Overview of Nature-based Solutions and Their Potential to Support Improved Air Quality and Healthy Cities in Tajikistan and Dushanbe

Air quality and environmental issues in Dushanbe

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Presentation outline

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- Air Quality Management in Dushanbe and Tajikistan
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Overview of the current situation

- On the quality of life Dushanbe ranked 215th among 223 cities in the world (2016 study by the British company Mercer). The air quality was an important indicator in the cities ranking.
- On air quality indicator, Dushanbe is among 20 worst cities in the Asia-Pacific region.
- The World's Air Pollution Index, which assesses air pollution in 2,000 cities in 134 countries, also assessed the air in Dushanbe as “polluted and dangerous to health”

Overview of the current situation

- 1990-2000s - a decrease in emissions from stationary sources due to the decline in industrial production.
- So, the value of emissions in Dushanbe decreased from 30.7 thousand tons in 1988 to 1.2 thousand tons in 2001.
- Over the last years, the volume of GDP has steadily increased in the capital, but there is no sharp increase in the volume of emissions due to the development of sanitary-hazardous production and the implementation of air-protection measures at the enterprises.

Major sources of air pollution

The main sources of air pollution in Dushanbe can be grouped as follows:

1. Air pollution by vehicles.
2. Air pollution from sand and dust storms.
3. Emissions from stationary sources.
4. Air pollution by household and industrial waste.

Main anthropogenic sources of air pollution

- In the beginning of 2019, the main industrial stationary sources of emission of chemical pollutants into the atmosphere in Dushanbe:
  - CHP-2,
  - Dushanbe Cement Plant,
  - other industrial enterprises of the city,
  - boiler houses,
  - small factory workshops that process and burn various types of waste.

- Many enterprises in the capital use coal as raw material for energy generation.
  - 24 enterprises in the city that produce heat by burning coal fuel.
  - Dushanbe CHP-2 managed by the state energy company “Barki Tojik”, which produced, for example, in 2018, 671.2 Gcal of heat or 82% of total heat production in the republic

Main anthropogenic sources of air pollution (cont.)

- Traffic jams and construction work in the capital caused local excess pollution.
- The vehicles share in air pollution has increased from 68.7% in 2009 to about 80% by 2015, due to decline in the industrial production and increase in the number of passenger cars.
- Due to poor fuel quality and poorly regulated engines, the average fuel consumption in urbanized areas is considered to be high.
- Heating season (from October to March) - coal/wood/low-quality fuel is burned in individual (single-family) houses. The central heating and power plant also operate on coal, which contributes to the deterioration of air quality in the city.

Natural sources of Air pollution

- The highest PM2.5 levels in 2019 were observed during dust storms in summer and fall
- Sand and dust storms - popularly known as the “Afghanis” - increased over the past 30 years
- Increased frequency of dust storms was caused by desertification.
- In the early 1990s, people destroyed 70 percent of the country's forested area - that's 700,000 hectares. Scientists say that along the dust storms path - from Ayvaj to Dushanbe - the forest strips are almost totally destroyed.
- On these days, the average PM2.5 concentration rose to 475 mg/m3 and the maximum value per hour rose to 838 mg/m3. This is 33.5 times higher than the permissible level .

The amount of pollutants emanating from stationary sources

(thousand tons / year)

