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AIR QUALITY IMPROVEMENT PLAN FOR TETOVO MUNICIPALITY

Further strengthening the capacities for effective implementation of the acquis in the field of air quality
This project is funded by the European Union

ABSTRACT

This air quality improvement plan was developed in order to provide a strategy for the air quality improvement in Tetovo municipality. As part of the plan an air quality assessment was carried out for pollutants regulated by the national legislation and measured in Tetovo. The emission study carried out to define the main emitting sources in Tetovo shows a prevalent role of the domestic heating, traffic and industry contributing to the total emission of NOx, $SO_{2,}$, CO and PM_{10}.

The air quality assessment was carried out with the air quality information collected in one air quality monitoring station situated in Tetovo. The study shows that the most critical pollutant in the Tetovo is particulate matter (PM_{10}). The PM_{10} concentrations exceed significantly both the daily and annual limit values defined in the legislation for the protection of human health. Concerning PM_{10}, it is clear that also secondary PM_{10} has great significance in total PM_{10} concentrations. For this reason the air quality improvement measures must include actions to reduce emission of the precursors of secondary PM_{10}, i.e. NO_x, SO_2, VOC and NH_3 emissions. The measurement data for O_3 is partly unreliable, but the long-term target value for ozone (O_3) is likely to be exceeded.

For $PM_{2.5}$, benzene and benzo(a)pyrene there are no available measurement data from Tetovo. Nevertheless the experience from other Macedonian cities give an indication that some of these pollutants may have importance for the local air quality. At least $PM_{2.5}$ has to be classified as a potentially critical pollutant.

According to the result of the emission inventory and the air quality assessments, a strategy for the air quality improvement is proposed. A set of possible measures were defined in order to reduce the emissions and their impact on air quality. These measures are classified as short-term and long term-measures. The short-term measures should be adopted as soon as possible in order to decrease the concentrations of the most critical pollutants. The long-term measures need more time to be implemented due to the need of significant funding and planning. The short-term measures of the plan are prepared mainly for the years 2017-2022 and the medium or long-term measures mainly for the years 2017-2027. The plan should be reviewed each five years.

The air quality improvement plan for Tetovo municipality was prepared with the support of the EU funded Twinning project ‘Further strengthening the capacities for effective implementation of the acquis in the field of air quality’. In the plan the emission assessment is based on the work done as part of the activities of the EU funded project ‘Strengthening capacities for implementation of environmental legislation at local level’ (Technical Report No. 6, Review of Air Quality in Tetovo) and has been utilized with the permission of the project team.

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1. INTRODUCTION

This plan aims at reduction of pollution and improving the air quality in the Tetovo municipality. The plan is prepared in accordance to articles 23 and 26 of the Law on Ambient Air Quality. Air quality improvement plans should be developed for those zones and agglomerations where the levels of pollutants in ambient air exceed limit or target values set for pollutant concentrations.

In this plan an assessment of NO_2, SO_2, CO, O_3 and PM_{10} concentrations based on the measurement data of years 2010-2015 from measurement station located in Tetovo was carried out using the indicators defined in the legislation. The assessment was carried out using the air quality criteria defined in the national legislation: the limit and target values and the information and alert thresholds (Decree on the limit values of the levels and types of polluting substances in the ambient air and alert thresholds, deadlines for limit values achievement, margins of tolerance for the limit values, target values and long-term targets, Official Gazette No. 50/05, 4/13).

The measures to improve local air quality in Tetovo agglomeration presented in this plan are based on the emission study of different pollutants in each main emission sector and air quality assessment covering the years 2010-2015. These measures should be adopted progressively in the next 5-10 years. Currently it is not possible to assess comprehensively the effects of the different emission sectors on local air quality, and therefore the measures cover all the major emission sectors. The measures are divided in to categories based emission sector. Part of the measures can be put into force fairly quickly and without significant additional resources and funding. The impact of these measures is not expected to be very significant but nevertheless they are important so that some progress in air quality improvement will be taken and seen at the local level in a short period of time.

The implementation of most of the measures to significantly decrease the emissions and the concentration of the critical pollutants take a longer period of time and need further planning and guaranteed funding. Implementation of these measures is expected to take several years and require political commitment at the local level. The measures developed at the local level will also have to be supported by the measures designed in the national level. The implementation of the measures will be followed and developed at local level with the coordination of the Ministry of Environment and Physical Planning (MEPP). The plan and the included measures should be reviewed in 5 years period.

2 GENERAL INFORMATION

2.1 Characterization of the Tetovo municipality and its population

Tetovo municipality is situated in the Polog statistical region located in the North-West part of the country, bordering Albania and Kosovo. Tetovo represents the center of a number of settlements and municipalities located in its surrounding. The neighbouring municipalities are Bogovinje, Brvenica, Zelino, Jegunovce and Tearce.

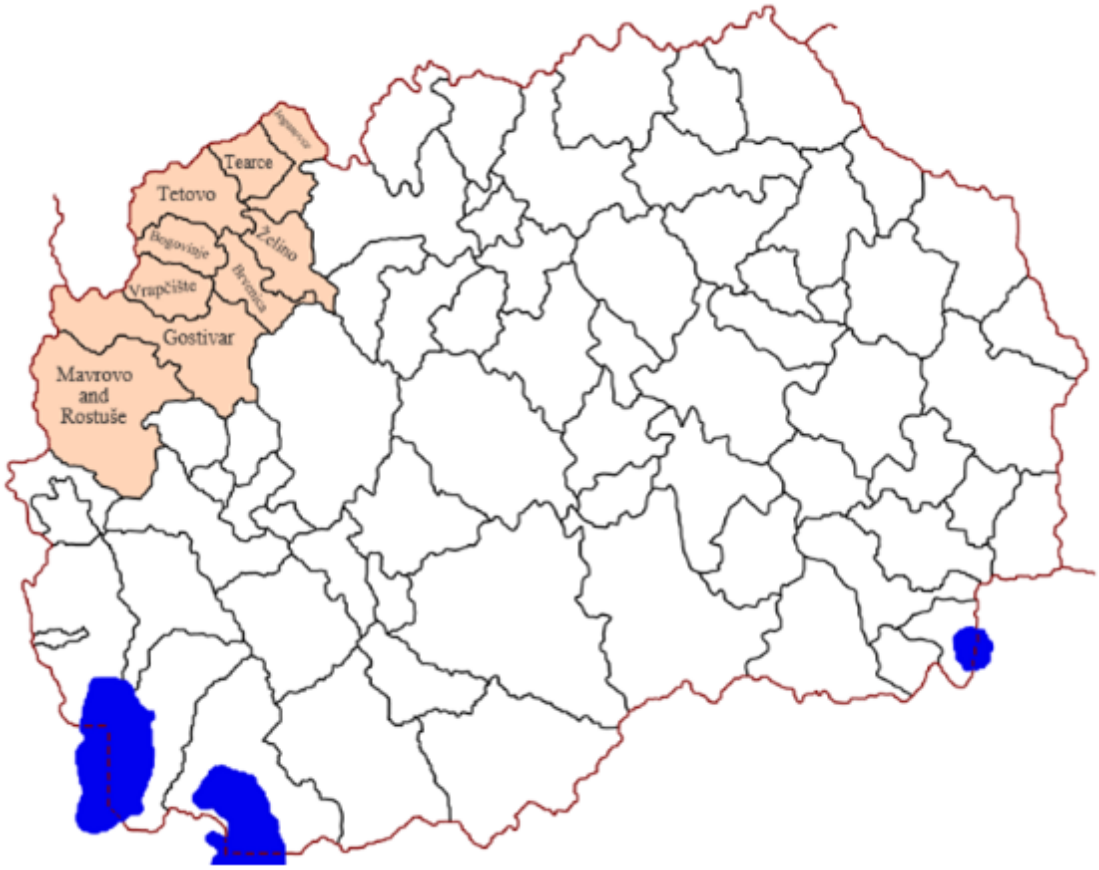

Figure 1. Map of Polog Statistical Region.

Tetovo town is the center of the municipality. According to the data from the census and household registry carried out in 2002, the total population in the municipality of Tetovo and nearby municipalities is presented in Table 1.

Table 1. Number of population and housing in Tetovo and neighboring municipalities

Municipality	Area (km^2)	Total number of population	Households	Houses (all types of lodgings)
Tetovo	87	86 580	20 094	22 592
Tearce	137	22 454	5 095	5 480
Zelino	201	24 390	5 226	5 325
Jegunovce	174	10 790	2 645	3 029
Bogovinje	141	29 000	na	na
Brvenica	164	16 560	na	na

Around 75% of the urban area in Tetovo is classified as housing area. Most of it consists of individual houses but with 15-20 % being collective residential facilities. The collective buildings are located near main routes of traffic in the town.

2.2 Topography and climate

Tetovo is located in the in the lower Polog valley in North-West part of the country on the foothills of Šar Mountain and divided by the Pena River. The municipality of Tetovo covers an area of 1 080 km^2 in average 468 meters above the sea level.

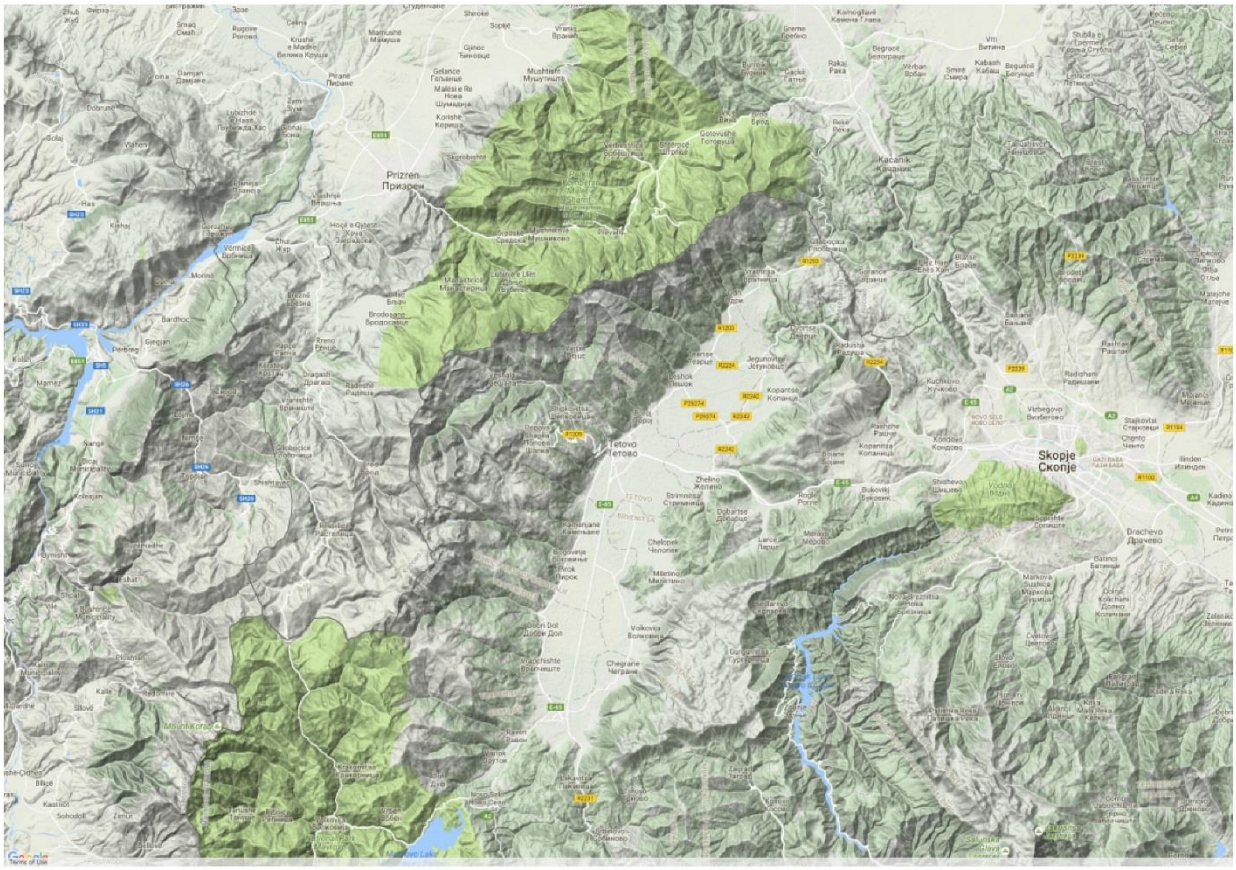

Figure 2. Topography of the Tetovo region.

Tetovo area is characterized by continental climate conditions. According to the meteorological observations from the year 2013, the average temperature in Tetovo was 12^{0}C. Monthly average temperatures for 2013 are presented in Figure 3. During that year the observed minimum temperature was -8^{0}C and maximum 34^{0}C.

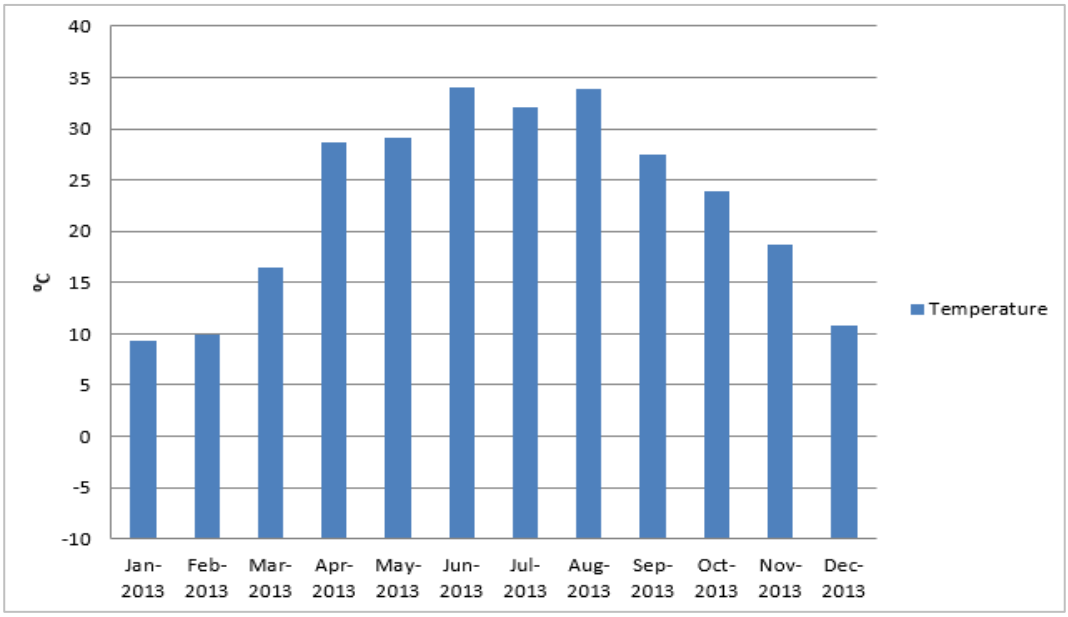

Figure 3. Observed monthly average temperature in Tetovo in 2013.

The uncertainty of weather observations is evident in the wind measurements. According to the measurements in 2013 the average wind speed was 1 m/s, with maximum observed wind speed 4 m/s. However, it is likely that due to the old instrumentation and lack of calibration the wind speed in reality is higher than that, with calm winds observed more than is realistic. According to the measurements the dominant wind direction is northwest. The wind speed and direction is presented as wind rose in Figure 4.

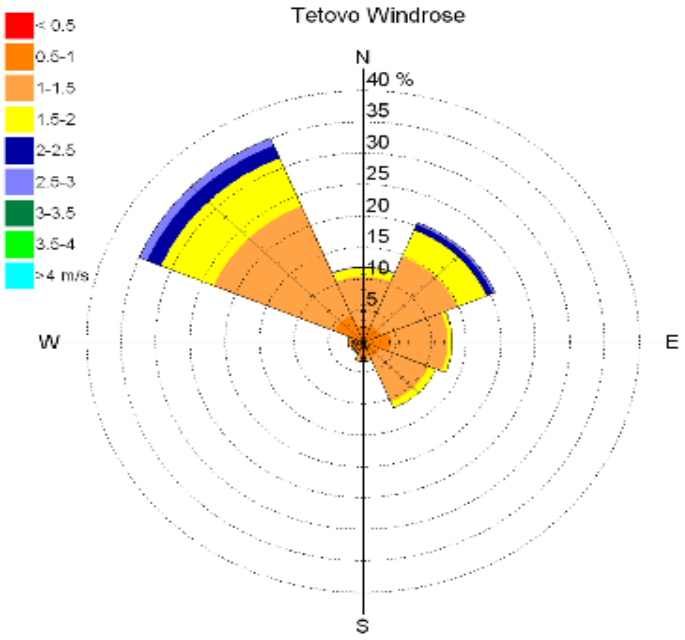

Figure 4. Wind rose representing the distribution of winds per speed and direction in 2013.

Despite the lack of adequate quality meteorological data from Tetovo, it can be estimated that the meteorology and topography have very significant contribution to the air pollution concentrations in Tetovo. As in other locations in the country, during the winter period very high concentrations of air pollution are measured. The high concentrations are observed during stable atmospheric conditions, with emitted substances accumulating into the valleys. During these periods there is reduced circulation in the atmosphere due to prolonged period with weak winds, very little rain and occurrence of temperature inversion.

2.3 Industrial activities

The main industrial sectors in Tetovo and surrounding municipalities are food manufacturing, farming, metal industry, textile industry and quarrying, mining, storage of minerals and concrete production. In the area there are also companies registered for wood manufacture, printing, leather tenting, production of plastic products, production of metal constructions and other machine parts etc.

