STATE OF AIR QUALITY IN BULGARIA: OVERVIEW

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LIST OF ABBREVIATIONS

AQ	Air Quality
AQP	Air Quality Programme
BAP	Benzo(a)pyrene
CAAA	Clean Ambient Air Act
EC	European Commission
ECJ	European Court of Justice
EEMRBNP	Energy Efficiency of Multi-Family Residential Buildings National Program
EPA	Environmental Protection Act
ESIF	European Structural and Investment Funds
EXEA	Executive Environmental Agency
GDP	Gross Domestic Product
GVA	Gross Value Added
IPPC	International Plant Protection Convention
LEZ	Low Emission Zone
MOEW	Ministry of Environment and Waters
NAPCP	National Air Pollution Control Programme
NAQIP	National Air Quality Improvement Programme
NDP	National Development Programme
NECP	National Energy and Climate Plan
NGO	Non-Governmental Organisation
NIE	National Inventory of Emissions
NIMH	National Institute of Meteorology and Hydrology
NSI	National Statistics Institute
OAP	Operational Action Plan
OPE	Operational Program Environment
PAH	Polycyclic Aromatic Hydrocarbons
PM	Particulate Matter
RHI	Regional Health Inspectorate
RIEW	Regional Inspectorate of Environment and Waters
SAMTS	State Agency for Metrological and Technical Surveillance
SFA	Solid Fuel Appliance

EXECUTIVE SUMMARY

The latest *Air Quality in Europe 2019* report estimated that exposure to $PM_{2.5}$ pollution caused 412 000 premature deaths in Europe in 2016[1]. In the case of Bulgaria, $PM_{2.5}$ pollution was estimated to have caused 13 100 premature deaths in 2016.

Analyzed air quality data from Bulgaria shows that there is a positive trend in moving towards compliance with most pollutants. PM_{10}, $PM_{2.5}$ and PAH continue to be problematic for most municipalities where monitoring of those pollutants is performed, whereas NO_2 is an occasional issue in Plovdiv and SO_2 is a persistent issue in Galabovo, located in the area of the lignite coal power plants in the southeastern part of Bulgaria. In general, however, accessibility to air quality data is limited. Only since 2018, air quality data has become more publicly available, but in many cases, the data is not presented in a user-friendly format.

The burning of solid fuels for residential heating is the main contributor to emissions of PM_{10}, $PM_{2.5}$ and PAH in Bulgaria. On the other hand, transport is the main contributor to NO_2 emissions and the coal-fired power plants to SO_2 emissions. The insufficient quality of municipal emission inventories is a crucial weakness of air quality management in Bulgaria. The most problematic areas in both the national and the local emission inventories are the residential heating emissions and to a lesser extent – transport emissions. With regards to residential heating emissions, there is a lack of reliable and up-to-date data on the amount and types of solid fuels used, as well as on the number of users of solid fuels for heating and types of equipment used. As far as transport emissions are concerned, there is lack of detailed traffic counts, modal splits and transport studies on municipal level.

As an EU member state, Bulgaria has to comply with the relevant EU legislation. The responsible national authority for ensuring compliance is the Ministry of Environment and Waters (MOEW). The ultimate responsibility for ensuring good air quality according to Bulgarian legislation, though, has been transferred to the local level and rests with the mayor of the municipality. At the same time, the Clean Ambient Air Act (CAAA) lists a number of bodies responsible for oversight of air quality management. Thus, responsibilities for air quality management and control are often unclear. For instance, there is not a single entity that can control use of certain fuels or appliances in people's homes or that can register and allow the use of solid fuel appliances (SFA). Therefore, it seems like controlling the major air quality issue in Bulgarian cities – emissions from residential heating – cannot be effectively executed under the current legal framework.

The Government of Bulgaria adopted two strategic air quality programmes in 2019 that outline measures to achieve compliance with the CAFÉ and the National Emission Ceilings Directives. The implementation of most measures in the programmes require some legal, administrative and planning actions, as well as access to funding for measures' implementation. In general, there is lack of experience with air quality-specific funding in Bulgaria. The first national funding scheme to provide such funding is the ongoing Operational Programme Environment (OPE) 2014-2020.

The lack of experience with air quality financing also means that potential beneficiaries, namely the municipalities, have no prior knowledge on planning and competitive bidding for funding for implementation of air quality measures. Overall, there is lack of capacity on local level to both design a project proposal or an SFA replacement program and then implement it.

Related to the issue of insufficient capacity for air quality management in municipal administrations is the suboptimal communication with citizens and civil organizations on air quality issues. Public awareness on

[1] Report available at: https://www.eea.europa.eu/themes/air/health-impacts-of-air-pollution/health-impacts-of-air-pollution

causes of poor air quality is generally low. There is lack of social attitude surveys, although some have been performed or are planned to be performed in the context of upcoming municipal SFA replacement programs.

This document presents the trends in air quality in Bulgaria, discusses the approaches to emission inventories, outlines the existing regulatory environment, summarizes the currently available funding options for air quality measures and highlights concrete actions in air quality management that Bulgarian cities have taken. The overall aim of the document is, based on the current context of air quality management in the country, to identify opportunities for further actions on improving air quality in Bulgaria. The identified issues and respective opportunities are summarized in Table A below.

TABLE A

MAIN ISSUES AND OPPORTUNITIES FOR IMPROVED AQ MANAGEMENT IN BULGARIA

TOPIC	ISSUE	OPPORTUNITY
Data	• Lack of data for some pollutants (such as $PM_{2.5}$) • No easily accessible AQ data	• Improve sampling for some pollutants, including citizen science • Provide a possibility for easy access to AQ data
	• Lack of detailed activity data for some sources of emissions (e.g. residential heating) • Lack of research and studies on AQ	• Conduct surveys to collect activity data to be used in emission inventories • Cooperate with academic and research institutions to improve the scientific knowledge on AQ
Legal	• Unclear responsibilities for AQ management • Inability to effectively control residential burni	• Work with local stakeholders to improve control on residential burning • Share international good examples
Funding	• No experience with AQ-related funding • Missed opportunities to achieve AQ benefits from other funding programmes	• Provide targeted AQ funding • Advise on potential funding synergies with other sectors
Capacity	• Lack of capacity for AQ management at national and local level • Lack of capacity at local level to plan and implement more complex measures such as establishing LEZ	• Improve capacity for AQ management, policy-making, securing funding for AQ measures, mainly at local level • Provide technical assistance to municipalities to implement measures
Communication	• Inadequate communication with the public • Lack of social attitude surveys on the topic of AQ	• Demonstrate approaches to improve communication with the public • Conduct social attitude surveys and share results with stakeholders.

INTRODUCTION

In 2015 the European Commission (EC) started an infringement procedure against Bulgaria for systematic and continuous failure to fulfil its obligations under the CAFÉ Directive. The infringement concerns exceedances of the daily and annual limit values for PM10 concentrations in all air quality (AQ) zones and agglomerations from 2007 until 2014, encompassing in total 28 municipalities. On April 5, 2017 the European Court of Justice (ECJ) delivered its judgement on case C-488/15 declaring that Bulgaria has indeed failed to fulfil its obligations under the CAFÉ Directive and declared that if Bulgaria does not take necessary measures, the country might be brought to court which may demand a financial penalty payment for the continuous infringement of EU legislation. In addition, in July 2019 Bulgaria was again referred to the ECJ due to persisting non-compliance with the hourly and/or daily limit values for SO_2 in the South-East AQ zone, where the four largest thermal power plants in Bulgaria are located.

In addition to PM_{10} and SO_2, some municipalities are non-compliant for $PM_{2.5}$, PAH, and NO_2. There has been a positive trend in moving towards compliance with most pollutants since 2015. NO_2 is an occasional issue in one municipality, SO_2 is a persistent issue also in one municipality, whereas PM10 (especially, due to the higher number of samplers), $PM_{2.5}$ and PAH continue to be problematic for most municipalities where monitoring of those pollutants is performed.

As a response to the initial ECJ ruling, the government of Bulgaria commissioned the drafting of the National Air Quality Improvement Programme (NAQIP)[2] which goal was to identify the sources of PM_{10} pollution on the territories of the non-compliant municipalities according to the ECJ ruling. In addition, the NAQIP had to outline measures to bring those municipalities into compliance. The NAQIP established that the main source of PM_{10} emissions was the continued use of solid fuels for residential heating. Therefore, one of the main measures to achieve compliance with the PM_{10} limit values was the replacement of the old, inefficient solid fuel appliances (SFA) on the territories of the non-compliant municipalities.

The use of solid fuels for residential heating in Bulgaria has its roots in tradition, topography (around one-third of the country is covered by forests) and economic factors. Bulgaria is one of the poorest EU Member States. Bulgaria's economy is mainly dominated by the service industry (about 68% of the economy), followed by industry (about 27%) and agriculture (about 4%). In 2019 Bulgaria's Gross Domestic Product (GDP) was BGN 119 billion (EUR 61 billion) and Bulgaria's real GDP grew by 3.4% compared to 2018[3]. Processing industries such as Food & Beverage, Iron & Steel and Machinery are the main industrial sectors in terms of production in Bulgaria[4].

In addition, according to Eurostat, about 30% of Bulgaria's population cannot keep their homes adequately warm[5]. Depending on which measure for energy poverty is used, analyses show that between 20% and 59% of the population is energy poor[6]. On the other hand, 84% of Bulgarians own the dwellings they live in[7], which makes a potential widespread, centralized SFA replacement program difficult to execute. The reason is that in the case of multi-family buildings, the predominant building types in most of the non-compliant municipalities,

[2] NAQIP available at: http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=1288

[3] Bulgarian National Bank. Annual report 2019. Available at: http://bnb.bg/bnbweb/groups/public/documents/bnb_publication/anual_report_2019_bg.pdf

[3] Data from National Statistics Institute (NSI), available at: https://infostat.nsi.bg/infostat/pages/module.jsf?x_2=6

[5] Eurostat, available at: https://ec.europa.eu/eurostat/databrowser/view/sdg_07_60/default/table?lang=en

[6] https://www.zazemiata.org/wp-content/uploads/2020/03/Teodora-Peneva_konferecija_2020_heating_type_energy_poverty.pdf

[7] Eurostat, available at: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_lvho02&lang=en

agreement of all dwelling-owners in a building has to be reached in order for certain interventions for improved heating efficiency to be implemented – e.g. connection to a central heating system.

This document is structured as follows: it starts with a presentation on the trends in air quality in Bulgaria, followed by a discussion on the approaches to emission inventories, the existing regulatory environment, as the currently available funding options for air quality measures and ends with a summary of concrete actions in air quality management that Bulgarian cities have taken. The overall aim of the document is, based on the current context of air quality management in the country, to identify opportunities for further actions on improving air quality in Bulgaria.