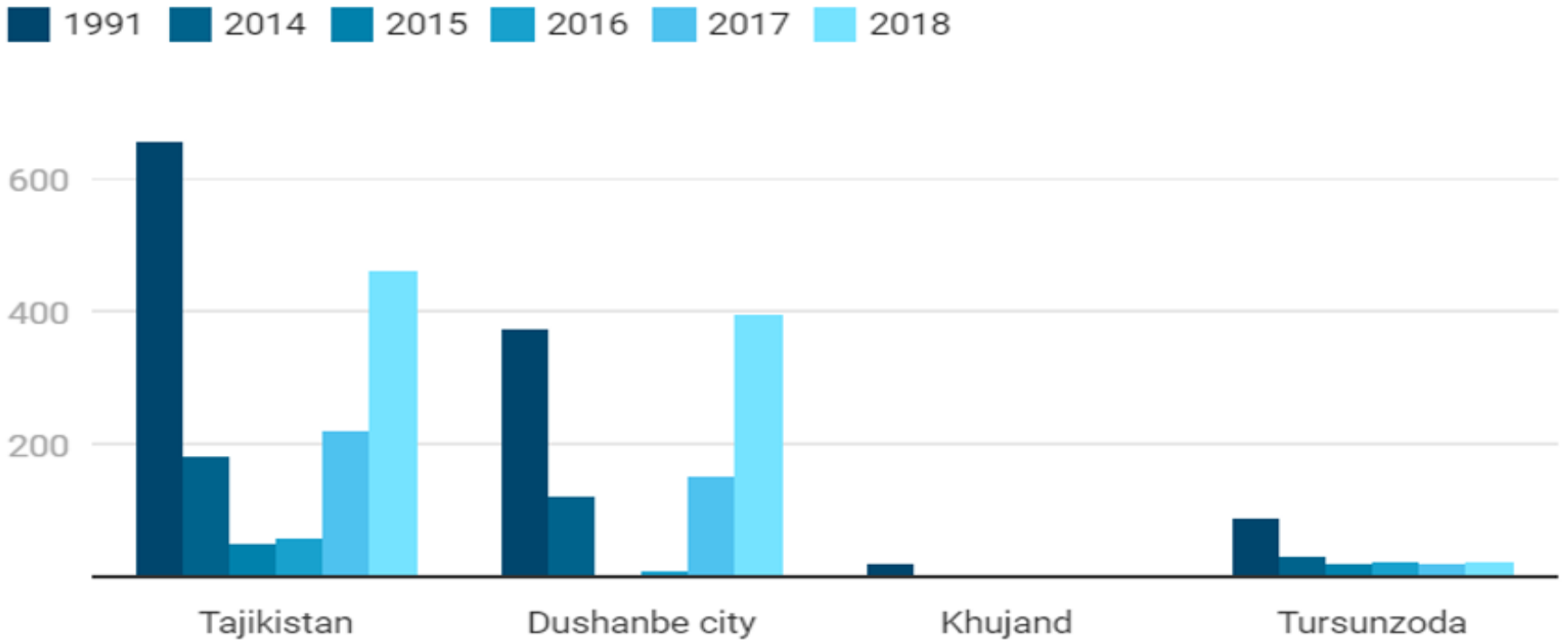
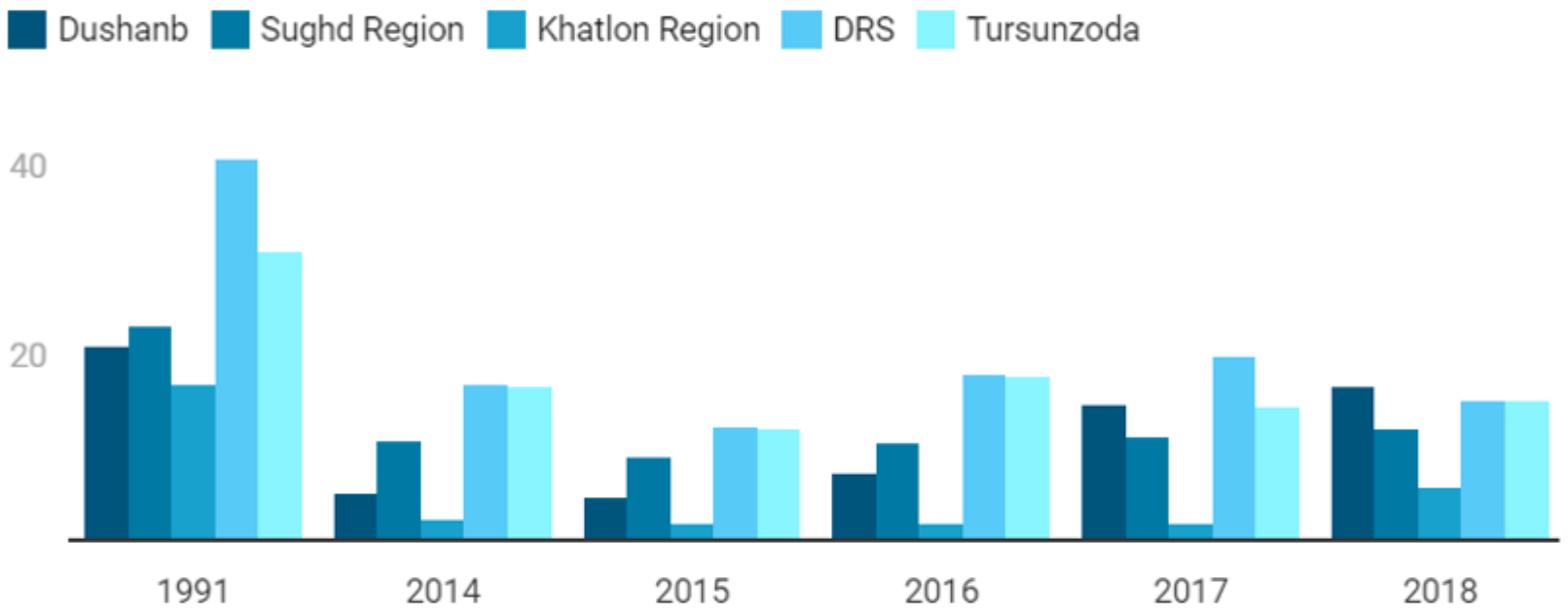


