, Embassy of Switzerland, UN Environment, United Nations Development Programme, and European Bank for Reconstruction and Development [EBRD]) has been instrumental in a number of advances being made in the areas of emissions inventory, monitoring, health impacts, dissemination of data, and abatement measures. Though very valuable, BiH has much work ahead to put in place structures that will allow it to successfully address its highly polluted air. The lack of coordination and harmonization and central authority for AQM is part of the root problem holding the country back in its efforts to address pollution. Without strong coordination, relevant institutions cannot create a policy and enforcement landscape that effectively controls pollution as severe as that in BiH.

**There is a need to take stock of the outcomes of development support on air pollution and to identify opportunities where investments and policy and institutional actions can scale up impacts on air quality supported by appropriate financing mechanisms.** The work of the abovementioned development partners and others has been instrumental in advancing progress on AQM in BiH. Stocktaking of the outcomes of the ongoing donor-supported activities and identification of opportunities and financing mechanisms should be coordinated among donors and conducted in collaboration with the government. Furthermore, the air pollution problem is significant and cannot be resolved without sustained government commitment combined with targeted policy actions; strong and adequately resourced institutions at all levels of government, particularly at the local level where the impacts are most felt; and sound planning and investments underpinned by rigorous analytical work. Government commitment is needed to ensure that institutions responsible for reducing air pollution are strong and well-staffed, supported by adequate budgetary resources, and are able to undertake sound planning and investments underpinned by requisite analytical work.

## Recommendations for Air Quality Management in Bosnia and Herzegovina

The recommendations of this report are summarized in Table ES.1.

**Table ES.1. Summary of key recommendations on AQM in BiH**

Recommendation	Time frame
<b>Legal and policy framework</b>	
Strengthen the legal framework, focusing on specific instruments that reduce pollution from mobile sources, large stationary sources, and district heating.	Short to medium term
Harmonize regulations on sulfur content in liquid fuels at the country level and in compliance with the EU Directive on sulfur content in liquid fuels (1999/32/EC).	Short term

Recommendation	Time frame
Harmonize timelines for achieving ambient air quality standards for specific pollutants; fully transpose EU legislation that relates to the National Emissions Ceilings Directive, control of volatile organic compounds from petrol storage and distribution, petrol vapor recovery during refueling of ore vehicles at service stations, and limit values for industrial emissions for new plants.	Short to medium term
Adopt and implement legislation on environmental inspections for air pollution sources.	
Strengthen the legal framework by adopting and implementing a menu of air pollution management instruments, including economic and market-based instruments.	Medium term
Introduce more stringent standards for solid fuel quality for use in households.	Short to medium term
Scale up adoption and implementation of local AQPs.	Short to medium term
<b>Air quality, emissions, and health data and analysis</b>	
Strengthen the air quality monitoring network to provide reliable time series data on pollutants, notably PM <sub>2.5</sub> , including clear protocols and procedures to strengthen QA/QC related to monitoring, data analysis, management, and reporting.	Short term
Expand air quality monitoring to include chemical constituents and species of PM such as pollutants including elemental carbon, organic carbon, sulfates, associated with combustion processes; PM <sub>2.5</sub> precursors including SO <sub>2</sub> , NO <sub>x</sub> , NH <sub>3</sub> , and NMVOC; BC; and metals such as lead.	Short term
Improve meteorological observation for Sarajevo valley area, background monitoring data, and a comprehensive inventory of pollutants to improve air quality modeling.	Short to medium term
Develop an inventory of stationary and mobile air pollution sources prioritizing the residential sector and addressing all pollutants including BC: (a) <b>Residential.</b> Strengthen information on solid fuel statistics, burning of waste in the residential sector, typical solid fuel quality, and combustion technology used in the country. (b) <b>Transport.</b> Address uncertainties related to vehicle age and imported used vehicles, address all pollutants including BC, and conduct source apportionment analyses in large, densely populated urban centers.	Medium term
Consolidate a centralized and consistent depository of air quality data collected across the country and build the capacity to conduct modeling and speciation efforts.	Medium to long term
Harmonize country health reporting with international systems of disease classification, that is, the International Statistical Classification of Diseases and Related Health Problems.	Short to medium term
Improve collection and reporting of morbidity data by disease and age group.	
Strengthen capacity for conducting health risk assessments for individual industrial facilities.	
<b>Reducing pollution from different sectors/sources</b>	
<b>Residential:</b> (a) Implement a pilot program to replace polluting stoves and boilers with more efficient ones, including Ecodesign stoves, and build on lessons learned and experience to date to develop a large-scale program; (b) put in place targeted financial incentives to help poor households adopt clean, efficient stoves; and (c) implement public awareness campaigns to promote stove replacements.	Short to medium term
Where approved local environmental action plans exist that contemplate interventions such as increased gas connections and expansion of district heating, conduct (a) cost-benefit analysis to inform selection of interventions and (b) analysis of distributional impacts of proposed interventions.	Medium to long term
<b>Mobile sources:</b> (a) revision of liquid fuel quality standards to make them more stringent; (b) establishment of additional economic incentives to replace older vehicles with more modern, cleaner vehicles; (c) stricter enforcement of measures to reduce	Medium to long term

Recommendation	Time frame
importation of old, polluting vehicles, including requirement for inspections at point of entry; (d) establishment of mandatory monitoring and inspection programs that are strictly enforced; and (e) inclusion of criteria related to vehicle use and maintenance in parameters for ECO tests for vehicles.	
<b>Transboundary:</b> Establish, together with neighboring countries, a technical knowledge platform on transboundary pollution.	Short to medium term
<b>Organizational framework for AQM</b>	
Strengthen capacity of agencies with responsibilities for AQM at the FBiH, RS, and BD levels and provide staffing with requisite expertise and adequate budgetary resources. Areas where staff capacity could be enhanced include source apportionments, inventory development, air quality modeling, and health impact analysis.	Short term
Bolster inter-sectoral coordination, particularly between environmental authorities and other sectors such as health as well as transport, industry, energy, urban development, and agriculture whose activities affect air quality. Include criteria for priority-setting, accountability mechanisms that cover relevant stakeholders, monitoring and evaluation of outcomes, and social-learning mechanisms to promote continuous improvement.	Short to medium term
Strengthen MOFTER and the Inter-Entity Coordination Body for the Environment to facilitate harmonization of legal, policy, and organizational frameworks.	Medium term
Strengthen horizontal and vertical coordination by establishing formal and permanent mechanisms for AQM policy development, implementation, monitoring, and evaluation.	Medium to long term
Establish reference laboratory for country and institute inter-laboratory calibration exercises.	Medium term
Strengthen effectiveness of environmental funds, established in the FBiH and RS, in addressing air pollution, by clarifying and developing criteria for prioritizing and selecting projects or activities to which funds are allocated and enhancing transparency related to the allocation of proceeds from fees to specific projects that reduce air pollution.	
<b>Public participation and stakeholder engagement</b>	
Develop an air quality index (AQI) to disseminate information to the public in a manner that is easily understandable and accessible to diverse audiences and facilitate issuance of health-related air quality alerts, for sensitive population groups and to the population as a whole, when necessary.	Short term
Develop public disclosure mechanisms for emissions reporting by operators of facilities.	Medium to long term
<b>Enforcement</b>	
Expand the number of inspectors and provide them with training and resources to conduct field investigations.	Short term
Put in place third-party verification of emissions reported by operators of polluting facilities.	Short to medium term
Put in place regulations to legally allow household inspections.	Short term
Strengthen enforcement by clarifying sanctions for noncompliance, increasing fines, and expanding the range of sanctions, in particular for stationary sources.	Medium term