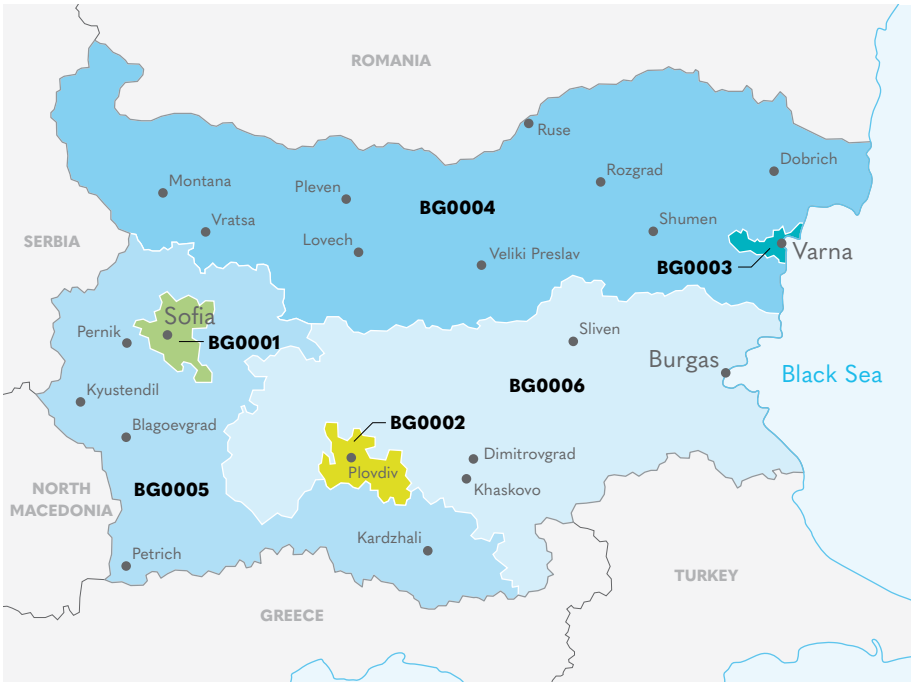
1 AIR QUALITY DATA

Bulgaria is divided into six Air Quality Zones (AQ zones) – Capital Agglomeration (BG0001), Plovdiv Agglomeration (BG0002), Varna Agglomeration (BG0003), North-Danube (BG0004), South West (BG0005), and South East (BG0006) – see Figure 1. Nevertheless, air quality management is not administered at the level of AQ zones; AQ zones are simply administrative units.

FIGURE 1

AIR QUALITY ZONES IN BULGARIA

SOURCE: ExEA



The location of the AQ stations that make up the National Air Quality Monitoring network is determined in Decree № РД-66/28.01.2013. According to this decree there are 57 AQ monitoring stations in Bulgaria – 41 automatic, nine manual and seven DOAS (differentiated optic absorption spectrometry) stations. The 41 automatic and nine manual stations cover 28 municipalities and include four ecosystem and background stations, as well as seven industrial stations. The DOAS stations, which are considered indicative, cover three more municipalities.

Not all pollutants are monitored in each station. For instance, in 2019 SO_2 was monitored at 40 stations, NO_2 – at 37 stations, PM_{10} – at 45 stations and $PM_{2.5}$ – at nine stations. Moreover, it is not uncommon that there are technical issues at stations which prevent them to operate for some time of the year. Depending on the duration of the problem, this might cause the data from those stations to be considered insufficient for official reporting. ExEA does not have the capacity to maintain the stations and hence, outsources this activity through public tenders, which can take a long time to be finalized. Therefore, sometimes stations that have technical problems might not operate for a large amount of time.

PM_{10} is the pollutant of primary concern for most Bulgarian municipalities as this is the pollutant with which widespread non-compliance with the limit values is observed. In addition to PM_{10}, some municipalities are non-compliant for $PM_{2.5}$, PAH, NO_2 and SO_2. Those pollutants are considered in the following paragraphs.

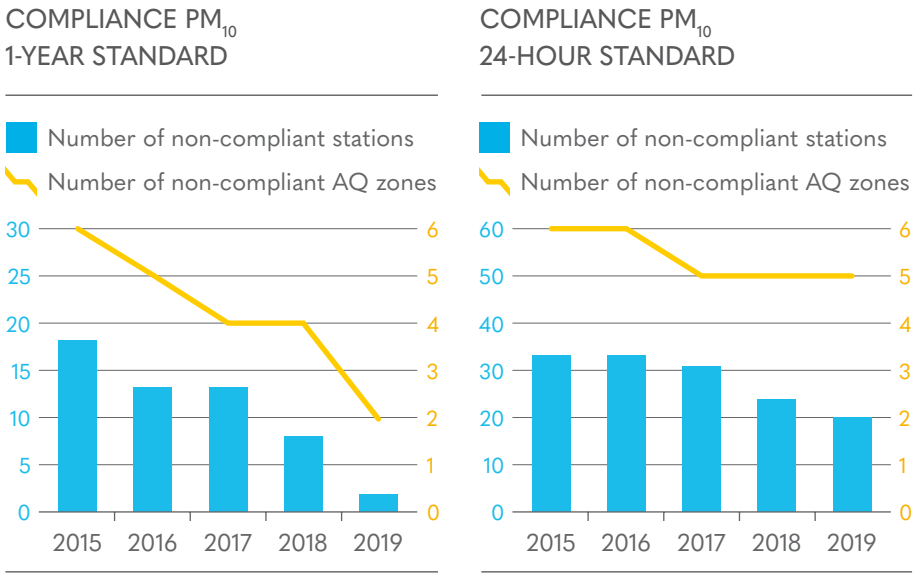
1.1 › PM_{10}

There seems to be a positive trend in the period 2015-2019 towards improving compliance with PM_{10} standards – both the annual average and the allowed number of exceedances of the daily limit values. Whereas non-compliance was observed in all AQ zones and at about 75% of all AQ stations in 2015, this number has dropped for both limit values in 2019. Compliance with the allowed number of exceedances of the daily limit value remains a challenge for a number of Bulgarian municipalities.

FIGURE 2

COMPLIANCE WITH PM_{10} LIMIT VALUES, 2015-2019

SOURCE: ExEA



Compliance with PM_{10} average annual limit values

Compliance with PM10 allowed number of exceedances of daily limit value

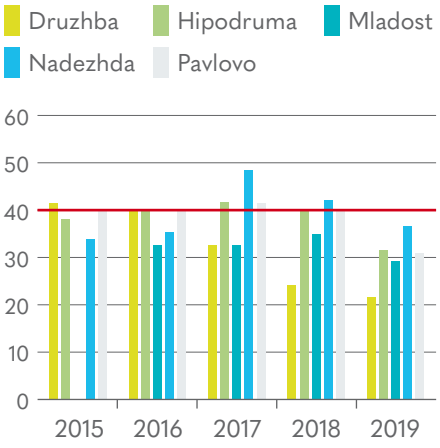
The following figures show the dynamic of PM_{10} compliance in Bulgaria's two largest cities – the capital Sofia (see Figure 3) and Plovdiv (see Figure 4). There are five AQ stations on the territory of the city of Sofia, whereas there are two AQ stations in Plovdiv.

FIGURE 3

COMPLIANCE WITH PM_{10} LIMIT VALUES, 2015-2019, SOFIA

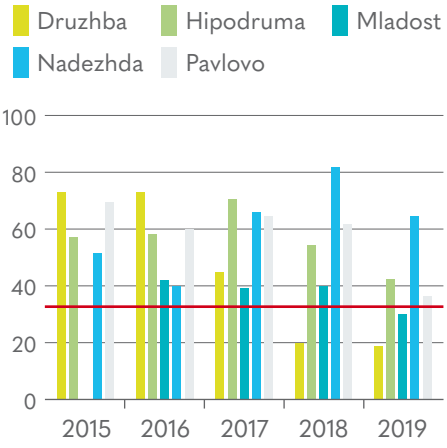
SOURCE: ExEA

PM_{10} ANNUAL AVERAGE, 2015-2019, SOFIA



Compliance with PM_{10} average annual limit values, µg/m³, Sofia

PM_{10} DAILY EXCEED, 2015-2019, SOFIA



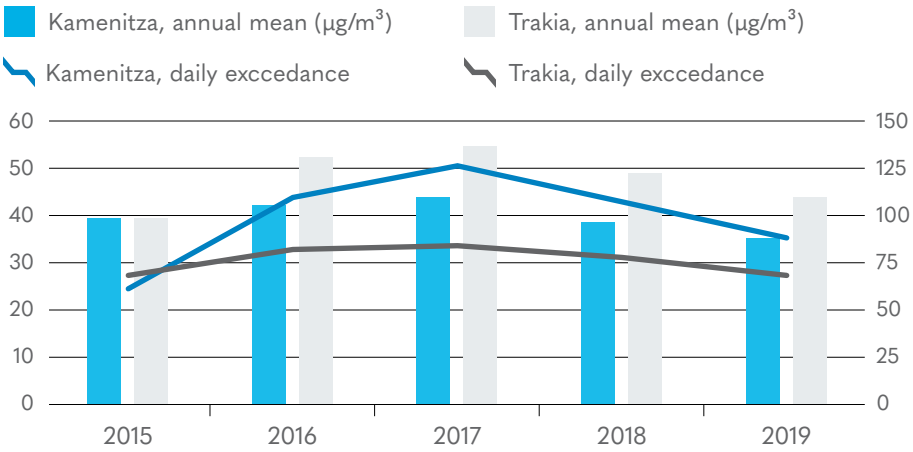
Compliance with PM_{10} allowed number of exceedances of daily limit value, Sofia

FIGURE 4

COMPLIANCE WITH PM_{10} LIMIT VALUES, 2015-2019, PLOVDIV

SOURCE: ExEA

PM_{10} DATA 2015-2019, PLOVDIV



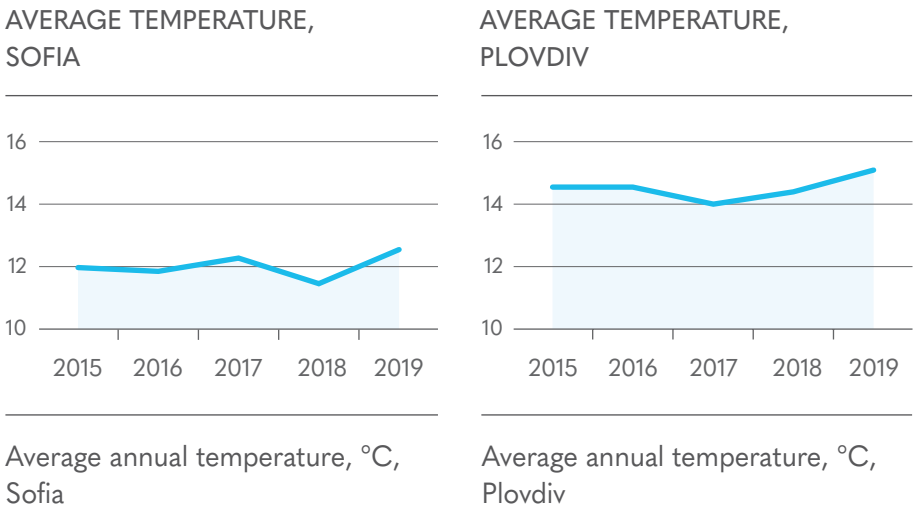
Compliance with PM_{10} average annual and allowed number of exceedances of daily limit values, Plovdiv

As shown on Figure 3 and Figure 4, all AQ stations in Sofia and one of the two AQ stations in Plovdiv were compliant with the annual average PM_{10} limit value in 2019. In addition, two out of the five AQ stations in Sofia were also compliant with the allowed number of exceedances of the daily limit PM_{10} value. It remains to be seen whether the downward trend is sustainable or was caused partially by the warmer 2018 and in particular, 2019 (see Figure 5), meaning that households used less solid fuels for heating during the winter in those years.