Jugohrom Alzar DOOEL Jegunovce for ferroalloys production is situated in the municipality of Jegunovce which is a neighboring municipality to Tetovo. This installation is major emitter of PM_{10} at a national level. The main activity is production of non-ferrous metals from ores, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes. This installation is categorized as an A-IPPC permit installation.

In Tetovo and its surroundings, food manufacturing companies are involved in production of bread, cookies, meat products, and frozen foods and milk products. The major companies in this sector are Zito Polog AD Tetovo (A-IPPC permit) which works as a poultry farm as well as a bread production installation and Sentis AD (B-IPPC permit) installation for milk production.

The major installations for textile production in Tetovo are the installations Teteks AD and Teteks Jarn Group which are both subject to A-IPPC permit. Moreover, there are several smaller textile workshops.

2.4 Traffic networks

In Tetovo region there are several major routes: motorway M4 from Skopje to Tetovo (35 km), regional roads P403 (28 km), P405 (28.5 km) and P407 (13.2 km) as well as a dense network of local roads. The regional roads are used for inter town communication and connection with the neighboring areas. The regional road Tetovo-Jazince also represents international road connection to Kosovo. There is no public transportation in Tetovo at the moment.

Figure 5. Street map of Tetovo

2.5 Energy and heating infrastructure

Electric power consumed in Tetovo is supplied by the national power network. Local electric power generation is negligible. Tetovo does not have a district heating system or any larger centralized heating system, so all consumers have their own local or individual heating systems.

3. LEGISLATIVE FRAMEWORK

3.1 Air quality legislation

Ministry of Environment and Physical Planning (MEPP) prepared the framework Law on Ambient Air Quality in accordance with the Framework Directive 96/62/EC on ambient air quality assessment and management. The Decree on limit values for levels and types of pollutants in ambient air and alert thresholds, terms for achievement of limit values, limit value margins of tolerance, target values and long term targets, has been prepared in accordance with Law on Ambient Air, taking into consideration the Framework Directive and the daughter directives. The Law and the Decree were updated with the provisions and details stipulated in the Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe (so called CAFÉ Directive) and Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. Until now, 16 bylaws have been prepared in accordance with the EU regulations and this process is still on-going.

3.2 Air quality criteria

The legislation defines the limit and target values, long-term objectives and alert and information thresholds for pollutants in ambient air (Table 2). Limit and target values for SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$, O_3, benzene, PAHs and certain heavy metal concentrations are defined for protection of human health. The alert threshold is a concentration level beyond which there is a risk to human health from brief exposure for the population as a whole and at which immediate steps are to be taken to improve air quality. The legislation defines alert thresholds for SO_2 and NO_2 concentrations and alert and information thresholds for ozone concentrations. Draft proposal exists for the information and alert thresholds for PM_{10} concentrations.

Table 2. Air quality limit values, target values, long-term objectives, information and alert threshold values for the protection of human health

	Limit or target value			Long term objective	Information and alert thresholds	
Pollutant	**Averaging period**	**Value**	**Maximum number of allowed occurrences**	**Value**	**Period**	**Threshold value**
SO_2	Hour Day	350 µg/m^3 125 µg/m^3	24 3		3 hours	500 µg/m^3**
NO_2	Hour Year	200 µg/m^3 40 µg/m^3	18 0		3 hours	400 µg/m^3**
Benzene (C_6H_6)	Year	5 µg/m^3	0			
CO	Maximum daily 8-hour mean	10 mg/m^3	0			
PM_{10}	Day Year	50 µg/m^3 40 µg/m^3	35 0		2 days 2 days	150 µg/m^3* 200 µg/m^3 with margin of tolerance of 50 µg/m^3 (25%) from the day of enforcement, with equal annual percentage reduction each 12 months to reach 0 % by 1 January 2022** (draft proposals at the moment)
$PM_{2.5}$	Year	25 µg/m^3	0			
Pb	Year	0.5 µg/m^3	0			
As	Year	6 ng/m^3	0			
Cd	Year	5 ng/m^3	0			
Ni	Year	20 ng/m^3	0			
BaP	Year	1 ng/m^3	0			
O_3	Maximum daily 8-hour mean averaged over 3 years	120 µg/m^3	25	120 µg/m^3	1 hour 3 hours	180 µg/m^3* 240 µg/m^3**

* information threshold

** alert threshold

3.3 Air quality plans and programs

Air quality improvement plans should be developed to ensure that concentrations of air pollutants will not exceed the air quality standards (limit values, target values, alert thresholds) when they have to be met. In accordance with the Law on Ambient Air Quality the following documents shall be prepared for the planning of air quality protection:

1. National level
   - National plan for ambient air protection;

- National programme for gradual reduction of the emission quantities from certain types of pollutants.

2. Local level

- Plan for improvement of the ambient air quality;
- Short-term action plan for ambient air protection.

Plans for improvement of ambient air quality should be prepared for the municipalities where the levels of pollutants in ambient air exceed any limit or target value.

In municipalities, where there is a risk that the levels of pollutants in ambient air will exceed one or more of the alert thresholds, short term action plan should be prepared indicating the measures to be taken in the short term in order to reduce the risk or duration of such an exceedance.

The content of the air quality plan should be in accordance with the provisions prescribed in the Rulebook on detailed content and manner of preparation of the plan for ambient air quality improvement.

3.4 Emission legislation

The regulation of permitted emission levels of pollutants in stationary emission sources is based on the Law on Ambient Air Quality (Article 13). Detailed emission limit values for different pollutants from different processes and enterprises are given in the Rulebook on the limit values for the permissible levels of emissions and types of pollutants in the exhaust gases and vapours emitted in the air from stationary sources (Official Gazette no. 141/10). The Rulebook refers to all identified (existing) industrial and energy production installations, and certain agricultural processes. Guidelines have been prepared for the adequate implementation of the rulebook. The guidelines are directed preliminarily at industrial operators, but also to inspectors dealing with control of emissions from stationary sources, and authorities giving A and B permits to operators.

4. CONNECTION TO OTHER PROGRAMS AND STRETEGIES

4.1 National plan for the ambient air quality protection

National plan for the ambient air quality protection has been adopted for the whole country in 2012. It identifies and describes the measures for emission reduction and improvement of ambient air quality. For each measure the responsible institution and deadline for its implementation were defined. The national plan is adopted by the Government upon proposal of the Ministry of Environment and Physical Planning and with the consent of the Ministry of Health and the Ministry of Economy, and is referring to the period 2013-2018.

The national plan includes measures that are general and sectoral in nature, i.e. measures for air quality monitoring and assessment, measures for air emissions reduction from industrial sector, measures for reduction of air emissions from transport sector, measures for reduction of air emissions from agricultural sector and measures for human health protection.

The national plan has numerous measures that have impacts at local level and support the local level activities to improve air quality. In many cases these national measures may even be primary measures in air quality improvement, since the air quality problems in the country are rather national and regional in origin than only local.

4.2 National program for gradual reduction of the emission

National emission reduction program in accordance with the EU Directive for National Emission Ceilings has been adopted by the Government in 2012. It specifies the measures for reducing pollutants in relation to the upper limits – ceilings for emissions and the projections for reducing the quantities of pollutant emissions on annual level until 2020.

The terms for preparing the programme for gradual reduction of the emission quantities of sulphur dioxide, nitrogen oxides, ammonia, volatile organic compounds, total suspended particles, and carbon monoxide are specified in Article 27-b of the Law on Ambient Air Quality.

The programme covers period 2012-2020 and is in accordance with all relevant documents in energy sector listed in the next subchapter.

4.3 Other planning documents

The plans mentioned above are in relation with the following strategic documents which have been adopted nationally:

- Third national communication on climate change;
- Strategy for energy development up to year 2030;
- Strategy to promote energy efficiency up to year 2020;
- Strategy for using renewable energy sources up to year 2020;
- National strategy and national plan for waste management;
- National strategy for transport.

This plan will be in-line with the all strategic documents of the country.

5. EMISSIONS IN TETOVO

5.1 Emission inventory

The emissions from different emission sectors for the Tetovo region were calculated and estimated by the EU funded project ‘Strengthening capacities for implementation of environmental legislation at local level’ (Technical Report No. 6, Review of Air Quality in Tetovo). Description of the methods used in the emission inventory is included in the technical report. The emission sectors are be divided as follows:

- Energy production (emissions from local power and heat production for the community in power plants);
  Industry (emissions from industrial plants including energy production and processes);
- Traffic (emission from passenger cars, buses and heavy duty vehicles);
- Domestic heating (emissions from heating of houses with own boilers and heating units);
- Diffuse emissions (emissions form construction and demolition works, agriculture, road surface etc.).

The emission inventory does not cover all possible emissions. For example the emissions from construction and work machines, small and medium size enterprises, agriculture, and waste management are not fully covered here. However it is assumed that these missing sectors do not have a major effect on the total emissions and air quality.

5.2. Energy production

In Tetovo there is no local power or heat production for the municipality.

5.3 Industry

5.3.1 Food processing

In Tetovo and its surroundings, food manufacturing companies are dealing with production of bread, cookies, meat products, and production of frozen foods and milk products. Major companies in this sector are Zito Polog AD Tetovo (A-IPPC permit) which works as a poultry farm as well as a bread production installation and Sentis AD (B-IPPC permit) installation for milk production. Emissions from food manufacturing occur primarily from the following sources:

- Processing of meat, fish and poultry, releasing mainly fats and oils and their degradation products;
- Baking of bread, cakes biscuits and breakfast cereals.

Where cooking or putrefaction is not involved, such as the production of fresh and frozen foods, emissions are considered negligible. The main pollutant from this branch is NMVOC as well as emission of all basic pollutants from combustion of fuels. However the emissions coming from fuel combustion in this sector are minor, bearing in mind that the installations have small capacity and small fuel consumption.

5.3.2 Ferro metal industry

Jugohrom Alzar DOOEL Jegunovce (previously a state owned company SILMAK DOOEL export import, from 1952) is located in the village Jegunovce, around 15 km from Tetovo. The main activity is production of non-ferrous metals from ores, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes. In 2008, MEPP issued an A-IPPC permit for adjustment with the operation plan for this installation based on an application made in 2006.

Production of ferroalloys generally involves the use of electric arc furnaces and reaction crucibles into which natural products with relatively fluctuating physical compositions are loaded. Due to this, the main environmental impact of producing ferroalloys is the emission of dust and fumes from the smelting processes.

The installation consists of seven electric ore furnaces, whose standard products are FeSi 75% and Si-metal. The maximum production capacity for this installation is 80 000 t of FeSi. Production of ferroalloys varied in the period 2005-2014 as can be seen in Figure 6.

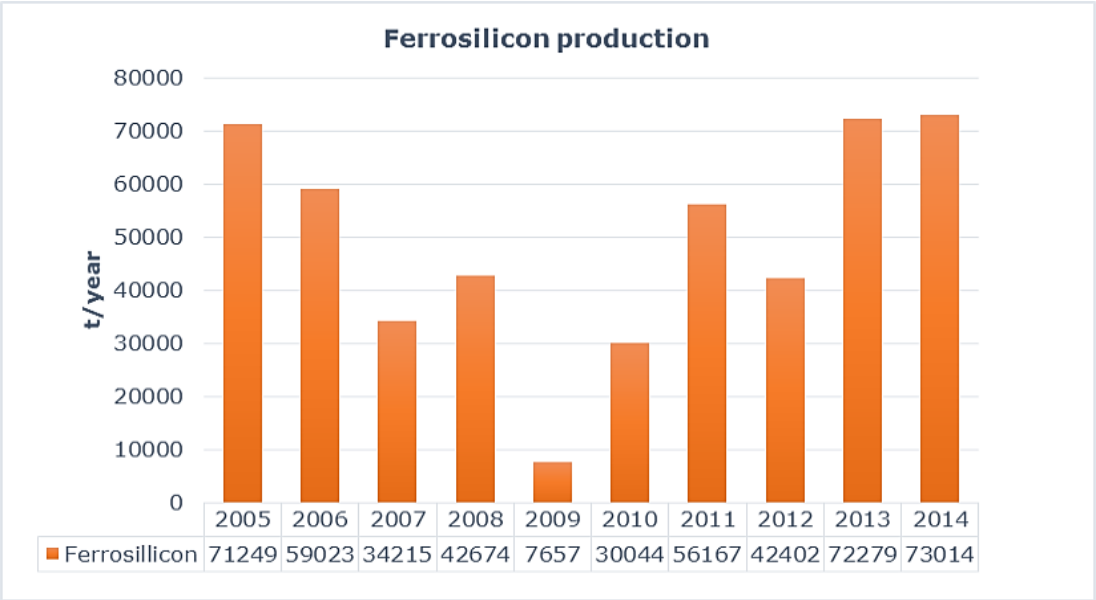

Figure 6. Ferrosilicon production in 2005-2014.

The basic raw material for production of ferroalloys is quartz/quartzite which is the source of Si used in the production of 75% FeSi. The main source of Fe is Fe_2O_3. Lignite, pit coal, wood coal and wood pellets are used as reducing agents in the process.

The main emissions to atmosphere come from the process of melting and reduction in the electric furnaces. The products of the combustion together with the excess air in waste gases, are emitted through 13 stacks (height 30-50 m). Emission measurements are performed twice per year by an accredited laboratory and once per year by internal monitoring. According to the emission measurement results as well as air quality self-monitoring of the installation, it can be concluded that this installation is a major source of dust emissions. Implementation of the operation plan regarding dust collector system is expected to significantly reduce dust emissions from this installation.

5.3.3 Textile production

The major installations for textile production in Tetovo are the installations Teteks AD and Teteks Jarn Group which are both subject to A-IPPC permit. Moreover, there are several smaller textile workshops.

Teteks AD Tetovo is the company with the larger production capacity, located in the urban part of the city. The installation uses coal and oil as fuels for production of steam. The installation have following boilers:

- Two coal boilers with heat input of 11.3 MW and 25.8 MW;
- Two fuel oil boilers with heat input of 9.5 MW;
- Two boilers with fuel oil with heat input of 7.8 MW;
- A boiler with a heat input of 8.1 MW.

Teteks Jarn Group is the second largest installation after Teteks AD Tetovo according the installed capacity in the textile production sector. This installation is also categorized as an A-IPPC installation and is located in the same yard as the installation Teteks AD Tetovo. The installation produces wool and yarns which are used in the textile industry as raw materials. The installation uses heavy fuel oil and electricity. In the production process a boiler with an input capacity of 5.5 MW is used.

5.3.4 Quarrying, mining, storage of minerals and concrete production

Standard techniques are assumed for this source including blasting, transportation and crushing of materials. Quarrying and mining of minerals results in emissions of particulates. PM emissions from this sector are occurring during storage, handling and transport of mineral products and may be significant at local level.

5.3.5 Other production

In Tetovo and neighbouring settlements there are also companies registered for wood manufacture, printing, shoe manufacture, leather tenting, production of plastic products, production of metal constructions and other machine parts etc. There are no activity data available for the calculation of the emissions coming from these activities. According to the EMEP/EEA guidebook 2013 on air emission inventory, dust emissions are expected from processing of wood manufacture, while main emitted pollutant in the other categories is NMVOC. However, due to their small capacities it is expected that these activities do not make significant contribution to the total emissions in Tetovo.

5.3.6 Total emissions from industry

Estimated emission quantities for the basic polluting substances from the installations which are subjected to A and B licenses are presented in Table 3. Detailed review of the installations, activities, production, and quantity of emission as well as manner by which data was gathered is presented in 'Technical Report No. 6, Review of Air Quality in Tetovo prepared as a part of the project 'Strengthening capacities for implementation of environmental legislation at local level'.

Table 3. Annual emission (in tons) of polluting substances from industry in Tetovo

Activity	SOx	NOx	CO	TSP	PM_{10}	$PM_{2.5}$	NMVOC	NH_3
Pig and poultry farms	0.2	2.5	95.7	40.8	31.3	6.7	45.9	152.6
Quarrying, mining and product of concrete	6.0	15.6	4.6	0.3	0.2	0.006	0.4	0.004
Textile industry	30.7	1.6	22.6	35.9				
Food production	0.0003	0.14	7.5	2.3	2.3	2.3	2.8	
Ceramics	2.8	1.3	62.9					
Heat production	2.1	2.4	1.9	0.06				
TOTAL	**41.8**	**23.5**	**195.2**	**79.4**	**33.8**	**9.0**	**49.1**	**152.6**

The emissions from Jugohrom Alzar DOOEL Jegunovce are shown separately due to the fact that the installation is 15 km away from Tetovo. However, the installation emits large amounts of pollutants in the air, especially PM_{10}. The emissions affect a wider region around the installation and are dispersed to inhabited areas in the surrounding. Table 4 represents the emissions of SO_2, dust, NO_X and CO for the period 2012-2014.

Table 4. Yearly emissions of pollutants emitted by Jugohrom Alzar DOOEL Jegunovce in the period 2012-2014.

Pollutants	2012 t/year	2013 t/year	2014 t/year
SO_2	729	1 899	773
NO_x (expressed as NO_2)	130	1 260	559
CO	530	1 311	675
TSP	11 894	18 323	9 760

5.4 Traffic

Calculation of the emissions from traffic was performed by the project 'Strengthening capacities for implementation of environmental legislation at local level'. CORINAIR Methodology (Tier 1) was used in the calculation. In the calculation the information of the amount of fuel used in transport in Tetovo by vehicle category and emission factors were used. The calculation is described detail in the report: Technical Report No. 6, Review of Air Quality in Tetovo.

