UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

UAE National Air Quality Agenda 2031

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UAE National Air Quality Agenda 2031

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Her Excellency Mariam bint Mohammed Almheiri
Minister of Climate Change and Environment

Foreword

It gives me great pleasure to launch the "UAE National Air Quality Agenda 2031", to be the strategy that will guide the national efforts to manage the air quality portfolio in the country in the coming years.

Air quality is a national priority, given the direct and indirect implications it can have on health, the economy and the environment.

The agenda provides an overview of the current state of air quality in the UAE as well as the relevant challenges and opportunities. It defines four focus areas - outdoor air quality, indoor air quality, ambient odor and ambient noise – and its implementation aims to achieve range of health, environmental, social and economic benefits.

The development of the Agenda was made possible through the valuable contributions of various federal and local government stakeholders. The active participation of our institutional partners proves the paramount importance of this endeavor. On that note, I extend my sincerest appreciation for their continued support, and hope that these partnerships will go a long way in advancing the implementation of the Agenda.

Acknowledgements

The UAE Air Quality Agenda 2031 was developed by the Ministry of Climate Change and Environment (MOCCAE) in partnership with the Global Green Growth Institute (GGGI). The document also benefited from technical input from AECOM and a review by the Climate and Clean Air Coalition. It was prepared based on a detailed situation and gap analysis, international benchmarking, and a series of group and bilateral consultation meetings with various federal and local entities listed below.

- Abu Dhabi Airports
- Abu Dhabi Public Health Center
- Abu Dhabi Department of Municipalities and Transport
- Abu Dhabi Quality and Conformity Council
- Abu Dhabi Waste Management Center (Tadweer)
- Ajman Municipality & Planning Department
- Bee'ah
- Department of Civil Aviation & Sharjah Airport Authority
- Department of Health Abu Dhabi
- Dibba Al Fujairah Municipality
- Dubai Airports
- Dubai Civil Aviation Authority
- Dubai Municipality
- Environment Agency - Abu Dhabi
- Environment Protection and Development Authority - RAK
- Etihad Rail
- Fujairah Environment Authority
- Fujairah Municipality
- General Civil Aviation Authority
- Ministry of Energy and Infrastructure
- Ministry of Health and Prevention
- Ministry of Industry and Advanced Technology
- Ministry of Interior
- Sharjah City Municipality
- Sharjah Environment and Protected Areas Authority
- Umm Al Quwain Municipality

1. Executive Summary

Air pollution is a recognized global issue which poses significant risks to the population. The World Health Organization (WHO) considers clean air to be a basic requirement of human health and well-being[1] and estimates that outdoor and indoor air pollution lead to approximately 7 million premature deaths worldwide each year[2].

The UAE has long recognized the important role air quality plays in supporting an overall healthy and sustainable life for its inhabitants. Consequently, the UAE afforded air quality a high priority and a key performance indicator (KPI) under its National Agenda leading to its Vision 2021[3] and will similarly recognize air quality in the UAE's Centennial 2071 Plan[4] objectives, which place a strong emphasis on a high quality of life and sustainable economy. Through this Agenda, the UAE aspires to:

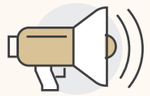
Enhance air quality to contribute to a safe and healthy environment that improves the quality of life

The importance of air quality is also recognized in the National Environmental Policy of the UAE[5]. It sets "improving air quality" as one of its eight priorities and specifies goals for it. In doing so, it adopts an interpretation of air quality which explicitly recognizes four areas of air pollution namely:

Outdoor Air Pollution - frequently associated with so-called 'classical' air pollutants such as nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3) and particulate matter, as well as a variety of organic and inorganic pollutants. Pollution sources could include stationary sources, mobile sources and area sources, and could arise from anthropogenic activities or naturally-occurring processes.

Indoor Air Pollution - caused by a very broad range of sources, including dampness / mould, cleaning / construction related chemicals / pesticides / tobacco / incense smoke and entrainment from outdoor pollution.

Ambient Odors - a form of air pollution that can lead to decreased quality of life or sense of wellbeing for members of the public, and exposures to odors can sometimes cause adverse health effects.



Ambient Noise - excessive ambient noise levels can pollute the atmosphere, causing annoyance and affecting peoples' quality of life. The WHO considers environmental noise to be a public health threat[6] as it has been acknowledged to cause adverse human health effects.