FIGURE 5

AVERAGE ANNUAL TEMPERATURES IN SOFIA (LEFT) **AND PLOVDIV** (RIGHT), **2015-2019**

SOURCE: ExEA



Average annual temperature, °C, Sofia

Average annual temperature, °C, Plovdiv

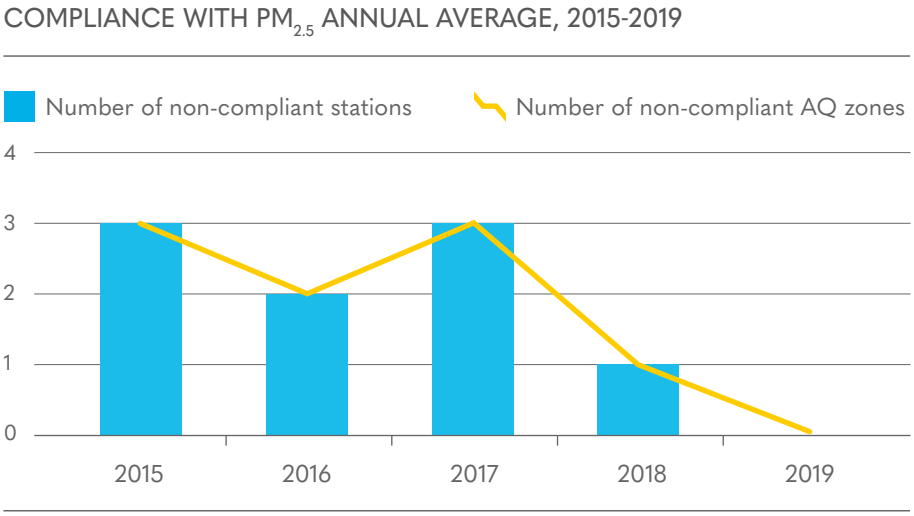
1.2 › $PM_{2.5}$

Similar to PM_{10} concentrations, there is a downward trend in $PM_{2.5}$ concentrations. In fact, in 2019 all AQ stations, measuring $PM_{2.5}$ were compliant with the annual average limit value. However, $PM_{2.5}$ is only monitored at ten stations in Bulgaria and in 2019 – nine were fully operational, the only AQ station in Sofia that monitors $PM_{2.5}$ did not work. Moreover, out of the ten AQ stations monitoring $PM_{2.5}$, only seven are in cities. Therefore, the territorial coverage of $PM_{2.5}$ sampling is much more limited than the one for PM_{10}.

FIGURE 6

COMPLIANCE WITH $PM_{2.5}$ LIMIT VALUE, 2015-2019

SOURCE: ExEA



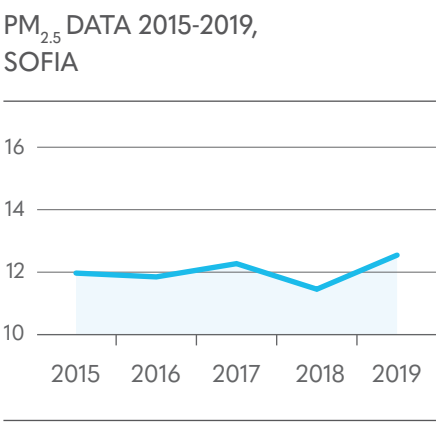
Compliance with $PM_{2.5}$ average annual limit value.

Sofia and Plovdiv each have one AQ station that monitors $PM_{2.5}$ (see Figure 7). Moreover, the $PM_{2.5}$ sampler has not been operating in the AQ station in Sofia for the last two full years. On the other hand, the $PM_{2.5}$ sampler in the AQ station in Plovdiv was not working in 2016. Hence, detailed analysis of $PM_{2.5}$ concentration trends is highly limited.

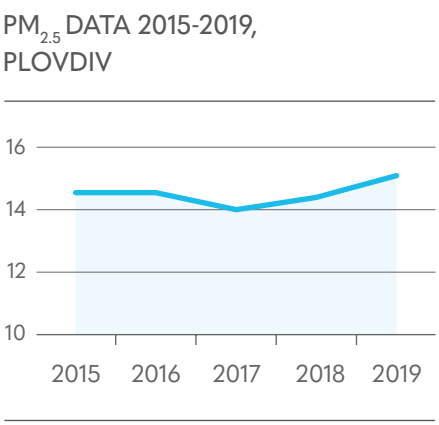
FIGURE 7

$PM_{2.5}$ ANNUAL AVERAGE VALUES IN SOFIA (LEFT) **AND PLOVDIV** (RIGHT), **2015-2019**

SOURCE: ExEA



$PM_{2.5}$ annual average values, µg/m^3, Sofia



$PM_{2.5}$ annual average values, µg/m^3, Plovdiv

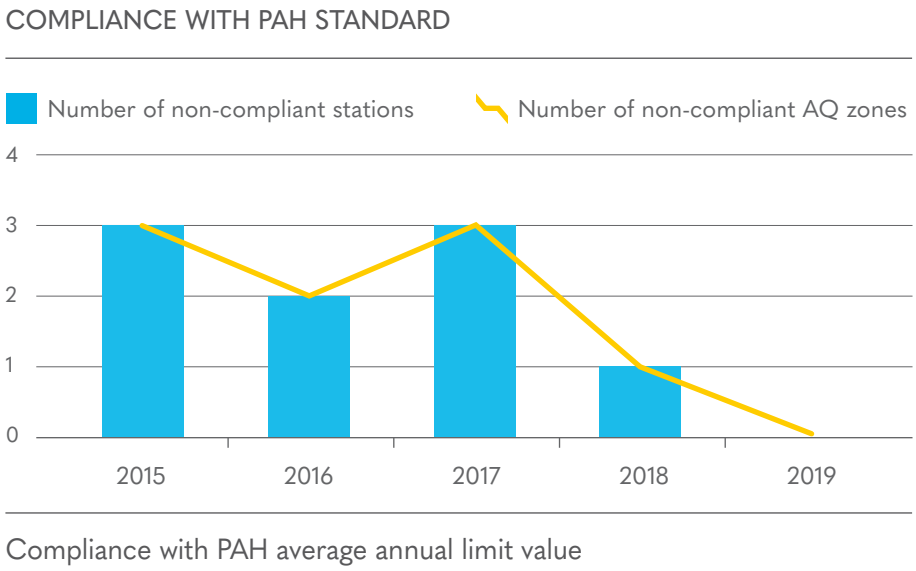
1.3 › POLYCYCLIC AROMATIC HYDROCARBON

Benzo(a)pyrene (BaP) is the Polycyclic Aromatic Hydrocarbon (PAH) that ExEA monitors and reports. BaP measurements are taken from PM_{10} samples. PAH data is not publicly reported annually by ExEA like the other pollutants. Instead, PAH data is reported in the annual State of Environment reports that are published two years after the current year. This is why the presented monitoring PAH data in Figure 8 covers the period 2013-2017.

FIGURE 8

COMPLIANCE WITH PAH LIMIT VALUE, 2013-2017

SOURCE: ExEA

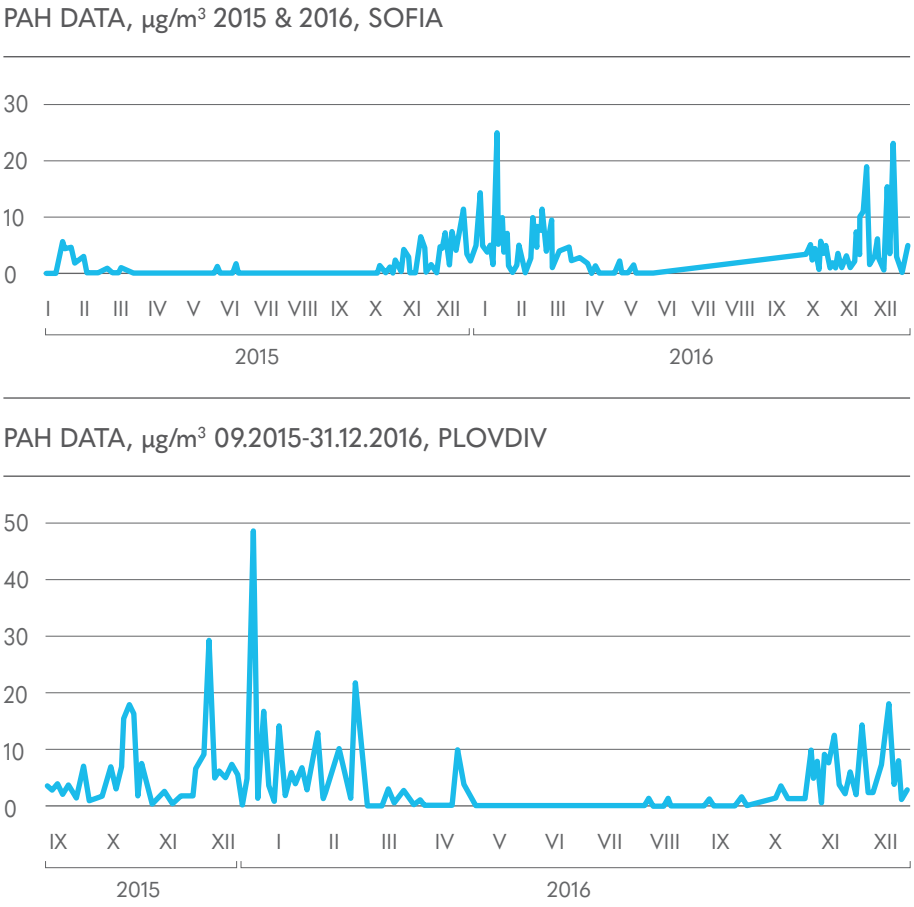


In 2017 PAH was analyzed at 14 stations only, therefore, the sampling coverage for PAH is also limited. As shown on Figure 8, there is no clear tendency in PAH concentrations with concentrations going up in one year, coming down the next one and going up again. Figure 9 presents PAH data from Sofia and Plovdiv (one AQ station is used for analyzing PAH in both cities) and it is clear that the peak in PAH concentrations are in the winter months.