Main corridors of the traffic in Tetovo are boulevards Ilindenska and Marshal Tito. Most of the larger buildings in Tetovo are located along these two boulevards, but also along boulevards Jane Sandanski, Blagoja Toska and Boris Kidric. The other parts of Tetovo mostly consists of narrow streets and individual houses around them. The intensity of traffic in Tetovo is evenly distributed during the year. There is a slight increase during the summer vacations. Decrease is notable at weekends and holidays. It can be expected that the pollution from traffic is distributed almost equally in all periods of the year. The congestion in the urban area starts in the morning (8:30 – 9:30) and lasts until late afternoon (16:30 – 17:30). The average driving speed in the city is less than 30 km/h due to high congestion in the center.

There is no public transportation available in Tetovo. Also, most of the infrastructure is not appropriate for safe bicycle transport. Parking is regulated in parts of the city, but in most of the city, parking is not controlled thereby encouraging increased use of cars and other private vehicles. Calculated emissions from road transport in Tetovo are shown in Table 5.

Table 5. Emissions from road transport in Tetovo.

Emission source	CO	NMVOC	NOX	PM
Direct emissions	654.7	81.4	610.9	21.6
Road vehicle tire and brake wear	-	-	-	4.86
Road surface wear	-	-	-	2.98

5.5 Domestic heating

Domestic heating along with industry and transport is one of the largest sources of emissions. Around 75% of the urban area in Tetovo is housing. Most of it consists of individual houses but with 15-20% being collective residential facilities. The collective buildings are located near main routes of traffic in the town. Tetovo does not have a district heating system or any larger centralized heating system, so all consumers have their own local or individual heating systems.

Most of the collective residential facilities in Tetovo use electricity as the energy source for household heating. Hence, they do not contribute in the local air pollution in Tetovo, but rather at the place of the production of the electricity.

Commercial facilities primarily use electricity, diesel or light oil as an energy source. The commercial and other facilities such as educational institutions and administrative institutions mainly use solid or liquid fuel for heating in the winter period.

Individual residential facilities consist of one to three households, often with each having an individual heating system. Most of them are using traditional biomass heating with wood as a primary energy source for heating although in the last few years there is a trend of new buildings to use heat pumps.

The heating season in Tetovo starts as early as October and can last until April. The coldest period is December to February. More than 70 % of the energy for heating is used during these three months, with most of the emissions being produced during this period. According to Makedonski Shumi (Macedonian Forests) 41.000 m^3 of heating wood is sold in the Polog Valley, and by interpolation, Tetovo uses around 20.000 m^3 of traditional biomass in the form of wood logs.

Calculation of the emissions from household combustion of wood (Table 6) was performed by the project 'Strengthening capacities for implementation of environmental legislation at local level' (Table 6). CORINAIR Methodology (Tier 1) was used in the calculation. The calculation is described detail in the report: Technical Report No. 6, Review of Air Quality in Tetovo.

Table 6. Emission from combustion of wood for heating in Tetovo.

Pollutant	**NO_X**	**CO**	**NMVOC**	**TSP**
t/year	20.4	1354.2	236.3	255.5

5.6 Other diffuse emissions

Other sectors have minor contribution to the diffuse emissions in Tetovo. Agricultural sector contributes to the emission of NH_3, NO, NMVOCs and PM_{10} in Tetovo. The emission are created from manure management, field burning of agricultural residues, application of fertilizers and utilization of farming machinery. Solid waste disposal and open burning also contribute to the emissions of NMVOCs and PM_{10}. Construction and demolition works create mainly PM_{10} emissions. Others sector with small amounts of emissions include distribution of oil products, car repair, concrete production etc.

5.7 Total emissions in Tetovo

The total emissions in Tetovo for each source type (stationary, diffuse and mobile) are presented in the Table 7. The figures are based on the calculations done as part of the project 'Strengthening capacities for implementation of environmental legislation at local level' (Technical Report No. 6, Review of Air Quality in Tetovo). The emission calculations are based on Tier 1 methodology and partially uncertain activity data. Therefore, the emission calculations should be updated when more information becomes available.

Diffuse sources, mainly use of wood in households contribute the most to the emissions of PM, CO and NMVOC. Traffic has significant contribution to NOx and CO emissions. The stationary sources located in Tetovo municipality do not have a major contribution to emissions of any of the pollutants. However, if the emissions from Jugohrom Alzar DOOEL Jegunovce located outside of Tetovo municipality will be taken into account, the stationary source sector emissions would dominate the emissions for each pollutant, especially for particulate matter. Therefore, the emissions from this installation will need to be taken into account in definition of the air quality improvement measures for Tetovo municipality.

Table 7. Annual emission of polluting substances from different type of sources

Source	SOx	NOx	CO	TSP	NMVOC	NH_3
Domestic heating	2.19	22.9	1356.45	265.59	358.36	
Industry	41.84	23.54	195.24	79.34	49.21	152.62
Traffic		610.9	654.7	29.44	81.4	
Total	44.03	657.34	2206.4	374.36	488.97	152.62
Jugohrom Alzar DOOEL Jegunovce (2014)	773	559	675	9 760		

6. AIR QUALITY ASSESSMENT FOR TETOVO

6.1 The process of establishing zones and agglomerations

Two zones and one agglomeration for the basic pollutants SO_2, CO, NO_2, NOx, PM_{10} and O_3 have been established on the territory of the country.

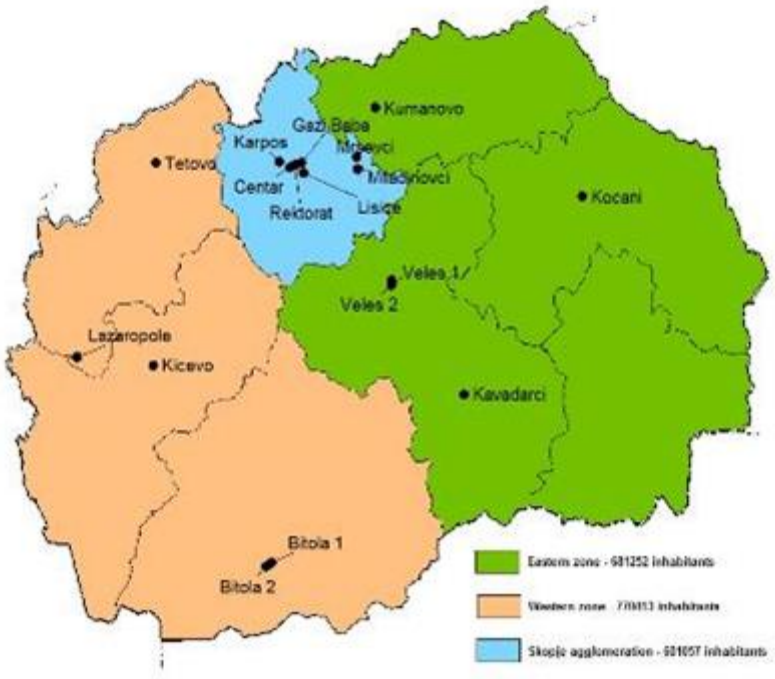

Figure 7. Classification of zones and agglomerations and situation of air quality measurement stations.

The zones are defined as: Western zone (South west, Polog and Pelagonija statistical region) and Eastern zone (North east, south east, Vardar and East statistical region) and one agglomeration Skopje (Skopje statistical region).

Table 8. Basic data per zone (data have been taken from the publication “Regions in Republic of Macedonia”, from 2016)

Zones/agglomeration	Statistical regions	Number of population	Area / km^2	Population density
Eastern zone	Vardar	686 003	13 183	52.04
	East			
	North East			
	South East			
Western zone	Pelagonija	770 944	10 476	73.59
	Polog			
	South West			
Skopje agglomeration	Skopje	619 279	1 718	360.46

6.2 Air quality network at national and local level

According to the Law on ambient air quality the Government established the national ambient air quality monitoring network. This network is managed by MEPP. It consists of 17 air quality monitoring stations, connected with the air quality database located in the Macedonian Environmental Information Center with GPRS connection. In the frame of the network there is calibration laboratory, for regular calibration of the instruments. One of the air quality monitoring stations is located in Tetovo. The station measures SO_2, NO_2, CO, PM_{10} and O_3 concentrations.

The monitoring station was located in the grounds of a secondary school Kiril Pejchnovik, during the period 13.05.2004 – 11.11.2014. The nearest local road was approximately 50 meters away. The surrounding area was mostly open and comprised of meadow and residential dwellings. Due to changes in the immediate environment and construction of a sports hall very close to the station, the station was relocated in November 2014. The monitoring station is now located in the vicinity of the primary school Kiril i Metodij. The station is classified as a traffic station.

In Tetovo there are no locally managed air quality monitoring stations.

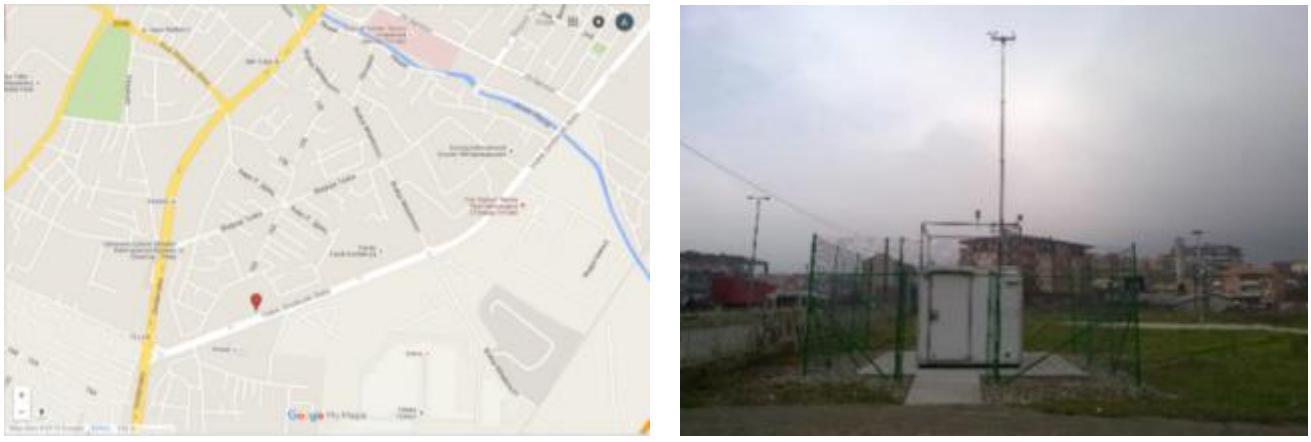

Figure 8. Present air quality monitoring station in Tetovo

6.3 Air quality in Tetovo

6.3.1 General

The air quality assessment for Tetovo has been made by the EU funded project 'Strengthening capacities for implementation of environmental legislation at local level' (Technical Report No. 6, Review of Air Quality in Tetovo). The assessment is made according to the Rulebook on criteria, methods and procedure for ambient air quality assessment. The assessment is based on the measurement data available from years 2010-2015. For some periods and years the data coverage was too low so that all concentrations comparable to the limit and target values have not been able to be calculated.

6.3.2 Sulphur Dioxide (SO_2)

According to the national legislation, sulphur dioxide concentration (SO_2) is regulated by two limit values and one alert threshold for protection of human health. Moreover a critical level for the protection of vegetation is included in the legislation. In following figures the measured SO_2 concentrations in Tetovo are compared to the limit values for the years 2010-2015. In 2012 the data coverage for SO_2 was poor and therefore this year is not included in the figures.

The daily limit value for SO_2 is set at 125 µg/m^3, not to be exceeded more than 3 times a calendar year. The following figure shows the 4th highest daily value for each year which must be smaller than the limit value. The values in figure show clearly that the daily limit value for SO_2 is not exceeded in Tetovo.

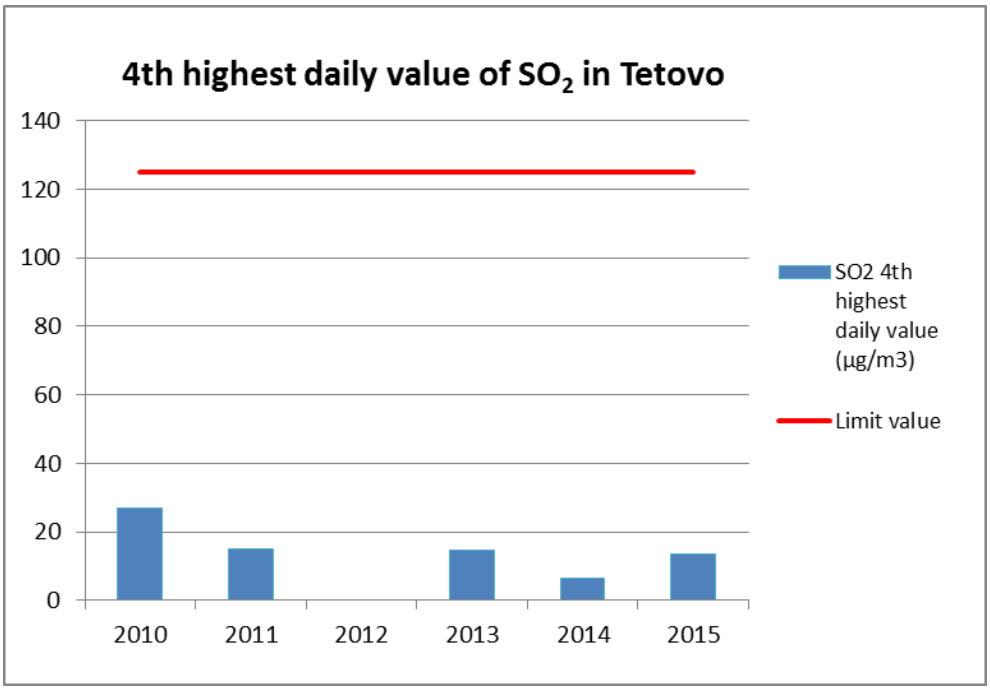

Figure 9. Assessment of the SO_2 daily limit value (125 µg/m^3) exceedance in Tetovo.

The hourly limit value for SO_2 is set at 350 µg/m^3, not to be exceeded more than 24 times a calendar year. The following figure shows the 25^h highest hourly value for each year which must be smaller than the limit value. The values in figure show clearly that the hourly limit value for SO_2 is not exceeded in Tetovo.

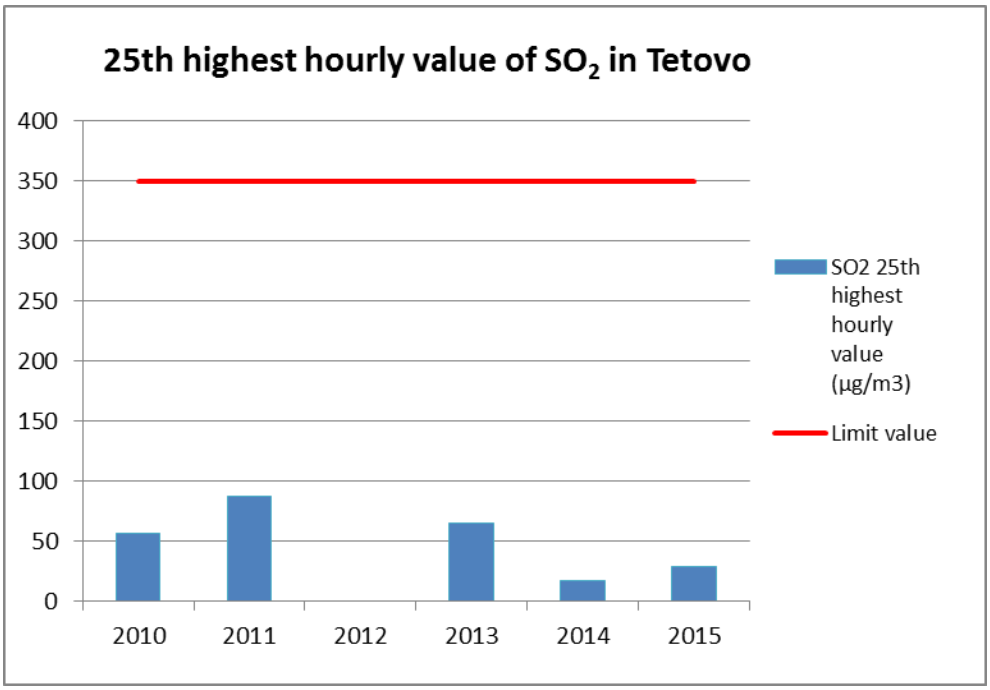

Figure 10. Assessment of the SO_2 hourly limit value (350 µg/m^3) exceedance in Tetovo.

The alarm threshold is set at 500 µg/m^3 as hourly value, and represents the threshold a level beyond which there is a risk to human health from brief exposure for the population. No exceedances of the alarm thresholds have been recorded in Tetovo.

Legislation includes also for SO_2 a critical level, set at 20 µg/m^3, as annual average and winter average, to be both respected in order to protect the vegetation. The annual or winter period averages do not exceed the critical value (Figure 11).