[1] World Health Organization (2005). WHO Air Quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Summary of risk assessment.
[2] WHO (2020). Health Topics - Air Pollution. https://www.who.int/health-topics/air-pollution#tab=tab_1
[3] UAE PMO (2018). UAE National Agenda Towards Vision 2021.
[4] UAE PMO (2017). UAE Centennial 2071. https://u.ae/en/about-the-uae/strategies-inititives-and-awards/federal-governments-strategies-and-plans/uae-centennial-2071
[5] MOCCAE (2020). UAE Environmental Policy.
[6] WHO (1995). Guidelines for Community Noise.

In recent years, both local and federal government agencies have made significant efforts to develop a robust understanding of the current state of air quality within the UAE. Efforts have tended to focus on implementing initiatives which deliver improvements to air quality management but may not necessarily maximize the beneficial outcomes of their efforts. Therefore, this UAE Air Quality Agenda has been developed with the objective **to lead and coordinate the actions from federal and local institutions for streamlined monitoring and management of air quality and effective mitigation of air pollution.**

The Agenda is thus expected to drive air quality improvements while also supporting the realization of co-benefits and leveraging synergies across a range of related sectors. It was designed to align with and support other national thematic or sectoral strategies, such as:

The Green Agenda, the National Innovation Strategy, the UAE Energy Strategy 2050, the National Smart Mobility Strategy, and the UAE Strategy for the Fourth Industrial Revolution. It also seeks to improve air quality in four areas: outdoor air quality, indoor air quality, ambient odors and ambient noise.

A key objective has been developed for each of the four areas and key performance indicators to measure progress, taking into account the country's level of maturity in each of the areas, in addition to ensuring its compatibility with the 2030 Sustainable Development Goals.

Figure 1: Strategic objectives for the National Air Quality Agenda 2031

The agenda was developed in partnership with the federal and local government and in line with international best practices. It follows an integrated approach by emphasizing the importance of concerted efforts and individual resources in multiple sectors and entities to achieve the national vision. Therefore, the successful implementation relies at the availability of resources shown in Figure (2) at each of the collaborating entities.

Enablers

- An integrated governance system for managing the air quality file
- Encouraging scientific and academic research
- Enhancing community awareness on air quality issues
- Strengthening technical and human capabilities
- Facilitating the availability of financial resources
- Promoting, adopting and applying advanced technology and innovation

Strategic Indicators

- The percentage of compliance with national standards
- PM2.5 concentration in residential areas
- Number of standards issued/updated related to maintaining indoor air quality
- % of Hourly Mean of hydrogen sulfide (H2S) Concentrations <10µg/m3

Figure 2: Enablers to achieve the indicators of the National Air Quality Agenda 2031

Due to the nature of air quality and its impact on several sectors and the variety of partners in each of the four focus areas, national working groups/ committees will be established to manage each of the four areas: outdoor air quality, indoor air quality, odors and ambient noise, to meet the required actions at the national level. Roles and responsibilities for the initiatives were also defined in the implementation plan, which depends on the successful completion of activities through the cooperation and commitment of the concerned authorities to implement the Agenda. The Ministry of Climate Change & Environment will act as the lead entity of the Agenda, it will follow up on its implementation, and will submit a report on the progress of the action plan to the UAE Council for Environmental and Municipal Work.

2. Current State of Air Quality in the UAE

2.1 Regulation of Air Quality

The following subsections set out how the four elements of air quality (outdoor air, indoor air, ambient noise, and ambient odor) are currently regulated in the UAE.

Only outdoor air quality and noise are currently clearly regulated at the federal level. Note that certain initiatives described later in this Strategy propose certain changes to the regulations in force at the time of compiling this document.

2.1.1. Outdoor Air

Outdoor air quality is currently regulated by the National Government by means of ambient (outdoor) air quality standards for seven key air pollutants set in Cabinet Decree No. 12 of 2006 Regarding Regulation Concerning Protection of Air from Pollution[7], these are:

- **Sulphur dioxide (SO_2),**
- **Carbon monoxide (CO),**
- **Nitrogen dioxide (NO_2),**
- **Total suspended particles (TSP),**
- **Particulate matter less than 10 microns in diameter (PM_{10}),**
- **Lead (Pb) and**
- **Ozone (O_3).**

Comparison of the above standards to several benchmarked countries reveals a similar range of criteria / priority pollutants (SO_2, NO_2, CO, O_3, PM_{10}) are regulated. The UAE does not currently include standards forother pollutants which are frequently regulated elsewhere, such as $PM_{2.5}$ and benzene. It is also noted that in some instances the current federal standards for certain pollutants are not as stringent as corresponding international benchmark country or WHO guidelines.