Chart: CABAR.Asia •
Source: Environmental Protection in the Republic of Tajikistan (2019). Agency on Statistics under the Pres of the Republic of Tajikistan
• Get the data • Created with Datawrapper

Emissions of harmful substances to atmosphere air from stationary sources

(thousand tons / year)



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• Get the data • Created with Datawrapper

- Territorial distribution of zones of periodic excessive air pollution in the city is associated with the functioning of large emission sources and groups of enterprises (industrial zones and industrial hubs):
  - cement plant area (with spreading at night in the southern direction along the Dushanbinka river valley);
  - area of Dushanbe CHP;
  - area of reinforced concrete enterprise;
  - area of city landfill;
  - local - asphalt and concrete plant, brick plant, sewage treatment plants, poultry farm (plus permanent pollution along highways with heavy vehicular traffic).

- Pollution in Dushanbe is noticeable with the onset of the heating season. But the most dangerous days in 2019 were in the summer and fall - average PM2.5 concentration rose to 475 mg/m3, and the maximum value per hour rose to 838 mg/m3. This is 33.5 times the permissible concentration.

- In spite of this, none of the cities in Tajikistan made the world list of cities with the most polluted air.

- Ecological issues in Dushanbe are caused also by the followings:
  - low percentage of implementation of environmental measures of the previous master plan of the city (1982);
  - City has not removed particularly harmful enterprises (cement factory, etc.), the airport, and sewage treatment facilities;
  - The system of landscaped public areas is not sufficiently formed in the peripheral parts of the city;
  - Only a fragmentary system of green areas of special purpose is formed.

- Based on the commitments undertaken by Tajikistan to reduce greenhouse gas emissions, a number of regulatory and policy measures have been taken, which can be the ground for development of the MRV Concept and subsequently the development of a special Law.
- The fundamental country development document is the National Development Strategy of Tajikistan to 2030, adopted in 2016.
- The Strategy outlines the general economic development directions, which, when implemented, can contribute to reduction of the GHG emissions:
  - the use of non-traditional (renewable) energy sources;
  - minimization of the negative impact of vehicles on the environment and human health;
  - encouraging the development of “green employment”;
  - expansion and state support of the environmental entrepreneurship and the environmental services market.

Dushanbe CHP-2. *source: viproliki.net*

Dushanbe cement plant. *Source: viproliki.net*

PM 2.5 review

- An air pollutant, which includes solid microparticles and tiny droplets of liquids.
- easily penetrate the biological barriers and therefore pose the greatest threat to the human body.
- particles with a diameter of less than 2.5 micrometers (μm). A micrometer or micron is one millionth of a meter.
- Anthropogenic origin: fine dust flies from car engines, factories and plants.
- Natural origin: dust from soil not covered by vegetation. For example, dust storms, from time to time brought into Dushanbe from Afghanistan and the drying Aral Sea.