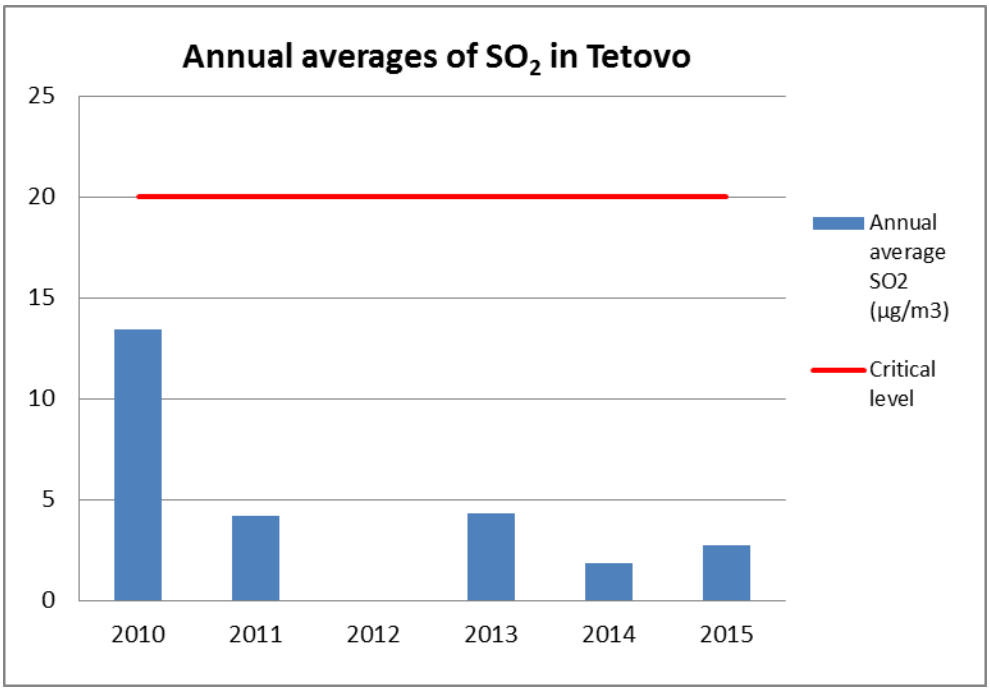

Figure 11. Assessment of the SO_2 annual critical level (20 µg/m^3).

As the concentrations of SO_2 are clearly below the limit values defined for protection of human health, SO_2 is not considered as critical pollutant in Tetovo.

6.3.3. Nitrogen Oxides (NO_x)

According to the current national legislation, nitrogen dioxide concentration (NO_2) is regulated by two limit values and one alert threshold for protection of human health. Moreover a critical level for the protection of vegetation is included in the legislation concerning the total nitrogen oxides (NOx). In following figures the measured NO_2 concentrations in Tetovo are compared to the limit values for the years 2010-2015. In 2011, 2012 and 2014 the data coverage for NO_2 was poor and therefore these years are not included in the figures.

The hourly limit value for NO_2 is set at 200 µg/m^3, not to be exceeded more than 18 times a calendar year. The following chart shows the 19th highest daily value for each year which must be smaller than the limit value. The hourly limit value was not exceeded in any of the years in Tetovo (Figure 12). The alarm threshold for NO_2 is set at 400 µg/m^3 as hourly value, and represents the threshold a level beyond which there is a risk to human health from brief exposure for the population. The alarm threshold is not exceeded in Tetovo.

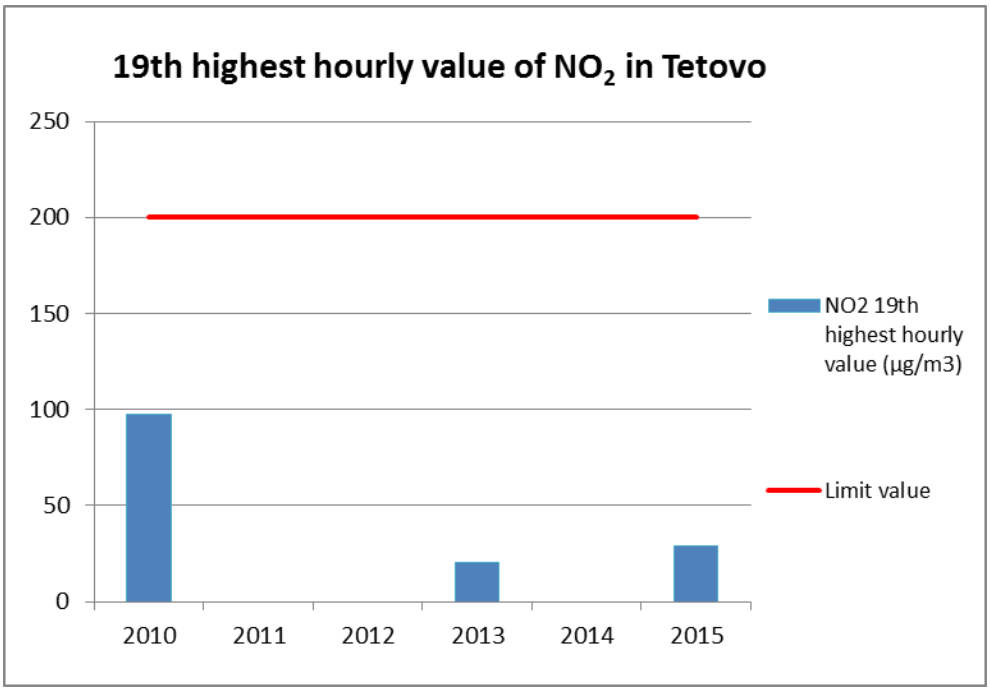

Figure 12. Assessment of the NO_2 hourly limit value (200 µg/m^3) exceedance in Tetovo.

The annual limit value for NO_2 concentration is set at 40 µg/m^3. The annual limit value is not exceeded in Tetovo during the period 2010-2015. Legislation includes also for NO_x (total nitrogen oxides) a critical level, set at 30 µg/m^3 as annual average, to be respected in order to protect the vegetation. The critical level is exceeded in Tetovo during some years. However, as the limit values for NO_2 defined for protection of human health are not exceeded, NO_2 is not considered as critical pollutant in Tetovo.

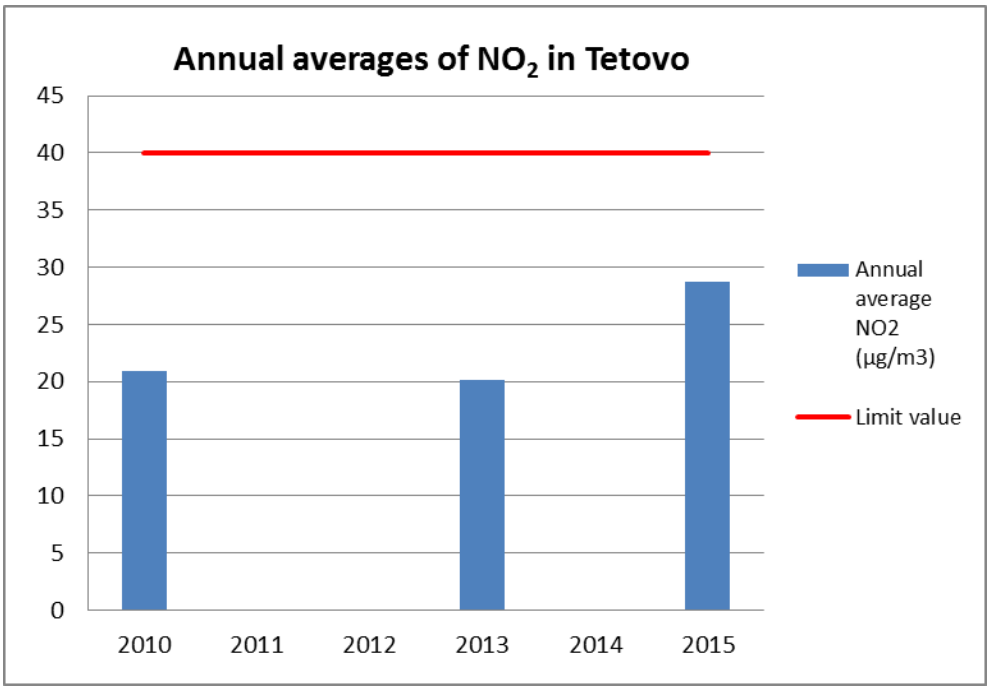

Figure 13. Assessment of the NO_2 annual average limit value (40 µg/m^3)

6.3.4 Suspended particles with size up to 10 micrometers (PM_{10})

According to the current national legislation, PM_{10} concentrations are regulated by two limit values for protection of human health. The annual limit value for PM_{10} is set at 40 µg/m^3, as annual average. The following figure shows that in Tetovo the annual limit value is exceeded constantly during the 2010-2015 period (2011 data was not taken into account due to poor data coverage). Moreover the averages are significantly higher than the limit value, showing an extremely critical situation in the area of study.

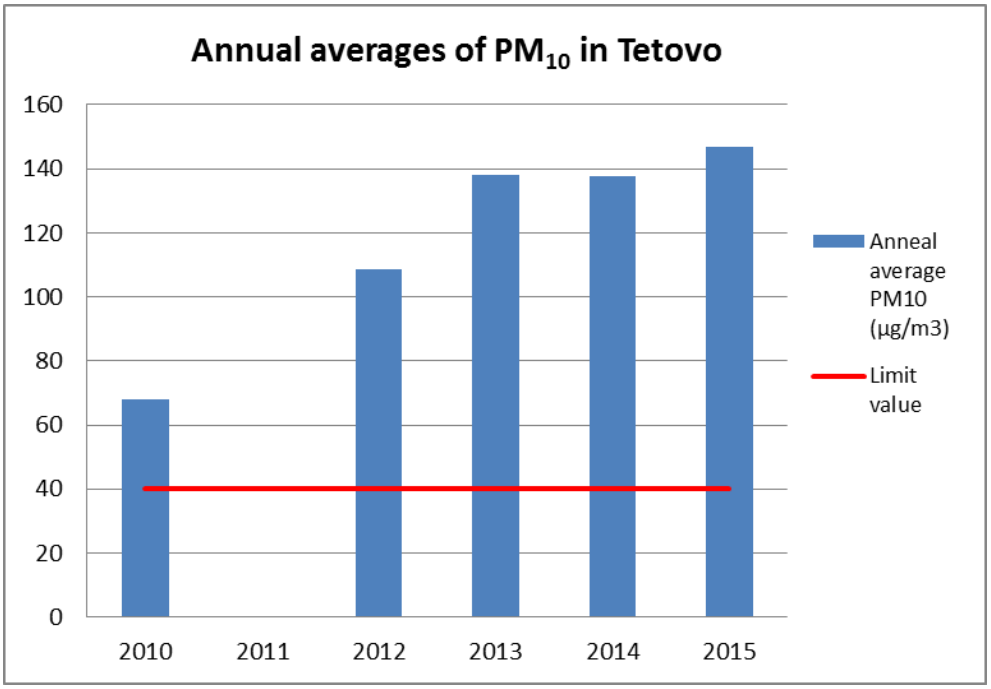

Figure 14. Assessment of the PM_{10} annual average limit value (40 µg/m^3)

The daily limit value for PM_{10} is set at 50 µg/m^3, not to be exceeded more than 35 times a calendar year. Figure 15 shows the number of exceedances of the daily value for each year. The values in the figure show clearly that the daily limit value for PM_{10} is constantly exceeded in Tetovo.

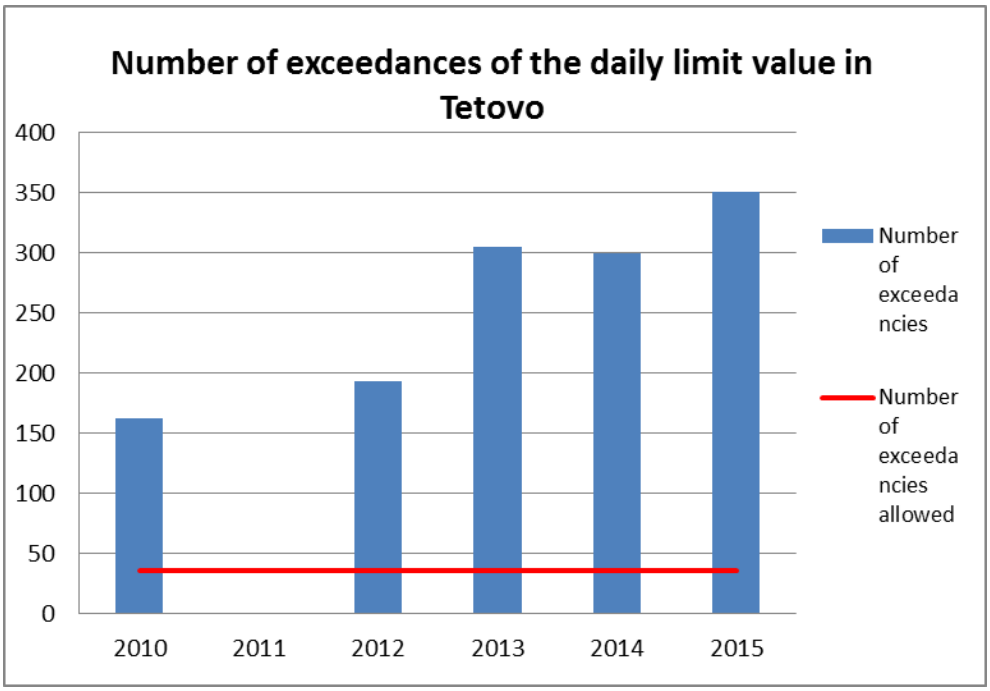

Figure 15. Number of exceedances of PM_{10} daily limit value (50 µg/m^3)

According to the measurement data the daily limit value is exceeded during large part of the year. In addition, for most of the days of exceedance are characterized by a very high concentration of PM_{10}. In figure 16 the daily average concentrations of PM_{10} in 2015 are presented.

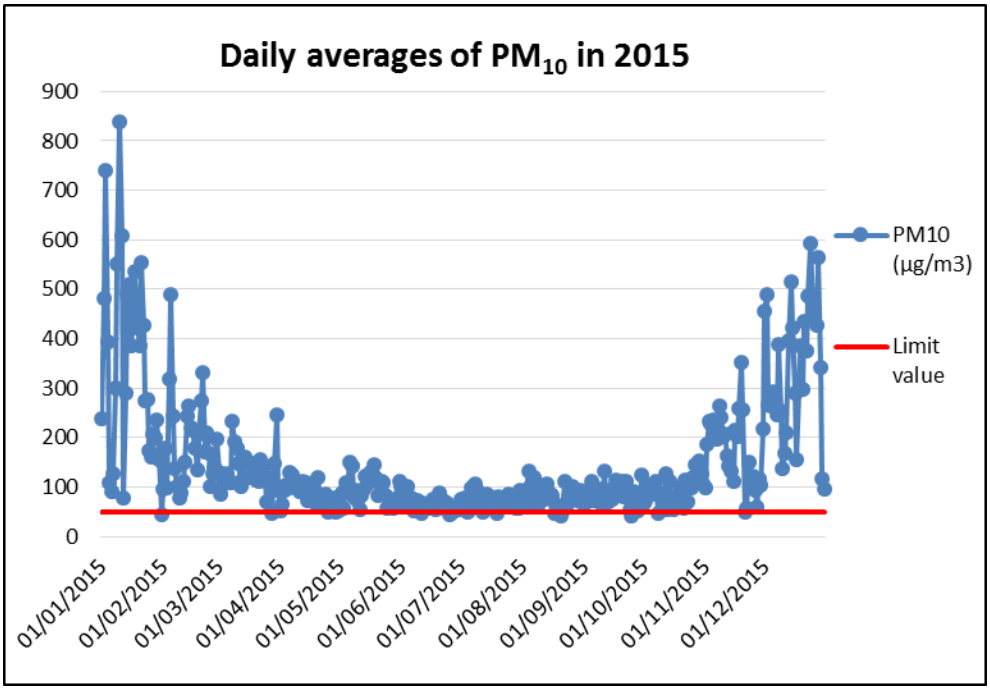

Figure 16. Daily average concentrations of PM_{10} in 2015 in Tetovo.

6.3.5 Suspended particles with size up to 2.5 micrometers (PM2.5)

According to the current national legislation, $PM_{2.5}$ concentrations are regulated by a limit value for the protection of human health, set at 25 μg/m^3, as an annual average.

Currently $PM_{2.5}$ concentrations are not measured in Tetovo. In Skopje there are two measurement stations for measurement of $PM_{2.5}$, and the ratio of PM_{10} and $PM_{2.5}$ in those stations can be utilized for rough estimation of $PM_{2.5}$ concentrations in other parts of the country where only PM_{10} is measured. In Skopje the $PM_{2.5}$ constituents approximately 60-70 % of the annual average PM_{10} concentrations. Utilizing this ratio and measured annual average concentrations of PM_{10} in Tetovo, it can be estimated that $PM_{2.5}$ limit value would exceed in Tetovo.

6.3.6 Ozone (O_3)

According to the current national legislation, O_3 concentration is regulated by one target value for protection of human health and two thresholds.

The target value for O_3 is set at 120 μg/m^3, expressed as maximum daily eight-hour mean, not to be exceeded on more than 25 days per calendar year averaged over three years. The following figure shows the exceedance for the year 2013. For 2012 and 2014 the data coverage was very poor and 2015 the measured concentrations are not realistic due to instrument malfunction, so averaging the exceedances for three years was not possible for this period.