FIGURE 9

PAH DATA IN SOFIA (TOP) AND PLOVDIV (BOTTOM), 2015 & 2016

SOURCE: ExEA



PAH daily concentrations, Sofia (top) – 2015 & 2016, Plovdiv (bottom) – 09.2015-31.12.2016.

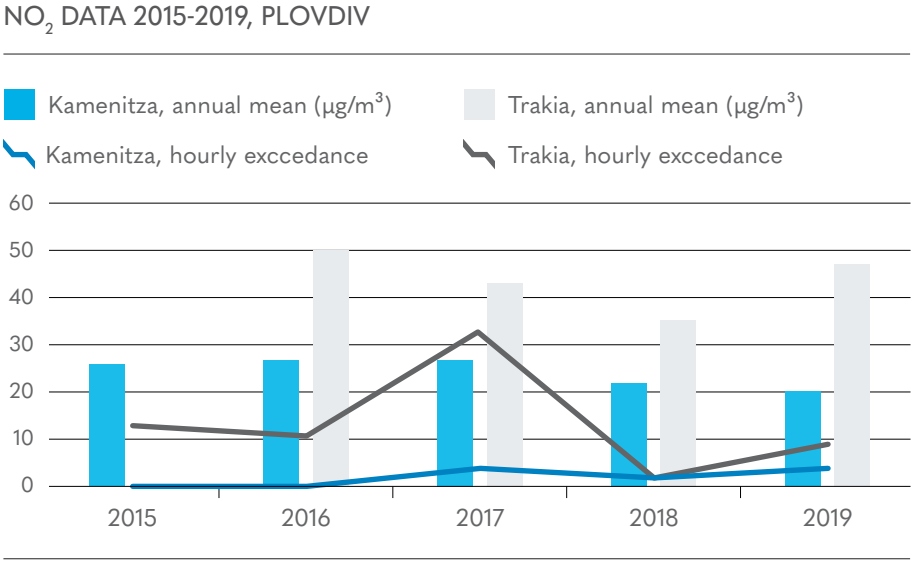
1.4 › NO_2

The only municipality that has experienced problems with compliance with both the NO_2 average annual and the allowed number of annual exceedances of the hourly limit values in the period 2015-2019 is Plovdiv. The non-compliance with the NO_2 standard in Plovdiv occurs at the traffic AQ station in the city. The municipalities of Pleven and Varna were also non-compliant with the average annual limit values in 2016, but since then, only the municipality of Plovdiv has been non-compliant with NO_2 standards. One AQ station in Sofia exceeded the allowed number of annual exceedances of the NO_2 limit value in 2017. The NO_2 data for Plovdiv is presented in Figure 10 below.

FIGURE 10

COMPLIANCE WITH NO_2 LIMIT VALUES, PLOVDIV, 2015-2019

SOURCE: ExEA



Compliance with NO_2 average annual and allowed number of exceedances of hourly limit values, Plovdiv, µg/m³

1.5 › SO_2

The main source of SO_2 emissions in Bulgaria are the coal-fired power plants in the Maritsa East energy complex. The Galabovo AQ station located in the area of the Maritsa East energy complex has been continuously registering non-compliance with SO_2 limit values in the period 2005-2019. In 2016 and 2017 the number of allowed exceedances of the daily limit values was breached in Pernik. Since 2017 Galabovo AQ station remains the only non-compliant station with the allowed number of exceedances of both the hourly and daily limit values.

1.6 › CONCLUSIONS ON AIR QUALITY DATA

Data is key in understanding any problem. In addition, availability and reliability of air quality monitoring data are instrumental in transparent air quality policy-making, public awareness and access to information. The main issues with air quality data are summarized below:

- Despite the fact that there are 57 AQ stations in Bulgaria, the sampling coverage for different pollutants is uneven. For example, there are only ten $PM_{2.5}$ samplers. The finer fractions of PM such as $PM_{2.5}$ and even PM_1 are gaining increased attention from health specialists and environmental authorities globally.
- AQ stations often malfunction and sometimes it takes a long time for them to be fixed. This is due to the fact that ExEA does not maintain the AQ stations, but outsources this activity.
- There is no easily accessible AQ data. Only since 2018, AQ data has become more publicly available, but in many cases, graphs are displayed and not actual concentrations, especially when it comes to AQ data prior 2018. Hence, citizens, researchers or different stakeholders cannot access the actual monitored concentrations unless they request this information officially through ExEA.

- PAH data is not readily available. PAH data is not published in the annual AQ report that ExEA started publishing in 2018. PAH data can be publicly obtained only through the State of the Environment report which contains data two years from the current year.
- There is a positive trend in moving towards compliance with most pollutants. NO_2 is an occasional issue in Plovdiv, SO_2 is a persistent issue in Galabovo, whereas PM_{10} (especially, due to the higher number of samplers), $PM_{2.5}$ and PAH continue to be problematic for most municipalities where monitoring of those pollutants is performed.
- It remains to be seen whether the positive trend in PM_{10} concentrations is sustainable or whether it was due to mild winters or to moving the location of AQ stations. A few AQ stations were moved in the last five years and the monitored concentrations at some of those AQ stations became compliant with the limit values.

2 EMISSION INVENTORIES

Emission inventories provide the basis for analysis of the reasons for air pollution and are therefore, essential for national and local planning of air quality policies. This section considers the availability of emission inventories at both national and local levels.

2.1 › NATIONAL EMISSION INVENTORIES

ExEA is responsible for reporting national emissions to the EC but for many sectors ExEA relies on the National Statistics Institute (NSI) to provide the data. The National Inventory of Emissions (NIE) reports are published annually and contain the national emissions' inventory for two years before the current year. Table 1 summarizes the main emission sources for the key pollutants presented above from the latest NIE submission in 2020, reporting 2018 emissions.

TABLE 1

MAIN EMISSION SOURCES, 2018, NIE 2020

POLLUTANT	MAIN EMISSION SOURCE	SHARE IN NATIONAL EMISSIONS, %
NO_x	Road transport: Passenger cars and heavy-duty vehicles and buses, combined	34%
SO_x	Public electricity and heat production	42%
$PM_{2.5}$	Residential sector	77%
PM_{10}	Residential sector	51%

SOURCE: CENTER ON EMISSION INVENTORIES AND PROJECTIONS:
https://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/2020_submissions/

Bulgaria's NAQIP also established that the principal source of primary PM_{10} emissions within all the municipalities was residential heating using thermally inefficient solid fuel appliances – estimated to account for around 85% of PM_{10} emissions. Road transport - the exhaust emissions from vehicles – was identified as a further contributor and may be significant in larger cities. The NAQIP acknowledged that about 54% of the population uses solid fuel for heating and that PM_{10} emissions from residential heating arise mainly from the burning of firewood and to a lesser extent of coal. Burning damp, unseasoned firewood, or coal having a high ash content and low calorific value, was highlighted as main contributors to high PM_{10} emissions; exacerbated if fuel is burned in old, inefficient stoves and boilers that represent the majority of such appliances used in Bulgaria (see Figure 11).

FIGURE 11

PTRADITIONAL STOVES USED IN BULGARIA

SOURCE:
www.krips.bg
www.emag.bg

2.2 › LOCAL EMISSION INVENTORIES

In contrast to the annual reporting of national emissions by ExEA, municipal emission inventories are only estimated during an update of the municipal AQP, which usually happens about every five years. Source apportionment analyses are also conducted during the AQP update. In general, and mainly due to lack of capacity, municipal authorities contract consultants to prepare the AQPs and consequently, the emission inventories.

Emission inventories should be the backbone of any air quality strategy, but in reality, they are some of the weakest aspects in the air quality management cycle in Bulgaria. The data from the emission inventories is the main input parameter in dispersion modelling conducted during AQP update. Usually dispersion modelling is done with software such as AERMOD and SelmaGIS. It is through dispersion modelling that the relative source apportionment is done. Namely, emissions from different sources are modelled separately and the attained PM_{10} concentration from the modelling at a receptor point (which coincides with the location of an AQ station) is assumed to be the given source's contribution to total PM_{10} concentrations at the receptor point. However, the result of those source apportionment estimations is highly dependent on the emissions that were calculated for the municipal emission inventory. As shown in Table 2, source apportionment done through modelling demonstrates that the main contributors to municipal PM_{10} concentrations are regional background, residential heating and transport.

TABLE 2

SOURCE CONTRIBUTIONS TO PM10 CONCENTRATIONS

SOURCE	SOURCE CONTRIBUTION TO PM_{10} CONCENTRATIONS, IN %		
	SOFIA[7]	PLOVDIV	PLEVEN
Residential heating	23%–39%	72%	42%
Transport	12%–57%	7%	13%
Industry	~1%	~1%	~1%
Regional background	22%–49%	20%	44%

SOURCE: SOFIA MUNICIPALITY, PLOVDIV MUNICIPALITY, PLEVEN MUNICIPALITY

Excluding the contribution of regional background[9], the main sources that contribute to PM_{10} concentrations are residential heating and transport. These are also the sources for which estimating a robust emission inventory is especially difficult because of the high number of users of both solid fuels and passenger vehicles. This is why detailed studies are needed in order to obtain up-to-date and specific information. Most AQPs, though, rely on obsolete information (2011 national census) for the main source of PM emissions – residential heating and on not very detailed information about the other significant source – transport. Therefore, the reliability of municipal emission inventories and source apportionment could be strengthened.

Besides source apportionment conducted as part of municipal AQPs, source apportionment at national level is conducted during the standard emission reporting process and the results are published in the National Inventory of Emissions (NIE) and the State of the Environment reports. However, the national level source apportionment is conducted because of the country's emission reporting obligations and not necessarily with the goal to improve air quality management. This is an important distinction as the granularity of the activity data for NIE, especially for the residential heating sector, is not detailed enough to support local air quality management.

On the other hand, universities, scientific and medical organizations have limited research in the area of air quality. Moreover, there is lack of elemental studies of PM_{10} – studies examining the chemical composition of PM_{10} filters in order to determine chemical elements that are indicators for a given emission source. The only such elemental studies were done by a team at the National Institute of Meteorology and Hydrology (NIMH), but due to lack of equipment at the time, full elemental analysis could not be performed.

[8] The source contribution to PM_{10} concentrations in Sofia is given in ranges due to the different source contributions to the concentrations at the different AQ stations which modelling results were compared to.

[9] Regional background contribution is usually the difference between the measured concentration of PM_{10} at a receptor point (AQ station) and the modelled one with all emission sources included in the modelling.