PM2,5 and PM10 in Dushanbe

- In Dushanbe, the average annual level of PM2.5 is about 0.013 mg/m^3.
- Thus, the average annual level of PM2.5 in 2018 was 0.015 mg/m^3, in 2019 - 0.012 mg/m^3, and in 2020 - 0.013 mg/m^3, with standard -0.035 mg/m^3 .
- While according to the online monitor of the US Embassy in Dushanbe, as of 05.05.2020, the AQI was 137 (unhealthy for sensitive groups).

	2000	2005	2006	2007	2008	2009	2010	2011	2012
SO_2	20	31	34	36 39	39	41	43	47	50
NOx	31	49	53	57	62	64	68	73	79
NH_3	19	30	32	34	37	39	41	44	47
Non-methane Volatile Organic Compounds	14	23	25	26	29	30	32	34	36
CO	360	575	615	663	715	742	791	849	913
PM2.5	12	19	20	21	23	24	26	27	30
PM10	23	37	40	43	46	48	51	55	59

[1]. Transboundary air pollution by major pollutants (S, N, O3) and PM in Tajikistan, EMEP, 2015. Environmental Performance Reviews. Tajikistan Draft third review. UN New York and Geneva, 2017. Source: http://pdf.knigi-x.ru/21biologiya/152663-1-obzori-rezultativnosti-ekologicheskoy-deyatelnosti-tadzhikistan-tretiy-obzor-proekt-organizaci.php

- People living in the southern regions of Tajikistan and Dushanbe are the most often affected by dust pollution.
- It is caused by the location of the city - there are mountains to the north and northeast that hold the dust over the city, so it takes a long time to settle.
- Dust storms from the Aral Sea most often cover the western part of Uzbekistan. But in recent years, they have begun to reach the upstream of the Zeravshan River, which flows down to Tajikistan.
- In 2013, scientists first recorded a dust storm in Gornaya Matcha district, located about 200 km northeast of Dushanbe
- It is a fact that the frequency and duration of dust storms have increased.
- In addition, over the past 30 years, there have been no more dust storms accompanied by rainfall.