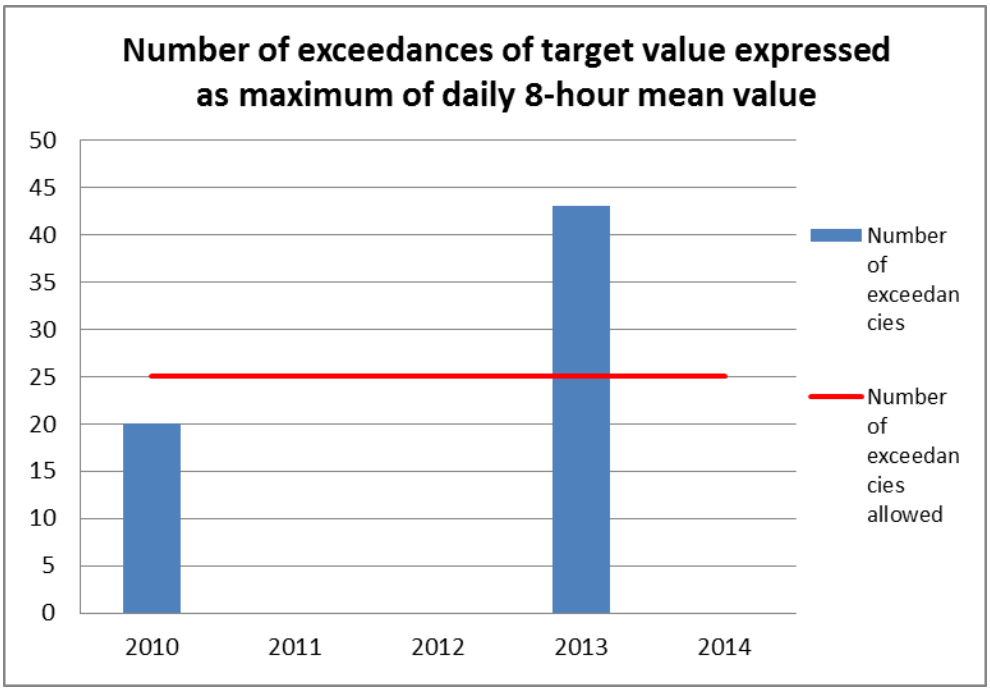

Figure 17. Assessment of exceedance of the O_3 target value for the protection of human health (120 μg/m^3).

The alert threshold for O_3 is set at 240 μg/m^3 as hourly average. The alert threshold represents the level beyond which there is a risk to human health from brief exposure for the population as a whole. The information threshold is set at 180 μg/m^3 as hourly average. The information threshold represents the level beyond which there is a risk to human health from brief exposure for particularly sensitive sections of the population. No exceedances of alert or information threshold were recorded in Tetovo during 2010-2014.

According to the data, the O_3 assessment shows a low level of criticality in Tetovo. However, due to the concentrations recorded especially during the summer periods, ozone should be considered as potentially critical in the area of study.

6.3.7 Carbon monoxide (CO)

According to the current national legislation the carbon monoxide concentrations are regulated by one limit value shown, calculated as maximum of the daily 8 hour averages and set at 10 mg/m^3. For the period 2010-2015, the measurements carried out show that the limit value was exceeded in 2012 and 2015 in Tetovo. In 2014 the data coverage was very poor. According to the data, the CO assessment shows a low level of criticality in Tetovo.

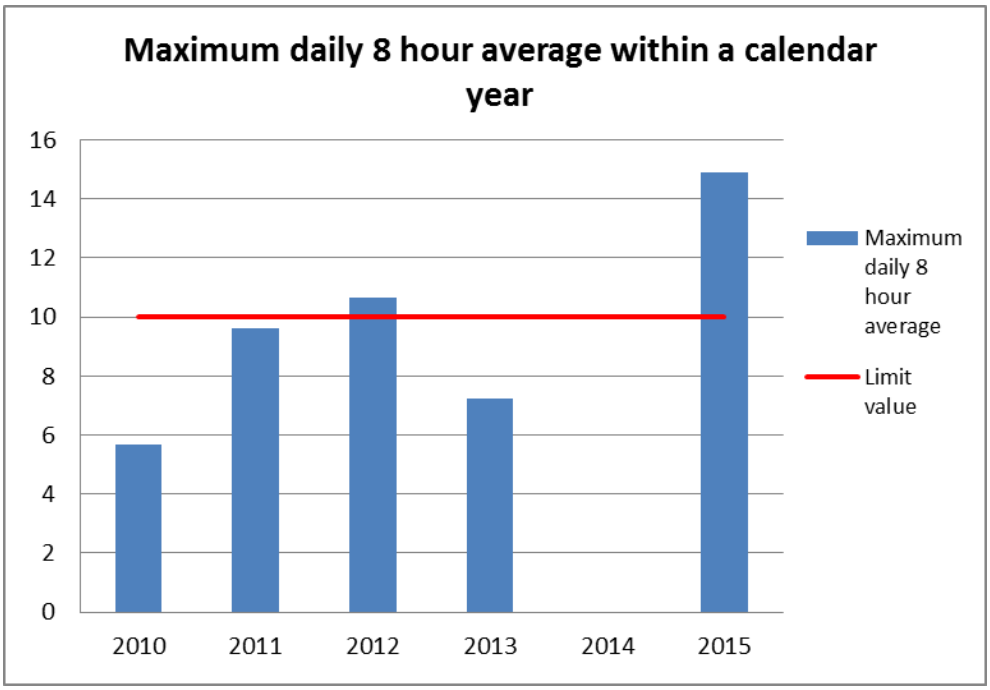

Figure 18. Assessment of the CO limit value (10 mg/m^3).

6.3.8 Other pollutants

Other pollutants such as benzene, PAHs and heavy metals regulated by the air quality legislation there are not regularly measured in Tetovo. In October 2015-February 2016 a campaign for measurement of heavy metals (Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, V and Zn) was carried out in Tetovo. According to the results the concentrations are below the target values specified in the legislation for arsenic, cadmium, nickel and lead concentrations. However, the comparison to target value is only indicative as the measurements should be continued for a full year with even distribution over the year to fulfil the data quality objectives from the legislation. For other heavy metals there are no target values specified in the legislation. The results are presented in table 9.

Table 9. Measured heavy metal concentrations in Tetovo.

Heavy metal concentrations (ng/m^3) in Tetovo												
	Al	**As**	**Cd**	Co	Cr	Cu	Fe	Mn	**Ni**	**Pb**	V	Zn
Average	2014	**3.3**	**1.8**	1.1	13.3	43.2	2679	75.5	**8.8**	**0.04**	10.9	150.4
Target/limit value		**6**	**5**						**20**	**500**		

PAHs concentrations have not been measured in Tetovo. PAHs are connected to the wood combustion practices, which are quite common in Tetovo. For this reason it is possible that

benzo(a)pyrene concentration is higher in areas, where small-scale wood combustion is common. According to the precautionary principle due to the lack of information, PAHs and heavy metals will be considered as potentially critical for the air pollution in Tetovo.

7. HEALTH IMPACTS OF AIR POLLUTANTS

The knowledge on the health effects caused by the exposure to different pollutants in the air is continuously increasing due to the research studies, and rising interest and awareness of the health aspect of pollutants in the air. Even relatively low concentrations of the pollutants can cause health effects especially for the vulnerable groups. Therefore, improved air quality can reduce the exposure to the pollutants in air and the negative health effect caused by pollutants. Table 10 presents the main health effects of different pollutants.

Table 10. Main health effects of different air pollutants.

Pollutant	Health effects
Particulate matter (PM)	Can cause or aggravate cardiovascular and lung diseases, heart attracts and arrhythmias. Can cause cancer. May lead to atherosclerosis, adverse birth outcomes and childhood respiratory diseases. The outcome may be premature death.
Ozone (O_3)	Can decrease lung function. Can aggravate asthma and lung diseases. Can lead to premature mortality.
Nitrogen dioxide (NO_2)	Increased cardiovascular and respiratory mortality and respiratory morbidity.
Sulphur dioxide (SO_2)	Aggravates asthma and can reduce lung function and inflame respiratory tract. Can cause headaches, general discomfort and anxiety.
PAHs, especially benzo(a)pyrene	Carcinogenic
Carbon monoxide (CO)	May lead to heart disease and damage to nervous system. Can cause headache and fatigue.
Arsenic (As)	Carcinogenic. May cause lung cancer.
Cadmium (Cd)	Carcinogenic
Lead (Pb)	Can affect almost every organ and system, especially the nervous and cardiovascular systems. May have adverse cognitive effects in children and lead to increased blood pressure in adults.
Mercury (Hg)	Can affect the liver, kidneys and digestive and respiratory systems. May affect also the central nervous system.
Nickel (Ni)	Carcinogenic
Benzene (C_6H_6)	Carcinogenic

Particulates attribute the most severe health risk from air pollutants. A threshold for particulate concentrations below which no damage to health is observed has not been identified. The effects of PM on health occur at levels of exposure currently being experienced by most urban and rural populations in both developed and developing countries. Both short-term and long-term exposure for the particulates can cause health effects. The health effects of PM are caused after inhaling the particles. Depending on their size, particles can penetrate into lungs and blood streams causing adverse effects in the respiratory, cardiovascular, immune and neural systems. The smaller is the particles the deeper they penetrate into the lungs. Particulates mortality effects are clearly associated by the $PM_{2.5}$ fraction, which typically presents 40–80 % of the PM_{10} concentration in Europe. The mortality in cities with high levels of pollution exceeds that observed in relatively cleaner cities by

15–20%. Even in the EU, average life expectancy is 8.6 months lower due to exposure to the $PM_{2.5}$ produced by human activities (WHO, 2016; EEA, 2013).

8. CONCLUSION OF THE AIR QUALITY SITUATION IN TETOVO

The air quality assessment for NO_2, SO_2, CO, O_3 and PM_{10} was carried out using the limit/target values defined in the legislation for the protection of human health. The assessment is based on the six year data from 2010 to 2015. For $PM_{2.5}$, benzene, heavy metals and PAH the assessment is based on indicative measures and general knowledge of the concentrations of these substances in the country. The results of the air quality analysis are summarized in Table 11.

Table 11. Overall air quality assessment in Tetovo

Pollutant	Air quality criteria		Assessment
NO_2	**Alert threshold**	400 μg/m^3, 3 consecutive hours	
	Hourly limit value	200 μg/m^3, not to be exceeded more than 18 times per year	
	Annual limit value	40 μg/m^3	
SO_2	**Alert threshold**	500 μg/m^3, 3 consecutive hours	
	Hourly limit value	350 μg/m^3, not to be exceeded more than 24 times per year	
	Daily limit value	125 μg/m^3, not to be exceeded more than 3 times per year	
CO	**Limit value**	10 mg/m^3, maximum daily 8th hours mean	
O_3	**Information threshold**	180 μg/m^3, 3 consecutive hours	
	Alert threshold	240 μg/m^3, 3 consecutive hours	
	Target value	120 μg/m^3 maximum daily 8th hour mean not to be exceeded more than 25 days per calendar year (averaged over three years)	
	Long term objective	120 μg/m^3 maximum daily 8th hour mean	
PM_{10}	**Daily limit value**	50 μg/m^3, not to be exceeded more than 35 times per year	
	Annual limit value	40 μg/m^3	
$PM_{2.5}$	**Annual limit value**	25 μg/m^3	
Benzene	**Annual limit value**	5 μg/m^3	
PAH	**Annual target value**	B(a)P - 1 ng/m^3	
Lead	**Annual limit value**	0.5 μg/m^3	
Heavy metals	**Annual target value**	As - 6 ng/m^3; Cd - 5 ng/m^3; Ni - 20 ng/m^3	

	Limit/objective not exceeded
	Limit/objective exceeded
	Uncertain situation
	Data not available/not measured

Assessment of the critical pollutants in Tetovo includes number of uncertainties, which are linked to uncertainties in emission inventories and air quality measurement data. In air quality measurement data there are lacks in data representativeness: there is no data available for certain periods of time

due to malfunctioning of equipment or poor data quality. For some important pollutants there is very little or no data. This concerns especially $PM_{2.5}$, benzene, PAH and heavy metals.

It can be observed that the most critical pollutant in Tetovo is the suspended particulate PM_{10} with concentrations exceeding both the daily and annual limit values very significantly. Due to the origin and the characteristics of this pollutant a medium or long term strategy with structural measures is required in order to reduce its concentrations in the atmosphere. Since the secondary PM_{10} has great significance in total PM_{10}, the measures must include actions to reduce emission of the precursors of secondary PM_{10}, i.e. NOx, SO_2, VOC and NH_3 emissions.

There is no data available concerning the $PM_{2.5}$ concentrations. Nevertheless due to the likely significant contribution of the $PM_{2.5}$ fraction to the total PM_{10}, an integrated policy is needed in order to reduce both the PM_{10} and $PM_{2.5}$ emissions. Also the primary measurement data from Skopje suggests that the annual limit value for $PM_{2.5}$ is likely to exceed also in Tetovo. $PM_{2.5}$ is an important pollutant from the health perspective, since the most significant health effects caused by air pollution are connected to $PM_{2.5}$.

The target value of ozone was exceeded in Tetovo in 2013 and there is even a possibility that the information threshold of ozone exceeds at certain periods. High concentrations of ozone have adverse health effects and they also cause damage to vegetation and crops. According to this situation a medium-long term strategy is needed in order to reduce the overall concentrations of this pollutant. Since ozone is a secondary pollutant in the atmosphere, the measures to decrease ozone concentrations must concern the precursors, i.e. NO_x and VOC emissions.

For CO there was monitored exceedance of the 8 hour limit value in 2012 and 2015. The exceedance was very slight in 2012 and but more significant in 2015 when the station had been moved to traffic location. In this plan it has been estimated that the CO levels are not very critical, but measures should be nevertheless taken to reduce the concentrations.

Moreover it can be observed that there is no data available of benzene and PAH levels in Tetovo. The lack of data also concerns heavy metals arsenic, nickel and cadmium for which there is only very limited information available. For this reason a conservative approach is adopted, considering these pollutants as potentially critical. However it is assumed that the measures that are planned to decrease the PM_{10} and $PM_{2.5}$ concentrations are enough also to decrease the concentrations of these pollutants.

No exceedance of limit values are recorded for nitrogen dioxide and sulphur dioxide during the previous six years. Therefore these pollutants are not classified critical in Tetovo. But as mentioned above that the NO_x and SO_2 are precursors for either secondary PM_{10} and/or O_3, they are this way included in the program. This is the reason why also the reduction of NH_3 emissions are included in the plan, although otherwise they are not dealt in the plan.

The most typical feature for the air quality in Tetovo is that the PM_{10} concentrations can get very high during the heating season from October to April. This is most probably connected to the increased emissions during that period but also due to the adverse weather conditions and prevailing topography of the region. In the winter time the pollutants emitted into the atmosphere stay in the valley and do not disperse into surrounding countryside.

The $PM_{2.5}$, PM_{10} and O_3 concentrations are affected also to some extent by the long-range transport of the pollutants. The share of the long-range transport for the prevailing concentrations has not been able to be assessed in this report. Especially in the case of PM the back-ground concentrations can be significantly high and long-range transport may also have effect on the local level. According

the emission calculations done as a part of the activities of the project 'Strengthening capacities for implementation of environmental legislation at local level' (Technical Report No. 6, Review of Air Quality in Tetovo) following sectors can be assumed as critical in Tetovo for air quality:

- PM_{10} emissions from in domestic households;
- PM_{10} emissions from industry (including Jugohrom Alzar DOOEL Jegunovce);
- NO_x and CO emissions from traffic.

Concerning the photochemically formed secondary PM_{10} and $PM_{2.5}$, the NO_x, SO_2, VOC and NH_3 emissions have a key role in the particulate formation. For this reason also those emissions have to be taken into account, when considering the measures to the decrease the PM_{10} and $PM_{2.5}$ concentrations.

Overall conclusion of the air pollution situation in Tetovo

- The most characteristic feature for the air quality in Tetovo are the very high concentrations of PM_{10} and the very significant variation of the concentrations between winter and summer seasons. Emission calculations show that major part of the primary PM emissions originate from domestic wood burning.
- The impact of PM emissions from Jugohrom Alzar DOOEL Jegunovce ferroalloy plant may be significant, but needs to be assessed more detailed.
- However to reduce the PM_{10}, $PM_{2.5}$ and also the NO_2 concentrations the traffic emissions must be taken into account. Traffic emissions affect the local air quality mostly during the summer time and in the city center, where the traffic is the most frequent.
- To reduce the formation of secondary PM and O_3, also emissions of NO_x, SO_2, VOC and NH_3 need to be reduced in all main emission sectors.
- The prevailing pollutant concentrations are not strictly and solely related to the amounts of emissions. Local meteorological and topographic conditions have a strong influence on local air quality and on its variation between winter and summer seasons. The emissions height and location of the emissions source have an effect on how concentrations differ geographically and in time.

9. POLICIES AND MEASURES TO IMPROVE AIR QUALITY IN TETOVO

9.1 Objectives of the plan

The overall objective of this plan is to improve the air quality Tetovo so that human health and the environment are protected according to the air quality legislation.

The main objective of the plan is to reduce the very high PM_{10} concentrations, but also CO and NO_2 concentrations. In Tetovo also O_3 concentration are high, but due to the secondary nature of this pollutant, the local measures are not so efficient to reduce the O_3 concentrations.