There are also accompanying emission limits for air pollutants from a range of stationary sources[7]. More locally focused management and monitoring of outdoor air quality activities are generally conducted by environmental or her agencies within each emirate[9].

2.1.2 Indoor Air Quality

While there are no federal regulations relating to indoor air quality, certain elements of indoor air quality management are also picked-up on in standards from the MOIAT and the federal Sustainable Buildings Regulations published by the Ministry of Energy and Infrastructure (MOEI). For example, there are standards or codes of practice for designing ventilation systems and undertaking sampling to ensure that levels of pollutants are kept to a minimum. Similarly, there are standards relating to controlling the compositions of surface coating products used indoors (e.g. varnishes and paints) and the use of asbestos in buildings. The new federal Sustainable Buildings Regulations also acknowledges the importance of indoor air quality and promote a combination of design decisions and choice of appropriate (low emitting) materials to achieve a healthy indoor environment. Currently, however, the scope of these guidelines is limited to projects conducted by the MOEI.

Pesticide use / management is covered by general framework documents in certain emirates[10]. Despite the current absence of federal regulations on indoor air quality, indoor air pollution has been identified as the second highest priority environmental health risk (after outdoor air pollution) in the UAE[11,12].

The roles and responsibilities for monitoring and managing indoor air quality are not consistently defined across the UAE, although these have been defined in some emirates (e.g. Dubai).

At the local level, building performance systems such as Abu Dhabi's Pearl Rating System for Estidama and Dubai Municipality's Al Safat green building evaluation system and Indoor Air Quality Compliance technical guidelines In addition to the "Barjeel" green building regulations in Ras Al Khaimah include considerations that are relevant to indoor air quality management.

[7] UAE Government (2006). Cabinet Decree No. 12 of 2006 Regarding Regulation Concerning Protection of Air from Pollution.
[8] e.g. United Kingdom, European Union, Canada, Singapore, China and South Korea.
[9] MOCCAE (2017). Knowledge - Air Quality webpage. https://www.moccae.gov.ae/en/knowledge-and-statistics/air-quality.aspx

2.1.3. Ambient Odor

Odors are currently not regulated at the federal level and the specific roles and responsibilities for monitoring and/or managing odors within each emirate are in some cases not clearly defined or understood and there may be some sub-areas that fall under the jurisdiction of different agencies. Most regulation in place also tends to be reactive (e.g. takes effect in response to receipt of complaints, which are then investigated). An exception to this is work undertaken in Abu Dhabi, where the Abu Dhabi Quality and Conformity Council has compiled several documents regulating waste management activities that can influence odor.

2.1.4. Ambient Noise

Ambient noise is currently federally regulated within the context of a variety of land use types[7], with limits consistent with international standards such as those published as guidelines by the WHO[13] and International Finance Corporation[14], though less comprehensive than the European Noise Directive (END)[15]. The Ministry of Industry and Advanced Technology (MOIAT) (formerly the Emirates Authority for Standardization and Metrology (ESMA) also publishes a range of standards which relate to the control of noise at source for specific types of domestic appliances), some commercial / agricultural equipment, and road going vehicles.

Certain emirates have implemented their own initiatives in relation to noise, including some key performance indicators based on noise limit breaches[16]. Agencies such as Abu Dhabi Department of Municipalities and Transport (DMT) incorporate noise into strategic planning processes to avoid / minimize potential future incompatible land use types (and thus the likelihood for noise-related issues). Recently, authorities in several emirates (including Abu Dhabi and Sharjah) have also introduced new radar-based monitoring of road vehicle noise, with a system of fines and license penalty points applied where measured noise levels at the roadside exceed a criterion of 95 decibels[17].

The roles and responsibilities for monitoring and managing ambient noise are relatively well-defined, although noise is currently not monitored broadly and consistently across all emirates.