2.3 › CONCLUSIONS ON EMISSION INVENTORIES

Emission inventories are the backbone of any air quality management system. Therefore, the issues raised above could be considered fundamental for the overall air quality management in Bulgaria. Some of the most important aspects of those issues are:

- Insufficient quality of emission inventories is a crucial weakness of air quality management because emission inventories feed in dispersion modelling which then produces source apportionment estimates, based on which measures to improve air quality are designed. The most problematic areas in both the national emission inventory and the local ones are the inventories of residential heating and to a lesser extent – transport emissions.
- There is a lack of reliable data on the amount and types of solid fuels used for residential heating, as well as on the number of users of solid fuels for heating and types of equipment used. The only available information is from the national census of 2011, conducted by NSI. Even this dataset does not contain the amounts of solid fuels used and the types of equipment in use in households. Therefore, even NSI that supplies ExEA with data for the national inventory of emissions does not have detailed activity data to estimate a robust residential heating emission inventory.
- In general, detailed information about the fleet composition is available. However, what is missing are traffic counts, traffic studies and modal splits. In the absence of those, consultants drafting a municipal AQP have to make a number of assumptions which reduces the credibility of the transport emission inventories and leads to some improbable outcomes. For instance, the annual transport PM_{10} emissions reported in Sofia's current AQP are higher than the national PM_{10} emissions from passenger cars, reported by ExEA.
- The approaches to estimating emission inventories are inconsistent among AQPs. Different consultants might use different approaches and emission factors, which makes it difficult to compare emission inventories and evaluate effectiveness of implemented measures.
- Available guidance for preparing AQPs is limited and outdated. MoEW's guidance on AQPs was adopted in 2001 and has not been changed since. In addition, the guidance does not provide detail or standardized procedures about structuring emission inventories, design and evaluation of measures.
- Overall, there is lack of academic studies and research related to air quality and the health effects of poor air quality. In addition, recently there has been a reduction in capacity at ExEA, whereas municipal capacities for air quality management have not improved, perhaps with the exception of Sofia.

3 KEY AIR QUALITY LEGISLATION AND STRATEGIC DOCUMENTS

The relevant EU legislation on air quality has been fully transposed into the Bulgarian national law. Ambient air quality management is regulated by the Environmental Protection Act (EPA), the Clean Ambient Air Act (CAAA) and numerous by-laws.

3.1 › CLEAN AMBIENT AIR ACT

The Ministry of Environment and Waters (MoEW) is responsible for implementation of the state policy for conservation of the ambient air quality (art. 19, s. 1 CAAA). The Minister of Environment and Waters, in coordination with the Minister of Health, is empowered to issue an ordinance on ambient air quality assessment and management (Art. 21 CAAA). Ambient air quality is monitored through the National System for Environmental Monitoring that is supervised by MoEW via the Executive Environmental Agency (ExEA). Additional ambient air monitoring systems may be established on municipal level (art. 20 CAAA).

The CAAA provides that the municipal mayors shall draft and implement Air Quality Programs (AQP) in all regions where AQ standards are breached in order to reach compliance with the applicable legal requirements (art. 27, s. 1 CAAA). Regions with poor air quality are identified by ExEA in cooperation with the Regional Inspectorates of Environment and Waters (RIEW) (art. 30, s. 1 Ordinance № 7/1999). Given any such identification, RIEW notifies the relevant municipalities of their legal obligation to prepare an AQP. AQPs shall contain reduction measures for each pollutant above the national standard. All AQPs shall be prepared in accordance with "Guidelines for the development of emission reduction programs and establishing standards of harmful substances in regions for assessment and management of atmospheric air quality exceeding established standards". The guidelines were adopted by MoEW in 2001 and have not been revised ever since i.e. the document is not only outdated, but also it does not correspond to the recent amendments of CAAA from 2019.

The AQP shall be adopted by the municipal councils. The mayor shall report annually on the implementation of the CAAA and a copy of the report shall be presented to RIEW (art. 27, s. 2 CAAA). The Mayor of the municipality, along with interested natural persons and legal entities, is responsible for the implementation of AQP (Art 33, s.1 CAAA). If the implementation of the AQP does not lead to the expected results and there are no intervening causes, the mayor of the municipality may be sanctioned as per art. 42a, s. 4 CAAA (fines range from BGN 5000 BGN to BGN 10 000).

One of the main tools at municipal disposal to implement its AQP, especially when the use of solid fuel appliances should be restricted or banned, is the establishment of a Low Emission Zone (LEZ). In this regard, the CAAA stipulates that municipalities are empowered to:

- establish LEZ as per art. 28a CAAAA and ban or restrict the use of certain fuels and appliances for residential heating in the LEZ, as well as restrict traffic or the movement of certain categories of road vehicles in the LEZ;
- organize and regulate traffic in cooperation with Ministry of Interior as per art. 29 CAAA when measures to reduce air pollution from traffic have to be taken.

3.2 › STRATEGIC DOCUMENTS

Air quality is defined as a priority in both the National Development Programme (NDP) 2020[10] and the vision for the next NDP 2030[11]. Both NDP documents highlight the objective to reach compliance with air quality limit values. The vision for NDP 2030 pays special attention to PM concentrations.

[10] NDP 2020 document available at: http://www.strategy.bg/StrategicDocuments/View.aspx?Id=765

[11] Vision for NDP 2030 available at: http://www.strategy.bg/PublicConsultations/View.aspx?lang=bg-BG&Id=4682

More specifically to air quality management, in 2019 the government of Bulgaria adopted two national level AQ programmes – the National Air Quality Improvement Programme (NAQIP) and the National Air Pollution Control Programme (NAPCP). Both programmes establish that the main source of PM emissions is residential heating, followed to a lesser extent by transport. As per the NAQIP and NAPCP municipalities need to phase out the use of solid fuel appliances (SFA) used for residential heating that do not meet the EU regulations on Ecodesign. Subject to network availability, the principal options for alternative heating methods are: (i) reconnection or connection to a gas network, (ii) reconnection or connection to a District Heating System, (iii) replacement by Ecodesign-compliant stoves or boilers, (iv) use of heat pumps.

Improving the fuel quality used for residential heating is another aspect of the residential heating measures included in the NAQIP and the NAPCP. However, the main measure to reduce emissions from residential heating is replacement of old SFAs, in particular SFAs using firewood.

The replacement of SFAs in order to improve local air quality is one of the issues which the measures included in the integrated National Energy and Climate Plan (NECP)12 are somewhat at odds with air quality management. On one hand, the NECP seems to recognize the emissions scenarios included in the NAPCP. On the other hand, however, it provides for increased use of biomass in the residential sector, when the NAQIP calls for the replacement of SFAs, most of which use firewood. In addition, the use of gas for residential heating to replace SFAs is an option included in both the NAQIP and NAPCP, but potentially is a measure that goes counter to climate change goals. Thus, there is a discrepancy between air quality and climate change goals that needs to be reconciled not just at national, but also at EU level.

3.3 › RESIDENTIAL HEATING RELATED LEGISLATION

In accordance with Directive (EU) 2015/1535 Bulgaria notified the European Commission for its intention to apply early Commission Regulation (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to eco-design requirements for solid fuel local space heaters from January 1, 2020 instead from January 1, 2022 (Notification: 2019/0438/BG). The early implementation of Regulation (EU) 2015/1185 was regarded by the Bulgarian government as a prerequisite for successful and timely implementation of NAQIP and the municipal efforts for phasing-out polluting stoves. However, the EC issued a detailed opinion objecting such legal move.

Following the adoption of the NAQIP, some ordinances related to fuel quality standards were introduced. The "Ordinance on quality requirements for solid fuels used for residential heating, terms procedures and methods for control" introduced quality requirements for solid fuels used for residential heating i.e. coal or coal briquettes burned in heating appliances with power output less than or equal to 0.5 MW. The standards are enforceable as of March 22, 2020. Only fuels that meet the quality requirements may be placed on the market, distributed and sold. Coal-based fuels may be sold only in packages by registered traders in registered warehouses and stores. The control is at the producer, importer or retailer. The control on the imported coal is conducted jointly by Customs and the State Agency for Metrological and Technical Surveillance (SAMTS). The control on local producers and retailers is executed by SAMTS.

"Ordinance Nº 6/07.10.2019 on requirements and control on firewood used for residential heating" introduced requirements on quality of firewood. The Ordinance shall be applicable only in those municipalities affected by PM10 air pollution. The exact territorial scope for application of the Ordinance shall be determined by the municipal council. The Ordinance requires the use of dry firewood (moisture content up to 30%) that is not

[12] NECP available at: https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en#final-necps

chemically treated, not covered with paint, glue and other toxic substances and not mixed with plastic, rubber etc. The obligation to meet the said requirements is vested in the end-users. In principle, monitoring and control for observation of the Ordinance shall be conducted by the municipal authorities and RIEWs.

3.4 › TRANSPORT RELATED LEGISLATION

The NAQIP and NAPCP established that the main transport issue with regards to PM emissions are old (pre-EURO, EURO 1 and EURO 2 categories) vehicles, especially diesel passenger cars. Due to the large share of pre-EURO 2 passenger vehicles (over 40% of the total passenger fleet in the country)13, the transport measures in the NAQIP and NAPCP are mainly measures to strengthen vehicles' control on the road and the quality of the periodical technical inspections. Establishing LEZs for transport in the major Bulgarian cities (the four largest ones) is also considered as a measure.

Therefore, in response to NAQIP, many amendments in the regulatory and legal framework were prepared and/or introduced in 2019-2020, including improved regulations on periodic technical inspections for motor vehicles. Amendments in the ordinance for the periodical technical inspections (Ordinance № H-32/16.12.2011) were introduced that will allow the classification of the motor vehicles in different "environmental groups" according to the vehicles' emissions. Each motor vehicle will receive a special, machine-readable sticker containing information about the applicable environmental group of the vehicle. The sticker system may enable municipalities to regulate the access of different types of motor vehicles to city hot-spots via the establishment of LEZ for transport. It is expected that the amended Ordinance № H-32/16.12.2011 will be officially adopted by mid-2020.

3.5 › INDUSTRIAL SOURCES RELATED LEGISLATION

Due to the SO_2 infringement procedure opened against Bulgaria, the legislation on industrial emission sources is also briefly considered. In general, Bulgarian legislation is in line with EU legislation on industrial emissions. The following ordinances relate to control of emissions from industrial sources:

- Ordinance on permissible emission rates for sulfur dioxide, nitrogen oxides and dust emitted into the air from large combustion plants;
- Ordinance for limiting the emissions to the atmosphere from medium combustion plants;
- Ordinance № 10/6.10.2003 on the emission limit value (concentration in waste gases) of sulfur dioxide, nitrogen oxides and dust emitted into the air from large combustion plants.

In addition, major industrial sources fall under the International Plant Protection Convention (IPPC) and are subject to applying for emission permits. Nevertheless, SO_2 concentrations are above the limit values in the area where the largest coal power plants in Bulgaria are located. Local coal used in those plants is mainly lignite and has a high sulfur content.