9.2 Measures to improve air quality

9.2.1 General

The measures to improve local air quality in Tetovo that are presented here are based on the emission inventories and air quality data assessment. Because it has not been possible to assess

the effects of the different emission sectors on local air quality in detail, the measures cover all the major emission sectors. However it is assumed that the severe situation of the air pollution related to the particulate matter in Tetovo is significantly related to domestic heating. Therefore the plan includes several measures for the reduction of emissions from wood burning. This reduction could be achieved with measures related to renewal of the old stoves used for heating and restrictions for wood burning. Also information measures aiming for better maintenance and use of the wood combustion units are of importance together with energy saving actions.

Because of the importance of the secondary PM_{10} and $PM_{2.5}$ the measures for PM concentration reduction also include actions to reduce emission of the precursors of secondary PM_{10}, i.e. NO_x, SO_2, VOC and NH_3 emissions. Since ozone is also a secondary pollutant in the atmosphere, the measures to decrease secondary PM formation also affect ozone concentrations.

In addition to the domestic heating an important emission sector is traffic, which contributes primarily to NO_x concentrations and to lesser extent to PM_{10} and $PM_{2.5}$ concentrations and therefore is addressed by number of emission reduction measures for road traffic.

Industry can have a local effect for PM_{10} concentrations and contribute to the part of the NO_x, SO_2 and VOC emissions. In Tetovo the main industrial emission source is Jugohrom Alzar DOOEL Jegunovce, which is situated actually outside the city of Tetovo. For the industrial sector, efforts have been made to implement the requirements of the Law on environment and bylaws for IPPC. Application of the IPPC regulations together with best available techniques (BAT) and proper regular maintenance of the installations should be effective in the long-run to reduce the emissions. Transposition of the new Industrial Emission Directive and new emission limit values for medium and small energy production plants will decrease the emissions in the long-run from the present level. For the emissions from industry (A and B permits) the national air quality legislation and environmental permits are the most efficient way to decrease the air quality impacts. For those reasons industry is not so widely covered in the measures of this plan. The plan also covers measures related to waste management, which directly and indirectly have influence on local air quality.

Most of the measures are presented in a general level and need more detailed planning, when starting the implementation. In addition, the costs, responsible authorities and time-frame for implementation of the different measures must be defined in more detail when the measures are designed in detail. The implementation of most of the measures to decrease the emissions and concentrations of the critical pollutants are expected to take a long period of time. The detailed air quality impacts, i.e. decrease in concentrations, of the listed measures were not possible to be assessed with the presently available information. This would have required development of real emission scenarios for each sector including model calculations based on the scenarios. The expected air quality impacts of the implemented measures should however be assessed whenever possible.

9.2.2 Description of the measures

Based on the emission inventory and air quality assessment it can concluded that the two main emission sectors affecting the high PM concentrations in Tetovo are domestic heating and industry. Therefore the main measures for local emission reduction should focus on those sectors. Especially domestic heating with wood, which influences air quality during the heating season from October to April, is important. The PM emissions from industry in Tetovo region are entirely dominated by Jugohrom Alzar DOOEL Jegunovce (around 96 % of the total PM emissions). Other target sectors in the plan are:

- Traffic;
- Waste management;
- Energy production and use.

In addition to the measures that are strictly related to the emission sectors mentioned above in the plan there are also measures that are related to:

- Information to the public;
- Administrative policies.

In general it would be favourable and cost-effective if the measures for local air quality improvement are as much as possible related to other policies which the local administration is promoting. Especially energy, climate, traffic and public transport policies are the ones that have a close relation to air quality and emission to air. In addition urban planning has a major role in the long run and give possibilities to decrease the emissions. The need for air quality improvement, especially for reduction of PM_{10} and $PM_{2.5}$ concentrations, is significant to protect the human health. The PM_{10} concentrations in Tetovo are the highest in Macedonian and European cities. However, it is clear that it is not possible to improve the situation very quickly, in the next few years, without making systematic changes in the key polluting sectors. The measures needed must be drastic and systematic, before the concentrations are decreased below the limit values In addition some of them may be expensive.

For the high O_3 concentrations it is not possible to decrease the concentrations just by local or even by national measures, due to the nature of the O_3 origin. It depends very much on the regional and international measures, how the O_3 concentrations will change in the future. The probability that target values of O_3 will be exceeded in the near future, even if the local emissions will decrease widely, is very high.

Many of the measures will affect emissions and concentrations of several pollutants at the same time, which is favourable also from the economic point of view.

The possible measures to improve air quality in Tetovo by local level activities are listed in the Annex 1. The measures are summarized as follows:

<u>Measures for domestic heating</u>

1. Domestic heating at the moment has a significant influence on air quality at the local level in Tetovo. Especially burning of wood and waste materials cause large part of the PM emissions. In the long-term substituting the use of wood with district heating, gas or other heating forms would have a strong impact on the PM emissions. In the short-term it would be possible to decrease PM emissions from domestic heating by performing chimney sweeping activities and increasing checking of solid fuel heating systems. Increasing energy efficiency in general in all sectors and especially in public buildings and private houses is necessary. This can include changes in lightning, thermal insulation and heating systems as well as regulations related to energy efficiency. Increasing energy efficiency is vital for existing buildings (renovation) and when constructing new buildings.
2. Changes in heating of the houses may play a major role in decreasing the emissions. Introducing a district heating network in Tetovo would decrease the emissions from heating and make heating more energy efficient. Also establishing a gas supply network for households and commercial sector may have the same effect. Adoption and promotion of new energy forms like solar, geothermal and wind power are favourable in the medium and long-term. Increasing the use of renewable biofuels in heating is acceptable only in bigger

heating units with advanced emission control. Improved fuel quality standards decrease emissions, but are mainly applicable at the national level.

Measures for traffic

3. Road traffic emissions have local effect especially in the central parts of Tetovo. There are numerous different possibilities to decrease the traffic emissions, but many of them may require major investments to traffic network or infrastructure (re-routing traffic, new connections) and are effective only in the medium and long-term. There are also measures that can be adopted fairly quickly, but their effect on traffic emissions may not be very significant, like lowering the speed limits. Creation of low emission zones (LEZ) or zones, where heavy duty vehicles are forbidden have been successful in many European cities. Reduction of traffic congestion in general in advantageous also for emission reduction. At the local level there are also possibilities to promote the use of vehicles with low or even zero emissions.
4. Freight transport in the city area with old and heavy vehicles may have a significant role in the total emissions caused by traffic. There are possibilities to organize the transport so that emissions are minimized: time-tables for freight delivering, effective signing and providing maps of designated routes to all companies in the city, distribution centres etc.
5. With local parking policy it is possible to some extent also to restrict traffic. Parking policy and parking charges have been used widely in European cities to regulate traffic in the city centres.
6. Introducing environmental friendly public transport in general is a common measure very widely used to decrease traffic volumes in cities. In modern high-quality public transport important aspects are e.g. travelling times, tariff policy, routes, network, exchange connections, information system, and implementation of e-ticket and smart ticketing.
7. Together with promotion of public transport, walking and cycling in the city area are commonly promoted. This means expanding pedestrian and bicycle network, removal of urban barriers, establishing safe bicycle parking systems and establishment of new pedestrian zones where supply of goods will only be conducted by low emission/electric vehicles (traffic calmed routes).

Measures for industry and waste management

8. Emissions from industry are mainly regulated by the national legislation and environmental permits for the enterprises. The supervision of the plants is the responsibility of the national or local environmental administration. At the local level it is possible to promote new emission prevention techniques (BATs) by granting subsidies and by voluntary agreements (e.g. eco-label, ISO 14 001, EMAS, cleaner production concept).
9. Better waste management may decrease emissions to air from landfills and prevent illegal burning of waste materials.

Measures for city and traffic planning

10. In general level city planning including also traffic planning are in the long-term important when preventing air pollution together with other harmful environmental impacts such as noise. Air quality assessment should be part of the city planning processes in the future.

Measures for diffuse emissions

11. To prevent diffusive PM emissions it is possible to adopt better and more intense street cleaning techniques and intensification of street cleaning and to convert the winter maintenance fleet to wet salt technology. Dust control at construction and demolition sites can be regulated by local level requirements.

Measures to increase public awareness

12. Measures that are easy and fast to implement are different kinds of information measures aiming to raise public awareness and to change public behaviour to more environmentally friendly. Informative campaigns could cover issues like energy efficiency, waste burning, cycling, walking, car-free days etc. Better and advanced real time air quality information provision to the public is important. It is also important to improve information concerning the health effects that poor air quality may cause.
13. Local air quality and the reasons behind the poor air quality are important to be widely understood in the local administration. Air quality assessments (e.g. dispersion modelling) should be made in all the major planning processes, which may affect significantly the air quality. Although the air quality monitoring is done by MEPP, it is also possible at the local level to arrange measurement campaigns. However when arranging local measurements, it has to be taken into account that there are enough resources and knowledge at the local level to guarantee that the measurements fulfil all the QA/QC requirements.

9.3 Review of the plan

Periodic check of the implementation of the measures should be done regularly at the local level with the MEPP supervision. The coordination between local and central level administration is recommended in order to check the effectiveness of the measures adopted and to assess the impact of each action undertaken for the air pollution improvement. Moreover, the exchange of information between the local and the central level is fundamental also in order to synchronize the measures at local and at national level.

For this purpose, briefings between MEPP and the local administration are recommended, for instance every year, in order to point out how the activities are affecting the air quality. During these meetings the following information should be shared:

- Overall situation concerning the planned activities reported by the local staff;
- Existence of possible problems, related to the implementation of the measures, due to different reasons (economic, logistic, social, etc.);
- Opinion of the local experts concerning the measures in progress and their effectiveness at the local level;
- Future actions planned;
- Implementation of measures at central level (e.g. emissions reduction, update of the emission inventories, results of modelling studies, analysis of the air quality dataset).

The results of the briefings should be taken into account in order to solve in the short time minor problems related to the measures and to prepare the plan review. According to the characteristics of the present plan, a first review of the document is strongly recommended in a relatively short period of time (after two years). During this period, it should be possible to gain further information concerning the importance of different emission sources in Tetovo. According to this more detailed information an improved assessment process could be made in order to define an updated set of structural measures to be adopted in the medium-long period for the air pollution improvement.

The plan review process could be structured in the following steps:

Update of air quality data and emission information: This activity concerns the chapters 5 and 6 of the present plan, with possible modifications in chapter 8. The role of MEPP in the information update process is fundamental. Concerning the emissions, a comparison between the original situation and the future situation is recommended.

Reconsidering of the possible measures to be implemented: This activity is extremely important and joint work between local and central experts is strongly recommended. In the measures reconsidering process the following aspects should be taken into account:

- Conclusions gained by the first reviewing activity (assessment of the air quality situation, identification of the most critical pollutants, definition of the main emission sources, definition of the main intervention sectors);
- Assessment of the effectiveness of the measures. The experience gained during the 2017-2018 period will be very valuable in order to assess the role of the measures adopted to improve the air quality. The opinion of the local administration in Tetovo will be essential in order to evaluate the real contribution of each measure, its social and economic impact and the related benefits;
- Coordination of the national and local measures. The reviewed local plan should be coordinated with the National programme for emission reduction and National plan for the ambient air quality protection. The local air quality plan should represent a sort of conformation of the national guidelines for the air quality improvement at the local level. The coordination between national and local scale measures is a basic requirement in order to reduce effectively the critical pollutants like PM and ozone.

Review of the key measures to be adopted: this final step should be made taking into account all the conclusions collected in the previous steps. The key measures should be defined (or confirmed if already adopted in the original plan) according to the emission targets, estimated effectiveness, funds needed for the implementation etc. Especially for the local measures the role of the local administration in the definition the measures is essential. Moreover each measure should be described in a dedicated table as made in the present document. The information of the responsible authority, the implementation time, the estimated costs and air quality benefits should be included in the tables.

After the first review of the plan, ordinary check of the activities is strongly recommended every 6 months and the plan should be in force for 5 years before starting a new reviewing process.

10 CONCLUSIONS AND RECOMMENDATIONS

Local air quality improvement plan is a document, which describes the targets for air quality improvement in a region or a city. The targets are the basis for local measures to improve air quality and decrease emissions of the major pollutants. The plan is primarily based on assessment of local air quality and major emission sectors. The plan may be considered as a strategy for the air quality improvement, but to be effective the resources and political support to implement the measures included in the plan should be safeguarded.

This plan for improvement of air quality in Tetovo is based on the available data of the air quality situation in the region. As described in the plan the assessment of local air quality and emissions include uncertainties, which have to be taken into account when implementing the plan and the measures. It also should be noted that the national programs and targets for air quality improvement will have an effect on local air quality and support the measures described here.

However despite of these uncertainties this air quality improvement plan should be discussed and adopted at the local level in Tetovo and decisions should be undertaken in order to define how to start implementing the measures included in the plan. As soon as the knowledge of the air quality situation and emissions and effectiveness of the different measures increase, the local administration should be prepared to evaluate the program and to specify the targets and measures. It is also important to start to clarify funding of the measures and other possibilities to implement the measures.

Since most of the measures will need resources, time and more detailed planning, it would be important to start the implementing some of the measures as soon as practically possible. Implementation of the long-term measures can start after they have been planned detailed enough and when their implementation is guaranteed also in other ways (e.g. necessary funding is decided).

ANNEX 1 **DESCRIPTION OF AIR QUALITY IMPROVEMENT MEASURES**

MEASURE NO	**1**
MEASURE NAME	**Substitution of old solid fuel heating systems with modern pellet heating units by financial incentives**
Target sector	Domestic heating
Description of the measure	Providing financial incentives to replace old wood fuel heating systems with pellet ones with better energy efficiency and lower emissions.
Objective of the measure	Objective is to decrease emissions, especially PM emissions, from domestic heating
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	Significant if adopted in large scale
Air quality impact	According to the emission factors for PM_{10}, the substitution of a traditional stove with a pellet unit can reduce the PM_{10}-emission approximately 25 kg/unit x year.
Other impacts	Decreases exposure to pollutants also inside dwellings and increases energy efficiency in household heating.
Responsible authority	Tetovo municipality
Timeframe for implementation	Medium - long
Costs	Needs funding, if the measure is promoted by local substitution.
Other requirements (technical, social etc.)	Modern technology for pellet burning is available with reasonable costs. A minimum efficiency requirements for the new heating units should be set. The financial incentives should be allocated after a certification of a proper installation of the heating system.
Connection to other plans	At the national level a subsidizing fund was allocated for the same purposes for the period 2017-2020.
Present status	Not implemented at local level

MEASURE NO	**2**
MEASURE NAME	**Enforce the ban on burning of inappropriate or waste materials in domestic heating units**
Target sector	Domestic heating
Description of the measure	Burning of inappropriate materials in domestic heating units can be banned totally, especially waste burning, because they can produce and release very harmful substances both in the indoor environment and to the atmosphere.
Objective of the measure	Objective is to decrease emissions of PM, PAHs and VOCs and to avoid the formation of other carcinogenic compounds like dioxins and furans.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	Locally noticeable.
Air quality impact	May be significant locally, especially for health effects due to the reduction of dioxins and furans formation.
Other impacts	Decreases exposure to pollutants also inside dwellings.
Responsible authority	Tetovo municipality, municipality's environmental units (inspections). Ministry of Local Self-Government and Ministry of Economy
Timeframe for implementation	Can be started after the change in the national legislation
Costs	No extra costs.
Other requirements (technical, social etc.)	Ban of waste burning and related controls requires change in the national legislation. The domestic waste burning should be clearly banned by legislation. Moreover local environmental inspectors should be allowed to enter in the private households to make inspections. Modern collection and treatment systems for domestic waste must be put in practice, to support the correct management of the domestic wastes.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**3**
MEASURE NAME	**Promotion of use of good quality wood in domestic heating**
Target sector	Domestic heating
Description of the measure	Giving information and guidance to households and citizens of the need to use only good quality wood in stoves and ovens and of the dangers of burning inappropriate or waste materials (especially domestic waste but also wood by-products, painted logs etc.). Wood quality is one important aspect, when decreasing emissions.
Objective of the measure	Objective is to decrease emissions, especially PM emissions, from domestic heating.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	May be significant if also the other good practices in conducting and maintaining the biomass heating systems are adopted at the same time by the population.
Air quality impact	Significant.
Other impacts	Decreases exposure to pollutants also inside dwellings. May increase energy efficiency of the heating units.
Responsible authority	Tetovo municipality
Timeframe for implementation	Can start immediately.
Costs	Information campaigns cause minor costs. Adoption of measure may cause extra costs for households to get better quality wood and to have proper storage.
Other requirements (technical, social etc.)	Information must be widely available in many forms. It would be useful to produce material for the whole country at the same time. Enough good quality wood must be available at the markets. The good practices in conducting and maintaining the biomass heating systems include also the adoption of measures 4 and 5.
Connection to other plans	
Present status	Some national materials by MEPP available already

MEASURE NO	**4**
MEASURE NAME	**Promotion of good practices concerning domestic heating with wood: good firing habits, heating units maintenance and dry wood storing**
Target sector	Domestic heating
Description of the measure	To reduce emissions it is important that combustion circumstances and maintenance of the stoves and heating units in general are as good as possible. Information and guidelines concerning the good practices in conducting and maintaining domestic heating units are fundamental to guarantee that the emissions are as low as possible.
Objective of the measure	Objective is to decrease emissions, especially PM emissions, from domestic heating
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	May be significant if also the other good practices in conducting and maintaining the biomass heating systems are adopted at the same time by the population.
Air quality impact	Significant.
Other impacts	Decreases exposure to pollutants also inside dwellings. May increase energy efficiency of the heating units.
Responsible authority	Tetovo municipality
Timeframe for implementation	Can start immediately.
Costs	Needs some minor funding to produce information material. Costs for households are minimum.
Other requirements (technical, social etc.)	Information must be widely available in many forms. It would be useful to produce material for the whole country at the same time. The good practices in conducting and maintaining the biomass heating systems include also the adoption of measures 3 and 5.
Connection to other plans	
Present status	Some national materials made by MEPP available already

MEASURE NO	**5**
MEASURE NAME	**Recommendation for regular chimney sweeping and inspection of private stoves and ovens**
Target sector	Domestic heating.
Description of the measure	If chimneys of houses are swept regularly and if also at the same time the heating units are inspected generally by chimney sweepers or other personnel, it would partly guarantee that the emissions of those units are as small as possible. People are not aware about the need to sweep the chimneys.
Objective of the measure	Objective is to decrease emissions, especially PM emissions, from domestic heating.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	Together with other measures concerning house hold heating with wood may have significant effect at least locally.
Air quality impact	Significant
Other impacts	Decreases exposure to pollutants also inside dwellings. May increase energy efficiency of the heating units.
Responsible authority	Tetovo municipality, companies providing chimney sweeping services (recommendations) Protection and Rescue Directorate (inspections)
Timeframe for implementation	Information can start immediately.
Costs	Causes some extra costs for households.
Other requirements (technical, social etc.)	There is a need to inform population about the importance of chimney sweeping practice. Chimney sweepers must have enough resources for the task. The good practices in conducting and maintaining the biomass heating systems include also the adoption of measures 3 and 4.
Connection to other plans	Strategy for Health and Environment, Local Environmental Action Plan
Present status	Requirements are in the national legislation (Rulebook on regular cleaning and maintenance of smoke ducts 146/10), but they are not put into practice very efficiently.