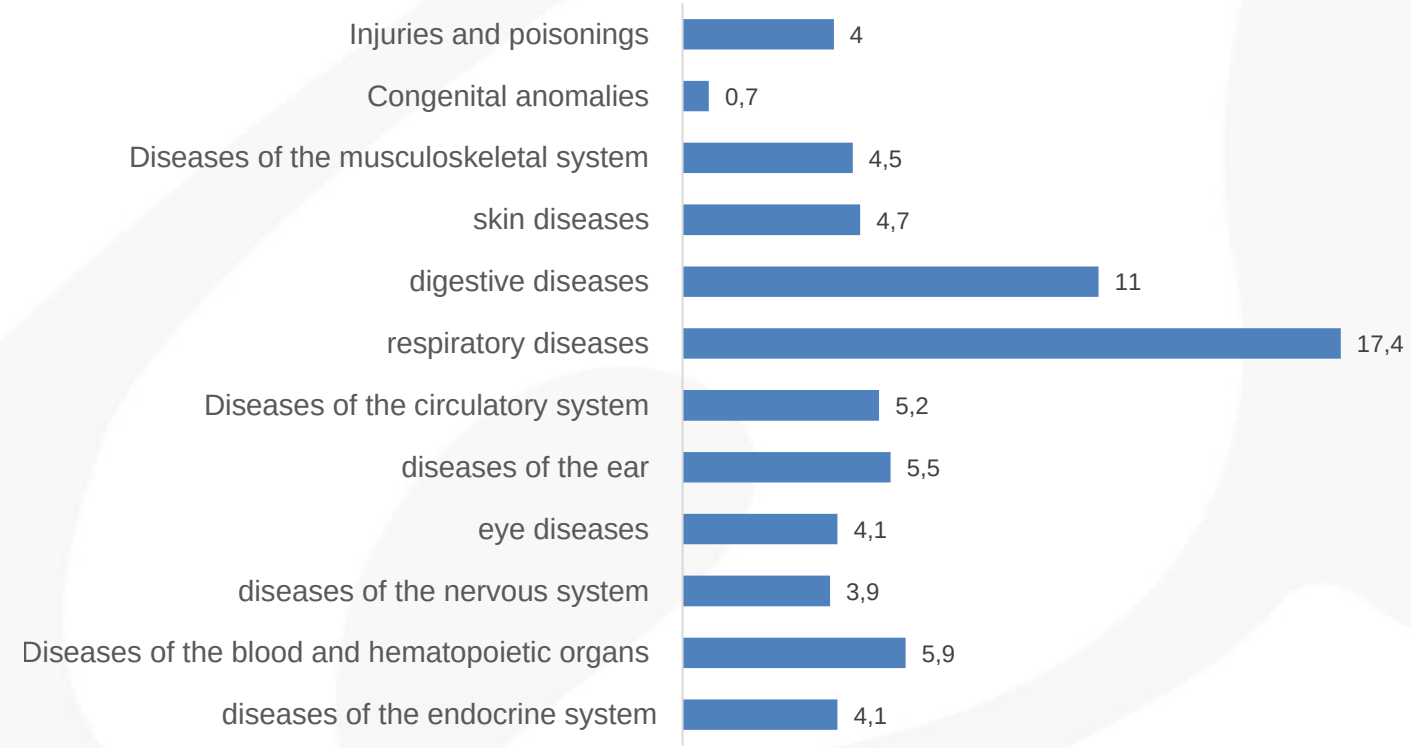
Air pollution effect on health

Harmful air emissions cause the following diseases (WHO):

- Asthma, lung diseases - sulfur dioxide, particulate matter, ozone;
- Heart disease - carbon monoxide, contaminated particles;
- Elderly people and children - ozone, contaminated particles.

Air quality is an important environmental factor affecting public health in Tajikistan, but this fact has not yet been sufficiently recognized.

The structure of morbidity in Tajikistan shows that more than 29% of diseases are associated with the respiratory system



Air quality monitoring in Dushanbe and Tajikistan

- State monitoring
- Environmental Monitoring Department (EMD) of the Agency for Hydrometeorology
- Air quality is monitored in Dushanbe by two permanent stationary stations operating in automatic mode and two mobile laboratories.
- Automated air quality stations operate twenty-four hours a day, measuring the amounts of the most important pollutants (carbon monoxide, nitrogen oxides, sulfur dioxide, formaldehyde, suspended particulate matter).
- Hydromet measures daily meteorological data (free access on the website), prepares environmental bulletins (paid services).

	Controlled pollutants	Published data on controlled
Dushanbe	SO2, CO, CHOH, NO, NO2, dust	SO2, CO, CHOH, NO, NO2, dust
Khudjand	SO2, CO, NO, NO2, dust	SO2, NO2, dust
Bokhtar	SO2, CO, NO, NO2, dust	SO2, NO2
Spitamen	SO2, CO, NO, NO2, HF, dust	
Tursunzade	SO2, CO, CHOH, NO, NO2, dust	SO2, NO2, HF, dust

Air quality monitoring in Dushanbe and Tajikistan

- Non-Government Monitoring
- Air quality indicators in Dushanbe can be freely observed from the air monitor installed by the U.S. Embassy in 2018. The monitor is designed to measure particulate matter in the ambient air at the U.S. Embassy, located in the Zarafshan district of Dushanbe.
- Air quality monitoring measures particulate matter less than 2.5 micrometers in diameter (PM 2.5). It is considered the most hazardous to health, and is therefore an air quality standard recognized by the U.S. Environmental Protection Agency (EPA).
- Real-time air quality data is available on the specialized air website airnow.gov.
- Youth Group on Protection of Environment (YGPE) monitors air quality with low-cost sensors. YPGE installed 11 low-cost PM2.5 sensors in 8 cities in Tajikistan during the year ended July 2021.

Recommendations to improve air quality monitoring

The problem of environmental pollution, especially of the Earth's air shell, is becoming more and more critical as time goes on. The problem can be addressed through development and improvement of the environmental monitoring systems with application of advanced organizational and technological methods. The main areas of methodological support are analyses of dust pollution and the presence of pollutants in the air.

1. Radical modernization of the observation network and laboratory equipment;
2. Transition from a shortened air sampling and analysis program to a full program;
3. Organization of a subsystem for monitoring concentrations of fine dust, PM10 and PM2.5 fractions;
4. Introduction of advanced equipment and technologies in regional monitoring centers;
5. Development of a network of GAS stations, background monitoring as reference points for reconstruction of the air pollution characteristics on the territory of Tajikistan.
6. Conducting regular observations of the atmospheric air pollution and optimizing them by increasing the frequency of observations;
7. Step-by-step introduction of the automated systems for continuous measurement of the main pollutants in the air of settlements.