3.6 › CONCLUSION ON AIR QUALITY LEGISLATION AND STRATEGIC DOCUMENTS

Bulgarian air quality legislation is in line with EU legislation, in general. However, there are a number of issues that need to be addressed and/or clarified in order to facilitate implementation of measures that will bring improvement in air quality. The priority issues to be addressed are:

[13] Data from Ministry of Interior: https://data.egov.bg/data/resourceView/864a9a3b-7879-4728-a7db-f7cbb8e39ae0

- Responsibilities for AQ management are often unclear. The ultimate responsibility for ensuring good air quality rests with the mayor of the municipality. At the same time, the CAAA lists a number of bodies responsible for oversight of AQ management. Such bodies include RIEWs, Regional Health Inspectorates (RHI), in some cases Traffic Police, etc. Despite the multiple actors involved in AQ management, there is not a single entity that can control use of certain fuels or appliances in people's homes or that can register and allow the use of SFAs. Thus, it seems like controlling the major AQ issue in Bulgarian cities – emissions from residential heating – cannot be effectively executed under the current legal framework.
- The provisions of establishing a LEZ in a municipality are unclear. The CAAA provides for the establishment of municipal LEZs, but the CAAA needs to clarify important aspects of a LEZ – starting from what is the administrative act that establishes LEZ and going through other aspects of a LEZ such as: size of the LEZ, technical scope of LEZ, stakeholders involved in the control of LEZ rules, violations to LEZ rules, etc. Perhaps such weaknesses in the legislation is one of the reasons why not a single Bulgarian municipality has implemented a LEZ.
- Related to the issue of LEZ is the question whether municipal authorities have the legal powers to adopt local ordinances to ban or restrict the use of certain fuels and SFAs. It is clear that without such regulation, stove replacement will take much longer time and available funds for incentivizing it will not be spent optimally.
- In its current form, Ordinance № 6/07.10.2019 on requirements and control on firewood used for residential heating is unimplementable in practice because of the erroneous design (e.g. control is on users), missing practical tools to implement the ordinance (e.g. procedures to determine whether the firewood meets the standards) and lack of legal powers to inspect a person's home, among others.
- Strategic documents such as Bulgaria's NDPs recognize air quality as a priority, but include rather superficial provisions on how to improve air quality. In addition, there is unresolved discrepancy between air quality and climate change measures as evidenced by the AQ-related strategic documents and the NECP.

The issues with the AQ-related legislation hint at larger coordination and communication problems that obstruct AQ management. MoEW is the national body responsible for ensuring that air quality meets the national and EU limit values. MoEW is also the main lawmaker in the area, but in practice it is municipalities that have to implement the legislation. The points raised above suggest that for a number of important issues, the legal framework is not sound enough for municipalities to implement certain measures, especially such that are politically unpopular and lead to a potential legal risk.

4 FINANCIAL PROGRAMS

Financial programs that are specifically targeted at air quality are relatively recent in Bulgaria; the same goes for submitting funding applications for projects focused on air quality. This section presents the available funding from programs, targeted specifically at improving air quality; namely, through the replacement of old, inefficient SFAs. The second part of the section presents financing programs that were not specifically focused on air quality improvements, but the results from their implementation also deliver air quality benefits.

4.1 › SPECIFIC AQ FINANCIAL PROGRAMS

For the first time since Bulgaria's EU accession, the national Operational Program Environment (OPE) 2014-2020, funded through the European Structural and Investment Funds (ESIF), contained a separate priority axis that focused entirely on air quality.

In December 2018 OPE started the provision of direct grants to municipalities for pilot programs aiming to phase-out old SFAs. Due to the limited amount of funding for SFA replacement (BGN 111.4 million), the Managing Authority of OPE designed eligibility criteria for municipalities that would receive funding. Seven municipalities were deemed eligible for funding: Sofia, Plovdiv, Burgas, Vidin, Dimitrovgrad, Montana, Smolyan. Maximum funding for each municipality, given the available financial resource, was specified. The municipal projects are to be implemented in two stages: preparatory Phase I – including population surveys, awareness campaigns, analysis on pollution sources and possible stove replacements options, etc. and Phase II – actual substitution of SFAs with modern appliances, gas and district heating (where available) or electric heating. Projects that have started are still in Phase I. Therefore, there is still no data on the approaches to stove replacement that will be adopted, the number of SFAs to be replaced, the costs and the benefits of SFA replacement. Even though the time horizon of OPE is 2014-2020, funds can be disbursed until 2022.

In addition to SFA replacement, OPE funds the update of municipal AQPs and measures in public transport. A transfer of additional funds was added to OPE specifically for modernizing public transport in municipalities, including electrification of public transport. Table 3 shows the contracted amounts under the AQ axis of OPE, the activities that were funded and the beneficiaries.

TABLE 3

CONTRACTED FUNDS UNDER OPE AQ AXIS AS OF APRIL 15, 2020

ACTIVITY	BENEFICIARIES	CONTRACTED FUNDS, BGN
AQP update	**18 Municipalities:** Asenovgrad, Blagoevgrad, Varna, Veliko Tarnovo, Vratsa, Gorna Oryahovitsa, Galabovo, Dimitrovgrad, Montana, Nessebar, Pernik, Pleven, Plovdiv, Ruse, Smolyan, Haskovo, Shumen, Sofia	3 089 311
Stove replacement projects (Phase I and II)	**7 Municipalities:** Sofia, Plovdiv, Burgas, Vidin, Dimitrovgrad, Montana, Smolyan	111 442 102
Public transport measures	9 Municipalities: Stara Zagora, Burgas, Varna, Vratsa, Pleven, Ruse, Sliven, Haskovo, Sofia	598 457 911
AQ information system	ExEA	699 997
TOTAL		**713 689 322**

SOURCE: OPE 2014-2020, http://2020.eufunds.bg/bg/6/0/PriorityLines

It is expected that OPE 2021-2027, which is currently being drafted, will include an air quality priority axis with a larger allocation than in OPE 2014-2020. The first draft of OPE 2021-2027 states that funding will mainly be provided to projects that reduce emissions from residential heating and transport, with the priority being reducing emissions from residential heating. The first draft of OPE 2021-2027 plans SFA replacement in 120 000 households[14].

In addition to OPE funding, six Bulgarian municipalities (Sofia, Burgas, Ruse, Stara Zagora, Veliko Tarnovo, Montana) applied and acquired funding for an AQ project through LIFE IP. The LIFE IP project has total budget of EUR 16 666 266 and runs from October 2018 to October 2024[15]. A number of activities are planned in the LIFE IP project, including the replacement of a total of 10 500 old SFAs in the six participating municipalities. Other project activities include, among others:

- purchasing of additional AQ stations – two for each participating municipality;
- analysis and suggestions for improvement of the national Winter Supplement Program that provides financial aid for heating in the winter for vulnerable households;
- suggestion for the design and roll-up of a national SFA replacement program.

Finally, following the adoption of Bulgaria's NAQIP by Council of Ministers, the Government of Bulgaria pledged BGN 100 millions of funding for air quality from the state budget for the period 2020-2023. However, crucial questions such as – what the funds will be spent on, which is the entity to manage the funds, which are the eligible applicants – have not been clarified. Hence, the pledged funding has not been made available yet.

[14] https://www.eufunds.bg/sites/default/files/uploads/opos/docs/2020-04/OPE_2021-2027_ver.%201_draft_BG.pdf

[15] http://www.lifeipcleanair.eu

4.2 › FUNDING PROGRAMS WITH AN EFFECT ON AQ

Two national funding programs that were not directly focused on improving air quality, but indirectly contribute to that are the DESIREE GAS project and the Energy Efficiency of Multi-Family Residential Buildings National Program (EEMRBNP). The two programs are briefly presented below.

The DESIREE GAS project aimed to connect households in single-family and multi-family buildings to the gas network in order to improve heating energy efficiency. The project was funded with BGN 20 million from the International Kozlodyu Fund[16], administered by the European Bank for Reconstruction and Development (EBRD). The implementation of the DESIREE GAS project is under the supervision of Ministry of Energy. The project started in September 2015 and was initially meant to last for three years. However, the duration of the project was extended until June 2020. Applicants are eligible to receive 20% grants, later increased to 30%, but no more than EUR 1 200 per applicant, of the capital expenditures to connect to the gas network. Credit lines with preferential terms to cover the co-financing on the part of the applicant were also established through commercial banks. The DESIREE GAS project has provided connection to the natural gas distribution grid to 12 000 households. However, the project did not specifically target the substitution of SFAs and thus, switch from electric heating or district heating to natural gas were also eligible.

The EEMRBNP has been implemented since 2015 under the supervision of the Ministry of Regional Development and Public Works. The EEMRBNP provides a 100% grant to homeowners' associations for a package of energy efficiency measures to enable multi-family buildings designed before April 26, 1999 to cover the requirements for energy efficiency class C. The eligible energy efficiency measures do not necessitate improving the energy efficiency of heating. The EEMRBNP defines a multi-family building as a building on at least three floors, containing six or more dwellings. The EEMRBNP has a budget of BGN 1 billion. As of January 2020, applications for 5 112 multi-family buildings have been approved and contracts have been signed with the homeowners' associations of 2 022 buildings. Although new applications are currently not being accepted, the EEMRBNP is expected to be resumed in the following years.

4.3 › CONCLUSIONS ON AQ FINANCING

The main source of PM emissions, contributing to poor air quality in Bulgarian cities, is residential heating on solid fuels. The national census from 2011 showed that more than 1.4 million dwellings in Bulgaria use solid fuels for heating; for instance, more than 54 000 dwellings in the capital Sofia use such fuels for heating[17]. The scale of a potential SFA replacement program is large and hence, some funding will be needed to incentivize such replacement to take place. Therefore, availability for targeted AQ funding, in particular for SFA replacement in vulnerable households, is of utmost importance should major strides towards compliance with AQ limit values be made. The issues with AQ financing are summarized as follows:

» In general, there is lack of experience with AQ-specific funding. The OPE 2014-2020 was the first national funding scheme to provide such funding and there are no lessons learned to be drawn yet as OPE projects are in their infancy.

[16] The Kozlodyu Fund is an international fund that provides assistance to Bulgaria in exchange for the government's agreement to close off four blocks of the Kozlodyu nuclear power plant earlier than scheduled.