MEASURE NO	**6**
MEASURE NAME	**Study to assess out the possibilities to introduce district (central) heating in Tetovo**
Target sector	Domestic heating
Description of the measure	To make a study find out the possibilities to replace small ovens and boilers that now are used for heating of the buildings to central heating.
Objective of the measure	Objective is to decrease emissions in housing areas, especially PM emissions, from domestic heating
Target pollutant	Especially PM_{10}, $PM_{2,5}$, NO_x and SO_2, but also VOCs and PAHs are affected
Change in concentration	In the long-run may be effective to decrease emissions.
Air quality impact	In the long-run may be effective to decrease emissions.
Other impacts	Decreases energy consumption at the communal level, because heating energy is produced more efficiently in power plants.
Responsible authority	Tetovo municipality and district heating companies
Timeframe for implementation	Medium - long
Costs	Needs investments to the heating network, if the network is built. Costs may be high and may need subsidizing.
Other requirements (technical, social etc.)	The costs for households must be reasonable. To be efficient the measure requires that a major part of the individual residential, public, commercial and industrial buildings are connected to the district heating network. The implementation of the measure may need some subsidizing.
Connection to other plans	Sustainable Energy Action Plan, Strategy for Health and Environment
Present status	Not adopted.

MEASURE NO	**7**
MEASURE NAME	**Recommendation to use modern energy sources (solar, geothermal, etc.)**
Target sector	Domestic heating
Description of the measure	As an alternative to connecting to central heating network or substituting old stoves with new ones, it is possible to use modern energy sources to heat the houses and to produce warm water. The utilization of these modern energy sources may also be done in smaller local networks.
Objective of the measure	Objective is to decrease emissions from domestic heating in general.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	May be significant locally in the long run.
Air quality impact	In the long-run may be effective to decrease emissions.
Other impacts	New technologies are usually more energy efficient than the present ones.
Responsible authority	Tetovo municipality. Ministry of Economy (subsidies).
Timeframe for implementation	Medium - Long
Costs	Causes extra costs for households.
Other requirements (technical, social etc.)	The costs for households must be reasonable, subsidizes may be needed. According to the position and the latitude of Tetovo, the use of solar and geothermal energy have the most potential.
Connection to other plans	Sustainable Energy Action Plan, National Programme for gradual reduction of emissions of certain polluting substances, Third national communication on climate change
Present status	No action

MEASURE NO	**8**
MEASURE NAME	**Prevention of street dust by street and sidewalk cleaning**
Target sector	Traffic
Description of the measure	Dust emissions from street and sidewalk surfaces and also from courtyards (resuspension) may be a significant local emission source, although the impacts may be temporary at each site. During driest periods resuspension of dust from streets can be prevented by more intense and regular cleaning.
Objective of the measure	Aim is to reduce local PM_{10} concentrations in the city area.
Target pollutant	PM_{10}.
Change in concentration	Locally and during dry periods effects may be even large, regionally small
Air quality impact	Locally and during dry periods effect may be even large, regionally small
Other impacts	May improve the general cityscape.
Responsible authority	Tetovo municipality
Timeframe for implementation	The plan for the street cleaning may be prepared immediately. Investment to cleaning technology requires more time.
Costs	Investment costs high, otherwise moderate, mainly for maintenance of cleaning equipment and work.
Other requirements (technical, social etc.)	Enough effective equipment must be available, may need some supervision by the local authorities. A very simple document could be prepared to show the frequency of cleaning and classify the streets, how often they are cleaned and washed and which streets belong to the cleaning program. Cleaning may vary between seasons street types to optimize the cost and the efficiency of the measure.
Connection to other plans	
Present status	

MEASURE NO	**9**
MEASURE NAME	**A study of creation of a low emissions zone(s) (LEZ) in the city center**
Target sector	Traffic
Description of the measure	Low emission zones in the central city area of Tetovo could decrease emissions from traffic, mainly private cars. The aim of the measure is to decrease traffic volumes in the city. Restrictions in LEZ could concern all vehicles or certain types of vehicles (e.g. heavy vehicles) or vehicles of certain age or /EURO classes.
Objective of the measure	By decreasing traffic in the city area also the emissions to air decrease.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Medium if the measure decreases traffic significantly. Main effects in the city center.
Air quality impact	Medium if the measure decreases traffic significantly. Main effects in the city center
Other impacts	The measure decreases traffic noise at the same time and improves traffic safety. May change pollution to new areas.
Responsible authority	Tetovo municipality, Ministry of Interior and Ministry of Environment and Physical Planning
Timeframe for implementation	Medium - long
Costs	Costs may be medium or high depending on the changes that need be done in the street network.
Other requirements (technical, social etc.)	A study is required to assess the possibilities to create LEZ in Tetovo and show what kind of alternative solutions are possible and how they affect traffic circumstances and also environmental impacts of traffic. The study should also define the criteria for LEZ (euro class definition, type of vehicles allowed in each zone etc.). Needs re-routing of traffic and changes in public and freight transport. Measures concerning traffic require careful planning and also funding needs to be guaranteed.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**10**
MEASURE NAME	**Reduction of traffic congestion: traffic lights synchronization and substitution of traffic lights with roundabouts**
Target sector	Traffic
Description of the measure	Smooth traffic flows cause less emissions than traffic flows that are very varying. By traffic lights synchronization and roundabouts etc. it is possible to create a traffic environment, which causes less problems.
Objective of the measure	Objective is to decrease emissions from traffic in general
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	May have positive effects in city level
Air quality impact	Impact not so large.
Other impacts	More fluent traffic flows and save of travel time
Responsible authority	Tetovo municipality
Timeframe for implementation	Implementation can start immediately
Costs	Medium costs for changes in the street network.
Other requirements (technical, social etc.)	At the same time parking of private cars has to be organized, so that they don't block traffic.
Connection to other plans	
Present status	

MEASURE NO	**11**
MEASURE NAME	**Re-routing traffic**
Target sector	Traffic
Description of the measure	Re-routing traffic from e.g. living areas to other parts of the city outside living areas is applicable in situations, if air pollution is very high and there are good possibilities to build new traffic connections without causing severe problems to new areas.
Objective of the measure	Objective is to improve air quality in very polluted areas by shifting the traffic to new streets outside living areas.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Locally can be very high, but only changes the pollutants to new areas.
Air quality impact	Locally can be very high, but negligible at city level.
Other impacts	Changes the pollution to new areas.
Responsible authority	Tetovo municipality
Timeframe for implementation	Long
Costs	High
Other requirements (technical, social etc.)	Requires new infrastructure, which must be located so that no new problems will arise. Re-routing of traffic should be planned together with measures concerning smart mobility (public transport etc.).
Connection to other plans	
Present status	Not known

MEASURE NO	**12**
MEASURE NAME	**Support for use of zero or low emission vehicles**
Target sector	Traffic
Description of the measure	At local level it is possible to promote the use of modern vehicles with zero or low levels of emissions (hybrid cars, electric vehicles etc.). This can be done e.g. by giving preference to this kind of vehicles in parking policy and fees, possibility to use bus lanes, etc. The zero and low emission vehicles can also be used by the city organization as an example for others.
Objective of the measure	Objective is to decrease traffic emissions in general,
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low at the start, but may be significant in the long-term.
Air quality impact	Low at the start, but may be significant in the long-term.
Other impacts	
Responsible authority	Tetovo municipality
Timeframe for implementation	Changes in parking policy can be implemented immediately.
Costs	Extra costs low compared to conventional vehicles. New infrastructure needs funding.
Other requirements (technical, social etc.)	Requires financial support or e.g. benefits in parking charges. Hybrid and electric vehicles require new infrastructure (charging places etc.).
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment, Third national communication on climate change
Present status	National policy subsidizing electric cars supports the local policies.

MEASURE NO	**13**
MEASURE NAME	**Implementation of policies of Green Public Procurement concerning the vehicles in public administrations**
Target sector	Traffic
Description of the measure	The Tetovo municipality can take into account in procurement environmental aspects of vehicles (like emissions) and promote the use of low emission vehicles. This acts as an example to the public and private sector.
Objective of the measure	Objective is to decrease traffic emissions in general.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low
Air quality impact	Low
Other impacts	Good example to the public.
Responsible authority	Tetovo municipality, public enterprises in the frame of the municipality
Timeframe for implementation	Can be implemented immediately
Costs	Extra costs low compared to convenient vehicles. New infrastructure, like charging places for electric cars, needs funding.
Other requirements (technical, social etc.)	Hybrid and electric vehicles require new infrastructure (charging places etc.).
Connection to other plans	
Present status	

MEASURE NO	**14**
MEASURE NAME	**Promoting flexi-time to council staff and also to other employers**
Target sector	Traffic
Description of the measure	Part-time working at home reduces traffic volumes during working days and flexi-time reduces traffic volumes during the morning and afternoon rush-hours. This may reduce the emission especially during the days and hours, when air quality in traffic environments is poorest.
Objective of the measure	Objective is to reduce emissions in the city area at times, when air quality is poorest.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low at city level, but may locally decrease the highest concentrations.
Air quality impact	Low at city level, but may locally decrease the highest concentrations.
Other impacts	May improve urban mobility and quality of life among the citizens.
Responsible authority	Tetovo municipality, other administrative bodies, private companies
Timeframe for implementation	Can be implemented immediately
Costs	No extra costs
Other requirements (technical, social etc.)	Mainly a voluntary action, but may be promoted effectively.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**15**
MEASURE NAME	**Supporting car-pooling and car sharing**
Target sector	Traffic
Description of the measure	Promoting car-pooling and car sharing voluntarily by information campaigns etc. may reduce traffic volumes in the city area
Objective of the measure	Objective is to reduce traffic emission in general.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low
Air quality impact	Low
Other impacts	
Responsible authority	Tetovo municipality, private companies, companies providing the car-pooling and car-sharing services
Timeframe for implementation	Can be implemented immediately.
Costs	No extra costs. Services can also be provided by private companies.
Other requirements (technical, social etc.)	A voluntary action, which can be promoted by the city and the municipalities.
Connection to other plans	
Present status	

MEASURE NO	**16**
MEASURE NAME	**Develop systems for renting electric scooters and bicycles**
Target sector	Traffic
Description of the measure	Promoting vehicle renting services voluntarily by information campaigns etc. may reduce traffic volumes in the city area
Objective of the measure	Objective is to reduce traffic emission in general.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low
Air quality impact	Low
Other impacts	
Responsible authority	Tetovo municipality, private companies
Timeframe for implementation	Can be implemented immediately.
Costs	May cause some extra costs. Services can also be provided by private companies.
Other requirements (technical, social etc.)	
Connection to other plans	
Present status	

MEASURE NO	**17**
MEASURE NAME	**A study to assess the possibilities to introduce public (bus) transport in Tetovo**
Target sector	Traffic
Description of the measure	Bus transport services gives a better alternative for the use private cars in the city area. Modern technology gives numerous possibilities for so-called high-quality public transport with good quality of service. The introduction of a unique ticket to be used for all public transports should be promoted. The creation of real-time e-bus showing real-time time-tables and waiting times increases the quality of the service. Smart phone applications can be created for the system.
Objective of the measure	Objective is to reduce traffic emission in general and to promote the use of public transport and make it more user-friendly.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	In the long-run may be effective, if public transport becomes a real alternative for the use of private cars.
Air quality impact	In the long-run may be effective, if public transport becomes a real alternative for the use of private cars.
Other impacts	Good quality public transport may have a positive effect on the general atmosphere of the city and citizens.
Responsible authority	Tetovo municipality, bus companies
Timeframe for implementation	Short - Medium
Costs	Costs may be significant depending on the investments and technology that is chosen.
Other requirements (technical, social etc.)	
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment,
Present status	Not implemented

MEASURE NO	**18**
MEASURE NAME	**Progressive renewal of the taxi fleet e.g. by license release policy**
Target sector	Traffic
Description of the measure	Renewal of the present taxi fleet can be done e.g. with license release policy so that the requirement for a license renewal is that the taxi in use meets certain emission limits.
Objective of the measure	Objective is to decrease emission from taxis.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	May be low at the start.
Air quality impact	May be low at the start
Other impacts	Causes extra costs for the taxi companies.
Responsible authority	Tetovo municipality
Timeframe for implementation	Medium - long
Costs	May be significant for the taxi companies
Other requirements (technical, social etc.)	Requires investments to the taxi fleet. May need some financial support from the municipality.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**19**
MEASURE NAME	**Parking policy and charges in the city center**
Target sector	Traffic
Description of the measure	With determined parking policy and with higher parking charges it is possible to decrease traffic coming into the city center.
Objective of the measure	Objective is to reduce traffic emissions in the city center.
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	May be noticeable in certain areas.
Air quality impact	May be noticeable in certain areas.
Other impacts	Increases incomes for the city
Responsible authority	Tetovo municipality
Timeframe for implementation	Can be implemented quite quickly
Costs	Mainly low, but new parking meters etc. cause some extra costs
Other requirements (technical, social etc.)	May not be socially acceptable among the citizens, especially before the implementation of improved public transportation. The funds collected by parking fees should be used to promote the traffic measures.
Connection to other plans	
Present status	

MEASURE NO	**20**
MEASURE NAME	**Developing bicycle network and removal of urban barriers and establishing safe bicycle parking places**
Target sector	Traffic
Description of the measure	By developing a good cycling network and infrastructure it is possible that cycling becomes a better alternative to the use of private cars.
Objective of the measure	Objective is to reduce traffic and traffic emissions especially in the central parts of the city
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low at the start
Air quality impact	Low at the start
Other impacts	Public health benefits to the population
Responsible authority	Tetovo municipality
Timeframe for implementation	Can be implemented in a few years
Costs	Depend very much on how widely and effectively the measure is put into force.
Other requirements (technical, social etc.)	Requires investments to the infrastructures
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment, Third national communication on climate change
Present status	

MEASURE NO	**21**
MEASURE NAME	**Establishment of pedestrian zones and networks**
Target sector	Traffic
Description of the measure	By developing pedestrian zones and network and infrastructure it is possible that walking becomes easier and more attractive especially in the central parts of the city.
Objective of the measure	Objective is to decrease traffic emissions in general
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Low at city level
Air quality impact	Low at city level
Other impacts	Public health benefits to the population
Responsible authority	Tetovo municipality
Timeframe for implementation	Can be implemented in a few years
Costs	Depend very much on the fact, how widely and effectively the measure is put into force
Other requirements (technical, social etc.)	Requires investments to the infrastructure
Connection to other plans	
Present status	

MEASURE NO	**22**
MEASURE NAME	**Grants to employers and local authorities, if they encourage staff and clients to cycle or walk.**
Target sector	Traffic
Description of the measure	Local administrative bodies and private employers can encourage their workers to come to work by cycle or by walking. This can be promoted e.g. by campaigns or competitions.
Objective of the measure	Objective is to decrease traffic emissions in general,
Target pollutant	Primary pollutants are NO_2, CO, PM_{10} and $PM_{2.5}$.
Change in concentration	Effect minor at the city level
Air quality impact	Effect minor at the city level
Other impacts	Positive health effects for personnel
Responsible authority	Tetovo municipality, other administrative bodies, private companies
Timeframe for implementation	Implementation can take place immediately
Costs	No extra costs
Other requirements (technical, social etc.)	Workers must be motivated.
Connection to other plans	
Present status	Not implemented.