Air Quality Management in Dushanbe and Tajikistan

The Republic of Tajikistan has laws and resolutions defining regulations in the field of atmospheric air protection.

- Goals and objectives of the Law “On Atmospheric Air Protection” dated 16.10.09, No. 557 include:
  - regulation of public relations in this area in order to ensure safe environment for humans, flora and fauna,
  - maintain cleanliness and improve the state of atmospheric air,
  - establish state control over the use of the air basin of cities and industrial centers, other settlements, sources of air pollution, as well as strengthening the rule of law in these relations in the interests of present and future generations of people .
- In accordance with Article 3 of this Law “On the Atmospheric Air Protection”, the main principles of the atmospheric air protection are to ensure the cleanliness of atmospheric air from various pollutants and to maintain it on the basis of evidence-based norms and standards:
- State administration in the field of atmospheric air protection is performed by the Government of the Republic of Tajikistan, as well as by authorized state bodies.
- The authorized state bodies for the protection of atmospheric air in the country include the Environmental Protection Committee, the RT Ministry of Health.
- The competence of authorized state bodies on atmospheric air protection is determined by the Nature Protection Law of the Republic of Tajikistan

Air Quality Management in Dushanbe and Tajikistan

Key actors and government agencies

- Majlisi Oli of the Republic of Tajikistan
- The Government of the Republic of Tajikistan in the field of atmospheric air protection
- Local authorities in the field of regulation of relations on the protection of atmospheric air are in charge of
- Environmental Protection Committee under the Government of the Republic of Tajikistan
- State Agency for Hydrometeorology under the Environmental Protection Committee.

Air pollution stakeholders

- Majlisi Oli (Parliament)
- Local executive bodies
- The Environmental Protection Committee under the Government of the Republic of Tajikistan;
- State Agency for Hydrometeorology
- Ministry of Health and Social Protection of RT
- Ministry of Communications and Transport of RT
- Ministry of Industry and New Technologies of RT
- Ministry of Internal Affairs of the RT
- Ministry of Agriculture
- Statistics Agency under President of the RT
- National Academy of Sciences of Tajikistan
- Public environmental organizations. The youth environmental centers.

Recommendations for improving air quality management

1. Introduction of the carbon and fuel taxes from enterprises in Dushanbe, stationary and mobile sources of air pollution in the city, as a measure to combat CO2 emissions.

2. Improving the vehicles inspection.

3. Transfer of Dushanbe CHP-2 and the Cement Plant to gas fuel.

4. Gradual transition of enterprises to the use of electricity produced by hydroelectric power plants in Tajikistan. Transition to energy-saving technologies.

Recommendations for improving air quality management (cont.)

5. Transfer of administrative and residential buildings of the city to the renewable energy sources, in particular, to environmentally safe solar energy, the cost of which is constantly decreasing. Implementation of insulation and energy efficiency in city buildings.

6. Policies and investments to support cleaner vehicles, import of the hybrid and electric-powered vehicles (electric cars). Promote the use of clean transport by reducing customs duties.

7. Removing priority focus on the urban high-speed transport, pedestrian and bicycle networks. Reducing congestion, improving access to public transport, trolleybuses.

8. Reform the vehicle taxation (purchase, registration and annual road taxes) so that taxes are based on specific CO2 emissions.

9. Implementation of the advanced methods of household waste utilization and processing, including capturing methane emitted at waste disposal sites.

Recommendations for improving air quality management (cont.)

10. Development of an open and publicly available map of pollutant emissions into the atmospheric air in Dushanbe, public monitoring of the air quality.

11. The Republic of Tajikistan should become a Party to the Convention on Long-range Transboundary Air Pollution and its Protocols. Tajikistan's participation in the Convention will provide the country with better access to the information it needs to develop an air pollution monitoring strategy, a robust emissions inventory system, and an air quality management strategy.

12. Increasing the number of green solutions in the city, such as expanding city parks and green spaces, and creating green walls and roofs on existing buildings.

Thank you for your attention!

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