[17] National Statistics Institute. National Census 2011 – results, available at: https://www.nsi.bg/census2011/newsbg.php?n=68

- The lack of experience with AQ financing also means that potential beneficiaries, namely the municipalities, have no prior knowledge on competitive bidding for funding for AQ. Overall, there is lack of capacity on local level to both design a project proposal or an SFA replacement program and then implement it. Even if funding is available, the capacity deficiencies at local level might prevent optimal implementation.
- There is insufficient capacity at local level to analyze in detail the scale of funding needed for a major replacement of SFAs. Moreover, there are deficiencies in the evaluation, assessment and justification of measures and their impact on AQ.
- There is no unit or structure that can assist municipalities and local authorities in addressing the deficiencies in capacity identified above. Such structures could support municipalities on technical matters, project design and even project implementation.
- The financing mechanisms proposed so far in the OPE and LIFE IP projects are rather conservative by providing 100% grant schemes which experience from other countries has proven inefficient. There is lack of consideration or experience with different approaches to financing AQ measures at the household level (e.g. SFA replacement). Such approaches could include more progressive financial mechanisms that differentiate the provided support by household income level and living conditions, financing from commercial banks, use of financial instruments, tax breaks, green bonds, etc.
- Financing programs that were not AQ-specific, but could have contributed to AQ improvements failed to achieve additional AQ benefits. There were options to still deliver the outcomes of both the DESIREE GAS and the EEMRBNP, described above, while maximizing AQ benefits. If a second phase of EEMRBNP is indeed planned, it would be beneficial to include energy efficiency of heating in the overall energy efficiency interventions at the building level.

5 CONCRETE CITY ACTIONS

Apart from updating their municipal AQPs and implementing some of the standard measures in them, for instance awareness campaigns, landscaping, street cleaning, municipalities have not been executing more serious AQ measures until recently. This is changing following the ECJ infringement ruling, but especially because of the increased awareness among citizens of the harmful effects of poor air quality. A major contributor to citizens' awareness has been the high interest and deployment of PM sensors as part of the platform AirBulgaria[18]. Access to data, albeit not accepted as official, has empowered citizens to demand actions to improve air quality. Sofia municipality has been under the most citizens' pressure and hence, is the municipality that has taken the most concrete AQ measures. Concrete city actions from Sofia and other municipalities are discussed below.

5.1 › SOFIA

Realizing the need and the demand for more AQ data, Sofia municipality participated in the project AIRTHINGS[19], financed by the Interreg Balkan-Mediterranean program. The main project output was the installation of 22 AQ stations using modern sensor technology at the end of 2019. The data from the AQ stations is available in real time online at https://platform.airthings-project.com.

At the end of 2017, the Bulgarian Academy of Sciences and the National Institute of Meteorology and Hydrology (NIMH) developed an early warning system for AQ for Sofia municipality. Taking meteorological parameters into consideration, the system models the potential for poor AQ 48 hours in advance. The forecasts are published on Sofia's AQ website[20].

In the beginning of 2018 Sofia City Council approved the issuance of a "Green ticket" on days with poor AQ. The measure aims to incentivize citizens to use public transport instead of their own vehicles to commute. A "Green ticket" costs BGN 1, can be used the whole day and on all modes of transport. The "Green ticket" is introduced when at least two of the five AQ stations have PM10 daily levels of over 200 μg/m^3 for two consecutive days or when four AQ stations have PM10 levels of over 200 μg/m^3 in the same day. In addition, the park-and-ride at some metro stations are free to park for the days when a "Green ticket" is introduced. The early warning AQ system can also be used as a decision-making tool to introduce the "Green ticket". Sofia municipality has introduced a "Green ticket" for only a few days after City Council approved the measure.

During the 2018-2019 heating season Sofia Municipality cooperated with Za Zemyata – Friends of the Earth NGO to provide better heating options for 30 households in Novi Iskar district. The grant limit per household was BGN 2 000 and pellet heaters replaced 30 old SFAs. Moreover, a pallet of pellets (72 bags of 15 kilograms) was provided to each household by Sofia municipality in order to satisfy the fuel needs for the first heating season[21]. The initiative is a good example of the potential partnership opportunities between civil society and local authorities because the idea for the project came from Za Zemyata – Friends of the Earth and Greenpeace – Bulgaria and following discussions with Sofia municipality came to fruition. The project was meant to serve as a pilot to test the approaches for the upcoming wider scale SFA replacement – either through OPE or LIFE IP.

Sofia municipality played a major role in demanding legislative changes to introduce stickers on vehicles certifying their environmental group (Ordinance № H-32/16.12.2011 discussed in the section Transport related legislation). The legislation is expected to come into force in mid-2020. Sofia municipality sees this change in legislation as a key enabling mechanism to implement a Low Emission Zone (LEZ) for transport in the municipality.

[18] https://airbg.info/en/

[19] https://airthings-project.com

[20] https://air.sofia.bg

[21] https://www.zazemiata.org/wp-content/uploads/2020/01/Dolkad-beneficienti-pechki.pdf

There is no formal decision or intent to establish LEZ for transport or for residential heating in Sofia. Such measure has been mentioned a number of times by Sofia officials and the scope of LEZ has been previously discussed, but LEZs are yet to be established in Sofia.

5.2 › OTHER CITIES

As mentioned above, Sofia has been the most active municipality to introduce various AQ measures. However, some other municipalities, mainly the bigger ones, have also taken up some measures.

Burgas municipality was the first municipality in Bulgaria to purchase a mobile AQ station. The municipality participated in an EEA Grants project in the period June 2009 – March 2011 which provided 85% of the funding for the mobile AQ station[22]. The municipality decided to purchase its own mobile AQ station because of numerous complaints about poor AQ by citizens living in the direction of the largest oil refinery in Bulgaria. The mobile AQ station monitors AQ on the entire territory of Burgas municipality according to a pre-defined annual schedule.

NIMH has also developed an AQ system for Plovdiv municipality. The system allows modelling of air quality in close to real-time, as well as forecast modelling based on pre-defined emission profiles. The system is not publicly available, though.

Municipalities that will implement OPE projects (Sofia, Plovdiv, Burgas, Vidin, Dimitrovgrad, Montana, Smolyan) and the LIFE IP project (Sofia, Burgas, Ruse, Stara Zagora, Veliko Tarnovo, Montana) will be conducting SFA replacements. Sofia aims to replace about 20 000 SFAs through the OPE and LIFE IP projects, combined. The OPE project targets for the other municipalities are not known yet. As for the LIFE IP project, Burgas will aim to replace about 2 000 SFAs, Ruse – about 1 500, Stara Zagora – about 1 000, Veliko Tarnovo – about 550, and Montana – about 500. In addition, the LIFE IP project plans the purchase of two AQ stations in each participating municipality, as well as hiring local air quality experts in each participating municipality.

5.3 › POPULATION SURVEYS

Some municipalities have conducted or are planning to conduct population surveys mainly in the context of upcoming SFA replacement programs. One of the goals of those surveys is to establish a more up-to-date inventory of SFAs on the municipal territory, given that most municipalities are working with data about the structure of residential heating from the 2011 national census. Other objectives of the surveys are to get citizen's opinion on air quality issues, to check households' readiness to replace SFAs and to understand what the preferred heating options are for those households. The municipal surveys do not follow a standardized approach. In practice each municipality that had conducted or is planning to conduct such a survey defines the questions and scope of the survey and then outsources this activity to consultants.

In 2018 Za Zemyata – Friends of the Earth NGO, together with the polling agency Marketlinks, conducted the first and only one so far national survey of households for the purposes of air quality management – reaching 1005 respondents[23]. The goals of the survey were to establish:

- the structure of residential heating in the country;
- people's opinions regarding the effect on air quality from using solid fuel for heating;
- people's attitude and readiness to replace SFAs used for heating, including the need for and the preferred form of financial support to incentivize SFA replacement.

[22] http://87.126.141.158/burgas/bg/index/static/21/

[23] Za Zemyata, available at: https://www.zazemiata.org/wp-content/uploads/2019/04/Prouchvane-Final-Corrections.pdf

5.4 CONCLUSIONS ON AQ CITY ACTIONS

City actions on AQ have mostly been limited with the exception of Sofia municipality. The city actions planned and implemented to date show the following aspects:

- A number of municipalities seem to have been attracted by what appears a quick and easy fix – namely, the installation of filters on chimneys. Even Sofia municipality piloted the installation of such filters and currently has more than 150 filters installed. Installing filters is not a sustainable measure and therefore, priority should be given to other measures that directly reduce emissions and improve thermal comfort for households.
- No Bulgarian municipality has implemented a LEZ in any shape or form. The reasons for this might be both lack of political will and insufficient empowerment, including legal, to establish and control a LEZ.
- The municipality with the most resources and the largest AQ team – Sofia – is the most active municipality in terms of AQ actions. In addition, it is the municipality that experiences the highest citizens' pressure for implementing actions. Therefore, both the bottom-up demand from the citizens and the top-down capacity resources are key to implementing AQ measures.
- Communication with citizens and civil organizations can be improved. The experience with the replacement of 30 SFAs with pellet stoves in Sofia shows that a successful cooperation between authorities and civil organizations is possible. On the other hand, even in Sofia there has been some criticism about public inclusion and response to public feedback – for instance, in the case of selecting the locations for the 22 AQ stations installed through the project AIRTHINGS. Municipalities should be seeking active involvement and endorsement from citizens and civil organizations;
- Public awareness on causes of poor air quality is generally low. There is lack of social attitude surveys, although some have been performed or are planned to be performed in the context of upcoming SFA replacement programs.

6 KEY TAKEAWAYS

As most issues, an air quality management system should follow a certain logic in order to provide sustainable solutions. It all starts with **data** that identifies the problem, the source of the problem and the potential solutions. In order for the identified solutions to be executed, there needs to be a **legal** basis for their implementation. Additional interventions often require **funding** which is the means to actually implement actions. However, no activity can be implemented without people who have the **capacity** to move it forward. Finally, all of these issues have to be **communicated** in order to agree on the solution(s), the legal context, the possible funding, the implementation strategies and to disseminate the results from the implemented actions. Following this logic, a summary of potential opportunities to improve air quality and air quality management in Bulgaria is presented in Table 4 below. Focusing action at local level (municipalities, citizens) might provide the most benefits for air quality management in Bulgaria, as well as ensure the sustainability of actions.