MEASURE NO	**23**
MEASURE NAME	**Car-free days**
Target sector	Traffic
Description of the measure	Organizing car-free days supports citizen's consciousness of the environmental issues like air pollution. Car-free days are a European wide initiative aimed to stop the motor vehicles for a day (usually on Sunday) and to promote sustainable city traffic in general. During these days administrations can organizes further initiatives to raise the awareness of people toward environmental issues.
Objective of the measure	Objective is to raise awareness among the citizens so that they have a better understanding how and how much traffic influences the local air quality.
Target pollutant	All.
Change in concentration	May be locally significant during the day of stop.
Air quality impact	Low
Other impacts	Citizen's general awareness of environmental issues rises.
Responsible authority	Tetovo municipality
Timeframe for implementation	Implementation can the place immediately.
Costs	Low
Other requirements (technical, social etc.)	Requires information and campaigns for support. Social acceptance may be higher if the car free days are promoted during the week-end (no work related commitments). Needs enhanced public transport during the event. Environmental and social NGOs can be involved in the measure arrangement.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**24**
MEASURE NAME	**Continuous supervision of A and B permits installations and their emissions and measures proposed for air protection by installations**
Target sector	Industry
Description of the measure	Usually the most efficient way to reduce emissions from industry and energy production is to apply stricter emission limits. Authorities in the permit processes must apply new and modern emission limits, which are based on the most recent guidelines or limit values. Regular supervision of the permits and companies is important to quarantine, that the regulations are obeyed.
Objective of the measure	Aim is to reduce the emissions to a level, which is in accordance with the present legislation and guidelines, and take into account that the emissions do not cause harmful effects at the local level.
Target pollutant	All, but especially PM_{10}, NO_x, SO_2 and VOC.
Change in concentration	Varies from installation to installation. May be noticeable locally, but at city level small.
Air quality impact	Varies from installation to installation. May be noticeable locally, but at city level small
Other impacts	Provides reliable emission data for air quality planning
Responsible authority	Local environmental administration responsible for supervision, State Environmental Inspectorate and Ministry of Environment and Physical Planning
Timeframe for implementation	Continuous
Costs	Direct costs are minimal. Indirect costs for industry may be significant. To this end a progressive improvement plan should be agreed between local administration and companies in order to improve progressively the emission control in the plants, diluting the costs over a longer period.
Other requirements (technical, social etc.)	A permit installations are at the responsibility of the state inspectors. Implementation of the new limit values for emissions considering time-table must be realistic, but also short enough. Supervising personnel need to have the required knowledge.
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment
Present status	In progress

MEASURE NO	**25**
MEASURE NAME	**Promotion of voluntary tools for environmental improvement (eco-label, ISO 14 001, EMAS, cleaner production concept, ESCO etc.)**
Target sector	Industry
Description of the measure	Voluntary environmental improvement e.g. with environmental management systems give the companies a possibility to improve their technology, energy efficiency etc. in a way that is most suitable for them.
Objective of the measure	Objective is to decrease emissions in general
Target pollutant	Primary pollutants vary from company to company
Change in concentration	May have local importance. Low at city level.
Air quality impact	May have local importance. Low at city level
Other impacts	May also save money for the companies, if e.g. energy or material efficiency is improved.
Responsible authority	Tetovo municipality, municipal environmental unit, Ministry of Environment and Physical Planning
Timeframe for implementation	Implementation can take place immediately
Costs	Extra costs are minimum
Other requirements (technical, social etc.)	A voluntary and information measure
Connection to other plans	National plan for the ambient air quality protection
Present status	

MEASURE NO	**26**
MEASURE NAME	**Air quality assessment of Jugohrom Alzar DOOEL Jegunovce ferro-alloy plant**
Target sector	Industry
Description of the measure	Emission, especially PM emissions, from Jugohrom Alzar DOOEL Jegunovce ferro-alloy plant are significant and they may have a significant effect on air quality in Tetovo. The air quality impacts of the plant should be assessed by making dispersion model calculations and extra measurements in the area.
Objective of the measure	Objective is to increase the knowledge concerning the importance of the plant's emission on local air quality.
Target pollutant	Primary PM_{10} and $PM_{2,5}$
Change in concentration	Indirectly may be significant in the long-run
Air quality impact	Indirectly may be significant in the long-run
Other impacts	Helps in assessing the need for enhanced air quality monitoring. .
Responsible authority	Ministry of Environment and Physical Planning, national environmental administration (inspection), Tetovo municipality, municipal environmental unit
Timeframe for implementation	Implementation can take place in 1-2 years
Costs	Causes some extra costs mainly for the company
Other requirements (technical, social etc.)	
Connection to other plans	
Present status	Not implemented

MEASURE NO	**27**
MEASURE NAME	**Regular dust control at construction and demolition sites: water spraying and regular washing of truck wheels before they leave the construction or demolition site**
Target sector	Industry
Description of the measure	Dust emissions from local construction and demolition sites may be a significant local emission source, although the impacts may be temporary at each site.
Objective of the measure	Aim is to reduce local PM_{10} concentrations in the city area.
Target pollutant	PM_{10}
Change in concentration	Locally large, regionally small
Air quality impact	Locally large, regionally small
Other impacts	
Responsible authority	Local environmental unit, Tetovo municipality, construction and demolition companies
Timeframe for implementation	Immediately
Costs	Costs for dust removal are generally low.
Other requirements (technical, social etc.)	Requires decrees and inspection. The measure shall be mandatory by local or national legislation.
Connection to other plans	Strategy for Health and Environment
Present status	

MEASURE NO	**28**
MEASURE NAME	**Study on waste management systems: waste recycling, reuse and recovery as energy source prior to its final disposal; energy recovery from incineration of municipal waste; recovery of biogas from organic fraction of municipal solid waste**
Target sector	Waste management
Description of the measure	A study of the future waste management of the Tetovo municipality or even larger area is needed to define the possible solutions and techniques. Modern waste treatment systems decrease emissions from landfills and also emissions from illegal burning of waste and farming residues. Energy recovery from incineration of municipal waste replaces energy production from other fuels and decreases total emissions. By collecting the biodegradable and non-recyclable waste fractions effectively and treating them in modern waste treatment plants decreases emissions to air.
Objective of the measure	Objective is to decrease all emissions from inadequate and illegal waste disposal and treatment at the city level.
Target pollutant	Primary pollutants are $PM_{10,}$ $PM_{2.5,}$ VOCs, PAH and methane.
Change in concentration	In the long-run may have noticeable effect
Air quality impact	In the long-run may have noticeable effect at city level
Other impacts	Improves quality of waste management in general. Decreases the use of other fuels in energy production and green-house gas emissions Decreases also other effects of landfills (water and ground water pollution) and decreases general untidiness of the environment.
Responsible authority	Tetovo municipality, municipal environmental unit (supervision)
Timeframe for implementation	Implementation can take place gradually, but as a whole may need long time.
Costs	High
Other requirements (technical, social etc.)	Requires investments to the collection and transport and treatment technologies. Increases costs for the households. Requires also proper feasibility study and safeguarded funding with the support of government. Requires up-to-date waste legislation and its supervision. Funding must be guaranteed. May also need public information to support the requirements.
Connection to other plans	National plan for the ambient air quality protection
Present status	Not implemented

MEASURE NO	**29**
MEASURE NAME	**Increase the use of renewable energy sources in energy production in public buildings: solar power, geothermal energy, biofuels etc.**
Target sector	Energy production and use
Description of the measure	Tetovo municipality could increase the use of renewable energy sources in its own municipal buildings.
Objective of the measure	The decease emissions especially from machinery, traffic and heating. In this way public administration may at the local level give an example to private sector of environmentally friendly activities.
Target pollutant	All
Change in concentration	Small at first. If changes in the use of fossil fuels are large, also changes in concentrations of pollutants may be significant later on.
Air quality impact	Small at start, may be greater later on.
Other impacts	Also other environmental benefits may be gained at the same time.
Responsible authority	Tetovo municipality, public administrations
Timeframe for implementation	Medium - long
Costs	May cause some extra costs depending on the scale, how largely renewable energy sources are used.
Other requirements (technical, social etc.)	Renewable energy sources must be available locally with reasonable price.
Connection to other plans	National Emission Reduction Program, National plan for the ambient air quality protection
Present status	

MEASURE NO	**30**
MEASURE NAME	**Increasing energy efficiency and energy management and control in public buildings in general: thermostat sets, energy saving lamps, thermal insulation (wall, roof, windows)**
Target sector	Energy production and use
Description of the measure	Better energy efficiency decreases energy use and thus also emissions into the atmosphere.
Objective of the measure	Objective is to decrease emission in energy use and production
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	May be significant in the long-run
Air quality impact	May be significant in the long-run at the city level
Other impacts	Decreases energy costs in the long-run
Responsible authority	Tetovo municipality
Timeframe for implementation	Implementation can take place immediately step by step
Costs	Investment costs for energy efficient technology varies a lot depending on the actions.
Other requirements (technical, social etc.)	
Connection to other plans	National plan for the ambient air quality protection
Present status	

MEASURE NO	**31**
MEASURE NAME	**Minimum requirements of energy efficiency for new buildings (energy classes)**
Target sector	Energy production and use
Description of the measure	Better energy efficiency of the houses decreases heat consumption and thus energy consumption as well. Better energy efficiency may be gained by improving insulation of the windows, walls and roof of the houses.
Objective of the measure	The objective is to decrease emissions from heat production in general.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	In the long-term may be important.
Air quality impact	In the long-run may be important.
Other impacts	Decreases energy costs in long-term
Responsible authority	Tetovo municipality, (construction licenses), MTS
Timeframe for implementation	Medium
Costs	Investments will cause extra costs for households, but the better energy efficiency may compensate the cost of investments in few years.
Other requirements (technical, social etc.)	The costs for households must be reasonable. Can be promoted by building licenses.
Connection to other plans	National Emission Reduction Program, National Plan for the ambient air quality protection, Third national communication on climate change
Present status	According to law, the new buildings need an energy efficiency passport

MEASURE NO	**32**
MEASURE NAME	**Improvement in public lightning: LED-lamps etc.**
Target sector	Energy production and use
Description of the measure	Less energy using public lightning decreases energy demand and thus emissions into the atmosphere
Objective of the measure	Objective is to decrease all emissions in energy use and production
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also CO, VOCs and PAHs are widely affected.
Change in concentration	Low, since power used in Tetovo is produced outside Tetovo municipality
Air quality impact	Effects at the national level.
Other impacts	Decreases energy costs in the long-run
Responsible authority	Tetovo municipality
Timeframe for implementation	Medium - long
Costs	Extra costs for new technology are medium
Other requirements (technical, social etc.)	
Connection to other plans	
Present status	

MEASURE NO	**33**
MEASURE NAME	**Information campaigns: energy efficiency, waste burning, burning of farming residues and wild fires, low-impact mobility systems (cycling, walking etc.) and health effects of air pollutants**
Target sector	Public information
Description of the measure	Different kinds of campaigns that are related to air quality issues rise citizen's awareness. Raising awareness gradually leads to changes in people's behaviour. General information of air pollutants, their origin, their effects and ways to avoid emissions can be given to citizens and also to private sector. It is also important to inform, where one can find data of local air quality, especially after the national air quality portal is in use. Information can be delivered through media (newspapers, radio, TV), in internet, in schools, etc. There are regulations and guidelines concerning waste burning and burning of farming residues and also concerning wild fires. However these activities are still quite common and occasionally may affect local air quality significantly.
Objective of the measure	Objective is to raise people's awareness and to change their behaviour to be more environmental friendly. Aim is also to decrease diffuse emissions at local level. These emissions are especially connected to background concentrations of PM_{10}.
Target pollutant	All, but primary pollutants are PM_{10} and $PM_{2.5}$, but also VOCs and PAHs are affected
Change in concentration	In general level the impact is small, but locally may be significant at certain periods of time, and especially for acute episodes of pollution.
Air quality impact	Small or medium
Other impacts	Citizen's general awareness of environmental issues rises.
Responsible authority	Tetovo municipality, support from MOEPP, Ministry of Health and Institute of Public Health
Timeframe for implementation	Implementation can start immediately.
Costs	Low, mainly some material costs
Other requirements (technical, social etc.)	Requires carefully planned information and campaigns to be effective. Information shall be regularly planned as mandatory in the schools. It would be useful to produce materials for the whole country.
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment, Third national communication on climate change
Present status	Air quality portal at the national level. Some national materials have been produced.

MEASURE NO	**34**
MEASURE NAME	**Regular upgrading and updating of the local emission cadastres with sufficient scale of data and Improvement of the inventory of air emission**
Target sector	Administrative policies
Description of the measure	Reliable and updated cadastres of pollutants emissions are essential for emission inventories and air quality planning. Cadastres must be kept also at the local levels concerning B permit installations, traffic, domestic heating, construction etc. Emission inventory should be updated each year and also emissions from non-point sources (traffic, domestic heating, SMEs) should be calculated regularly
Objective of the measure	Objective is to provide reliable and accurate emission data for air quality planning. Emission database is the basis for air quality assessment and also for the measures to improve local air quality.
Target pollutant	All
Change in concentration	No direct effect on concentrations
Air quality impact	Indirectly significant
Other impacts	In the future emission inventories are easier and quicker prepare
Responsible authority	Tetovo municipality, municipal environmental unit
Timeframe for implementation	Implementation can take place immediately
Costs	Low
Other requirements (technical, social etc.)	Requires continuous data collection and updating. May require separate data systems.
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment
Present status	Basic data collected once in 2016 in the EU-funded project

MEASURE NO	**35**
MEASURE NAME	**Use of dispersion models for air quality assessment in urban areas (EIA) in especially city and traffic planning**
Target sector	Administrative policies
Description of the measure	Dispersion modelling gives an opportunity to assess what is the air quality impacts of different emissions sectors and emission points and also calculate future scenarios. By using model calculations it is possible to assess air quality at local and regional level and to assess what is influence of certain air quality measures to the local concentrations.
Objective of the measure	Objective is to improve air quality assessment and to help choosing the most effective measures to be implemented for air quality improvement.
Target pollutant	Mainly SO_2, NO_x, CO and PM_{10} and $PM_{2.5}$.
Change in concentration	No direct effect
Air quality impact	Indirectly may be significant
Other impacts	
Responsible authority	Tetovo municipality, municipal environmental unit, consulting companies, Ministry of Environment and Physical Planning
Timeframe for implementation	2-5 years
Costs	Relatively low
Other requirements (technical, social etc.)	Reliable models must be available for local circumstances. Reliable local meteorological data should be available. May need some support from MEPP. Consulting companies that provide the calculations must be skilled.
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment
Present status	No action

MEASURE NO	**36**
MEASURE NAME	**Improved inspections concerning open waste burning, burning of farming residues and wild fires**
Target sector	Administrative policies
Description of the measure	There are regulations and guidelines concerning waste burning and burning of farming residues and also concerning wild fires. However these activities are still quite common and occasionally may affect the local air quality significantly. Local authorities should pay more attention to these activities and take legal actions against performers of these activities.
Objective of the measure	To decrease diffuse emissions at local level. These emissions are especially connected to back-ground concentrations of PM_{10}.
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also VOCs and PAHs are affected.
Change in concentration	In general level the impact is small, but locally may be significant at certain periods of time, and especially for acute episodes of pollution.
Air quality impact	Small or medium
Other impacts	Improves general awareness of citizens in air quality issues.
Responsible authority	Municipal environmental inspectors, state environmental inspectors, Ministry of Agriculture, Forestry and Water Economy
Timeframe for implementation	Immediately
Costs	Needs no extra funding. At the contrary possible fines collected could improve the local level fund for environmental issues.
Other requirements (technical, social etc.)	Requires some time resources at the municipal level. The issue related to this measure concerns mainly the rural area surrounding Tetovo municipality. The efforts should be focused to these areas.
Connection to other plans	
Present status	

MEASURE NO	**37**
MEASURE NAME	**Integration of air quality improvement to other policies**
Target sector	Administrative policies
Description of the measure	Effects on air quality and emissions are included in all other local policies that may affect air quality. These kinds of policies are especially climate policies, local traffic planning, local land use planning and waste management planning
Objective of the measure	To ensure that air quality policies are in accordance with other policies and that common benefits are gained by different policies.
Target pollutant	All
Change in concentration	May be significant in long-term.
Air quality impacts	May be significant in long-term.
Other impacts	Optimizes environmental benefits in general
Responsible authority	Tetovo municipality, Ministry of Transport and Communications, Ministry of Economy, Ministry of Health, Ministry of Interior and all other relevant institutions
Timeframe for implementation	2-5 years
Costs	Small
Other requirements (technical, social etc.)	Requires that the bodies that are responsible for each sector have the basic knowledge of air quality issues. Requires co-operation in the administration. If the policies are not in accordance, with each other, mitigation of negative consequences should be planned.
Connection to other plans	
Present status	Not implemented

MEASURE NO	**38**
MEASURE NAME	**Protection of existing green areas and enlargement of green areas in urban areas**
Target sector	Administrative policies
Description of the measure	Because green areas (vegetation) in some degree absorb air pollutants and prevent dust dispersion, especially if the areas are big enough, the existence of vegetation should be guaranteed in city planning and building of new areas. New parks and green areas can be built to the living areas.
Objective of the measure	Objective is to create environmentally friendly and healthy city in general
Target pollutant	Primary pollutants are PM_{10} and $PM_{2.5}$, but also other pollutants may be affected.
Change in concentration	Low
Air quality impact	Low
Other impacts	Creates more comfortable city landscape. Improves citizen's mental health and well-being
Responsible authority	Tetovo municipality
Timeframe for implementation	Medium - long
Costs	Low
Other requirements (technical, social etc.)	Protection of green areas must be taken into account in town planning and building of new areas.
Connection to other plans	National plan for the ambient air quality protection, Strategy for Health and Environment
Present status	Not implemented