TABLE 4

MAIN ISSUES AND OPPORTUNITIES FOR IMPROVED AQ MANAGEMENT IN BULGARIA

TOPIC	ISSUE	OPPORTUNITY
Data	• Lack of data for some pollutants (such as $PM_{2.5}$) • No easily accessible AQ data	• Improve sampling for some pollutants, including citizen science • Provide a possibility for easy access to AQ data
	• Lack of detailed activity data for some sources of emissions (e.g. residential heating) • Lack of research and studies on AQ	• Conduct surveys to collect activity data to be used in emission inventories • Cooperate with academic and research institutions to improve the scientific knowledge on AQ
Legal	• Unclear responsibilities for AQ management • Inability to effectively control residential burni	• Work with local stakeholders to improve control on residential burning • Share international good examples
Funding	• No experience with AQ-related funding • Missed opportunities to achieve AQ benefits from other funding programmes	• Provide targeted AQ funding • Advise on potential funding synergies with other sectors
Capacity	• Lack of capacity for AQ management at national and local level • Lack of capacity at local level to plan and implement more complex measures such as establishing LEZ	• Improve capacity for AQ management, policy-making, securing funding for AQ measures, mainly at local level • Provide technical assistance to municipalities to implement measures
Communication	• Inadequate communication with the public • Lack of social attitude surveys on the topic of AQ	• Demonstrate approaches to improve communication with the public • Conduct social attitude surveys and share results with stakeholders

КОНКРЕТНИ ДЕЙСТВИЯ НА ОБЩИНИ ЗА ПОДОБРЯВАНЕ НА КАВ

EUROPEAN
CLEAN
AIR
CENTRE

До неотдавна общините не изпълняваха конкретни дейности в областта на качеството на атмосферния въздух (КАВ) освен актуализиране на програмите си за КАВ, както и предприемането на някои стандартни мерки като информационни кампании, озеленяване, миене на улици. Това се промени след решението срещу България на Европейския Съд, но всъщност промяната основно се дължи на повишената осведоменост на гражданите за вредните ефекти на мръсния въздух. Основни причини за повишената осведоменост на гражданите по проблемите на КАВ са високият интерес към и многобройните инсталирани сензори за фини прахови частици (ФПЧ) като част от платформата AirBulgaria[1]. Този достъп до данни, въпреки че данните не се разпознават от властите за официални, даде увереност на гражданите да изискват конкретни действия за подобрението на КАВ. Община София е общината в България, върху която гражданите оказват най-голям натиск за действия в областта на КАВ и следователно е общината, която е предприела най-много конкретни действия. Конкретни действия, предприети от Община София и от някои други български общини са засегнати по-долу.

СОФИЯ

Осъзнавайки нуждата и търсенето на повече данни за КАВ, Община София участва в проект AIRTHINGS2, финансиран по програма Interreg Balkan-Mediterranean. Основният резултат на проекта бе инсталирането в края на 2019 г. на 22 станции за КАВ, които използват модерна сензорна технология за измерване на замърсяването. Данните от тези станции са достъпни в реално време на платформата на проекта: https://platform.airthings-project.com.

В края на 2017 г. Българската Академия на Науките (БАН) и Националния Институт по Метеорология и Хидрология (НИМХ) разработиха система за ранно предупреждение за замърсяване на въздуха за Община София. Системата може да моделира риска от наднормено замърсяване на въздуха в София за следващите 48 часа като взима под внимание метеорологичната обстановка. Прогнозите се публикуват на уебстраница за КАВ на официалния сайт на Община София[3].

В началото на 2018 г. Общинският Съвет на София одобри издаването на „зелен билет“ в дни с влошен КАВ. Целта на мярката е да стимулира гражданите да използват градски транспорт, вместо личните си автомобили, за придвижване. Цената на „зеления билет“ е 1 лев като билетът важи за целия ден и за всички видове градски транспорт. Мярката „зелен билет“ влиза в действие когато поне две от петте официални станции за КАВ в София са отчели среднодневни концентрации на $ФПЧ_{10}$ от над 200 мкг/м^3 в два последователни дни или когато четири станции отчитат среднодневни концентрации на $ФПЧ_{10}$ от над 200 мкг/м^3 в един и същи ден. В допълнение, паркирането на паркингите на метро станциите също е безплатно в дни със „зелен билет“. Системата за ранно предупреждаване също може да се използва като инструмент за взимане на решение за въвеждане на „зелен билет“. Община София е издавала „зелен билет“ само в няколко дни след като Общински Съвет одобрява мярката.

През отоплителен сезон 2018-2019 Община София, съвместно с неправителствената организация За Земята, работиха по проект за замяна на отоплителните източници на 30 домакинства в район Нови Искър. Безвъзмездната помощ за всяко домакинство бе на стойност до 2 000 лева като 30 стари печки на твърдо

[1] https://airbg.info/en/

[2] https://airthings-project.com

[3] https://air.sofia.bg

гориво бяха заменени с пелетни печки. Също така, Община София предостави един палет пелети (72 чувала по 15 килограма) на всяко домакинство, за да се задоволят нуждите си от пелети за първия отоплителен сезон[4]. Инициативата е добър пример за сътрудничество между гражданското общество и местната власт, защото идеята дойде от За Земята и след дискусии с и подкрепа от Община София бе реализирана. Проектът бе използван да се тестват подходи за подмяна на стари печки на твърдо гориво, които да се приложат в проекти, финансирани по Оперативна Програма Околна Среда (ОПОС) или LIFE IP.

Община София изигра решаваща роля в настояването за законодателни промени, които да въведат стикери, удостоверяващи екологичната категория на леките автомобили (Наредба № Н-32/16.12.2011). Наредбата се очаква да влезе в сила през втората половина на 2020 г. За Община София тази промяна в законодателството би улеснило въвеждането и изпълнението на Зона с Ниски Емисии (ЗНЕ) за транспорта.

Няма официално решение за създаването на ЗНЕ за транспорт и/или за битово отопление в София. Подобна мярка се е дискутирала, включително и обхвата на ЗНЕ, но ЗНЕ все още не е въведена в София.

ДРУГИ ГРАДОВЕ

Както бе споменато по-горе, Община София най-активно е инициирала конкретни действия за подобряването на КАВ. Някои други общини, предимно по-големите, също са предприели подобни действия.

Община Бургас бе първата община в България, която закупи собствена мобилна станция за измерване на КАВ. Общината участва в проект по програма EEA Grants в периода юни 2009 – март 2011 и получи финансиране за 85% от разходите за мобилната станция[5]. Община Бургас взе решение да закупи собствена мобилна станция за КАВ, поради многобройни оплаквания за замърсен въздух от граждани, които живеят в посока на голяма рафинерия, извън Бургас. Мобилната станция измерва параметрите на КАВ на цялата територия на Община Бургас според предварително одобрен график.

НИМХ е разработил КАВ система и за Община Пловдив. Системата позволява моделиране на КАВ почти в реално време, както и прогнози за КАВ на базата на въведени емисионни профили. Системата не е с публичен достъп.

Общините, които ще изпълняват проекти по ОПОС (София, Пловдив, Бургас, Видин, Димитровград, Монтана, Смолян) и по проект LIFE IP (София, Бургас, Русе, Стара Загора, Велико Търново, Монтана) ще заменят стари печки на твърдо гориво с по-чисти алтернативи. София например цели да замени общо около 20 000 стари печки по линия на проектите по ОПОС и LIFE IP. Броят заменени печки за другите бенефициенти по ОПОС все още не е известен. Що се отнася до проекта LIFE IP, Бургас ще се стреми да замени около 2 000 печки, Русе – около 1 500, Стара Загора – около 1 000, Велико Търново – около 550 и Монтана – около 500. В допълнение, в проекта LIFE IP е заложено закупуването на две мониторингови станции във всяка участваща община, както и назначаването на експерти по въздуха на местно ниво в тези общини.

[4] https://www.zazemiata.org/wp-content/uploads/2020/01/Dolkad-beneficienti-pechki.pdf

[5] http://87.126.141.158/burgas/bg/index/static/21/

АНКЕТИ С НАСЕЛЕНИЕТО

Някои общини са извършили или обмислят анкетиране на населението основно в контекста на предстоящите програми за замяна на стари печки. Една от целите на тези анкети е актуализирането на информацията за броя печки в дадена община, тъй като повечето общини използват данни от последното преброяване на населението през 2011 г. Други цели на анкетите включват: взимане на мнението на гражданите по въпроси, свързани с КАВ, оценка за готовността на домакинствата да заменят старите си печки и предпочитаните от тях алтернативи на старите печки. Общинските анкети не следват стандартизиран подход. Всяка община, която е провела или планира да проведе такава анкета, определя въпросите и обхвата на анкетата и след това възлага нейното изпълнение на консултанти.

През 2018 г. За Земята, съвместно с маркетинговата агенция Marketlinks, проведоха първото и единствено към момента допитване на национално ниво по въпросите на КАВ, в което участваха 1 005 души[6]. Целите на допитването бяха да определи:

- Структурата на битовото отопление в страната;
- Мнението на населението относно ефекта върху КАВ от използването на твърди горива за отопление;
- Нагласите на населението за замяна на старите печки за отопление, включително и нуждата за и предпочитаната форма на финансово подпомагане за тази замяна.

ЗАКЛЮЧЕНИЕ

Конкретни действия на общините в сферата на КАВ са в по-голямата си част ограничени, с известни изключения в София. Действията на общинско ниво, които до момента са планирани и/или извършени, показват следното:

- Някои общини изглежда са били привлечени от идеята за бързо и лесно решение на проблемите на КАВ, а именно инсталирането на филтри на комините. Дори Община София пилотно инсталира филтри като към момента има инсталирани повече от 150 филтъра. Инсталирането на филтри на комини не е устойчива мярка и следователно предимство трябва да се даде на други мерки, които директно намаляват емисии на замърсителите и подобряват топлинния комфорт в домакинствата.
- Няма българска община с въведена ЗНЕ. Причините за това може да са както липса на политическа воля, така и недостатъчно овластяване на общинските администрации за въвеждане и контрол на ЗНЕ.
- Общината с най-много ресурси и най-голям екип в сферата на въздуха – София – е общината, която е най-активна в предприемането на конкретни действия за подобряването на КАВ. Община София е също и общината, подложена на най-голям граждански натиск за предприемане на действия за подобряването на КАВ. Следователно както и натискът „отдолу“, така и наличните капацитет и ресурси са важни предпоставки за предприемането на действия в областта на КАВ.
- Комуникацията с гражданите и гражданските организации може да се подобри. Опитът с проекта за подмяна на 30 стари печки с пелетни печки в Нови Искър е доказателство, че успешно взаимодействие между местна власт и гражданско общество е възможно. От друга страна, дори и местната власт в София е подложена на критики за недостатъчно включване и обратна връзка от обществото – например, в процеса на избиране на местоположенията на 22 станции за КАВ, инсталирани по проекта AIRTHINGS. Общините следва да търсят активното участие и подкрепа от граждани и граждански организации.

Осведомеността на обществото за причините за лошо КАВ е ниска. Има липса на допитвания сред населението, въпреки че няколко такива вече са извършени или се планират в контекста на предстоящите проекти за замяна на стари печки.

[6] За Земята, достъпно на: https://www.zazemiata.org/wp-content/uploads/2019/04/Prouchvane-Final-Corrections.pdf

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EUROPEAN CLEAN AIR CENTRE (ECAC)

was founded in 2019 by Krakow Smog Alert, a civil society organization advocating for clean air. ECAC is a think-tank whose mission is to support civil society organizations and decision makers with knowledge and solutions aimed at air quality improvement and climate protection. Its founders possess multiyear experience in advising international, national and local institutions on air quality policies with particular focus on health impacts, environmental finance and regulations as well as behavioural aspects.