[10] i.e. ADS 7/2013: General framework for pesticides control in all fields of use including public health, agricultural, and veterinary pesticides
[11] UAE Environmental Health Project (2010), National Strategy and Action Plan for Environmental Health.
[12] MacDonald Gibson, J. & Farah, Z.S. (2012). Environmental Risks to Public Health in the United Arab Emirates: A Quantitative Assessment and Strategic Plan. Environmental Health Perspectives 120(5).
[13] World Health Organization (WHO) (1999). Guidelines for Community Noise.
[14] International Finance Corporation (2007). Environmental, Health, and Safety Guidelines - General EHS Guidelines: Environmental - Noise Management.
[15] Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC of the European Parliament and of the Council.
[16] Government of Dubai (2020). Dubai Air Environment – Noise webpage. http://www.dubaiairenvironment.dm.gov.ae/about_noise
[17] Gulf News (2019). Do you drive a noisy vehicle in UAE? Dh2,000 fine, 12 black points. https://gulfnews.com/uae/transport/-do-you-drive-a-noisy-vehicle-in-uae-dh2000-fine-12-black-points-1.1570009851811

2.2 Data on Air Quality in the UAE

There is considerable variation in the availability and consistency of data on the state of air quality in the UAE (partly attributable to the absence of unified standards across all emirates). Data on ambient concentration of pollutants in outdoor air is the most abundant of the four focus areas. The UAE has 54 fixed outdoor air quality monitoring stations located in all seven emirates (see figure below) that monitor a range of pollutants which varies between stations but in many cases include those for which federal limits exist, plus certain additional pollutants / groups such as volatile organic compounds (VOCs) and hydrogen sulphide (H_2S)[18].

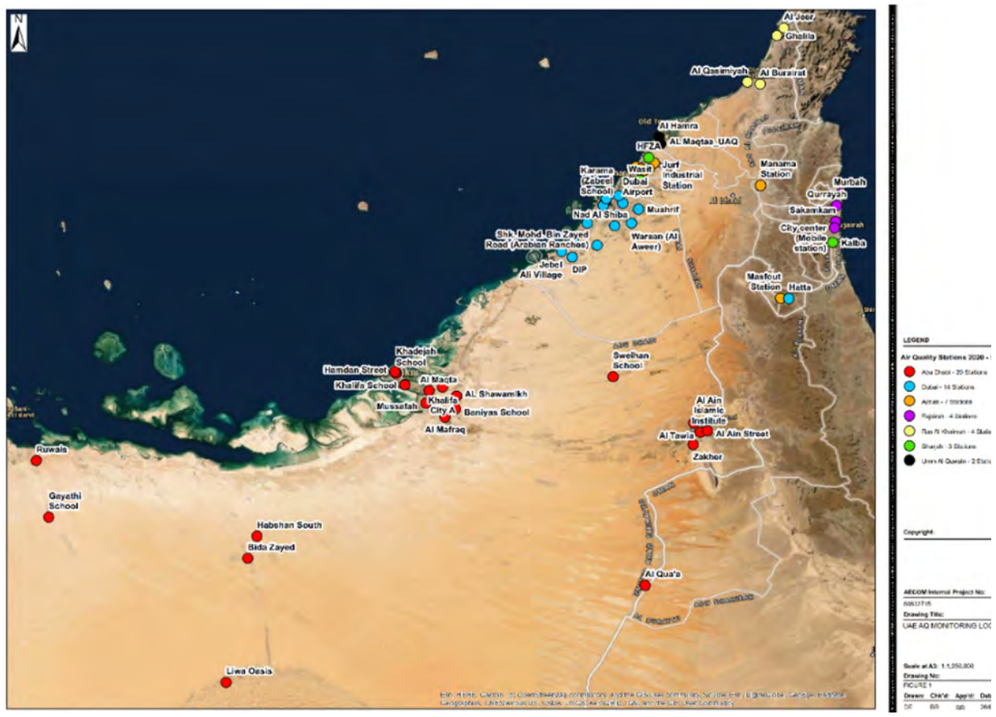


Figure 3: Ambient air quality monitoring stations in the UAE in 2021

[18] Environment Agency Abu Dhabi (2020). Air Quality Monitoring System webpage. https://www.adairquality.ae/

In addition, in 2019, the UAE National Air Emissions Inventory Project[19] was completed providing valuable information about the sources of different key outdoor air pollutants in the UAE[20]. The sectoral contribution of emissions per pollutant are presented below (Figure 4):

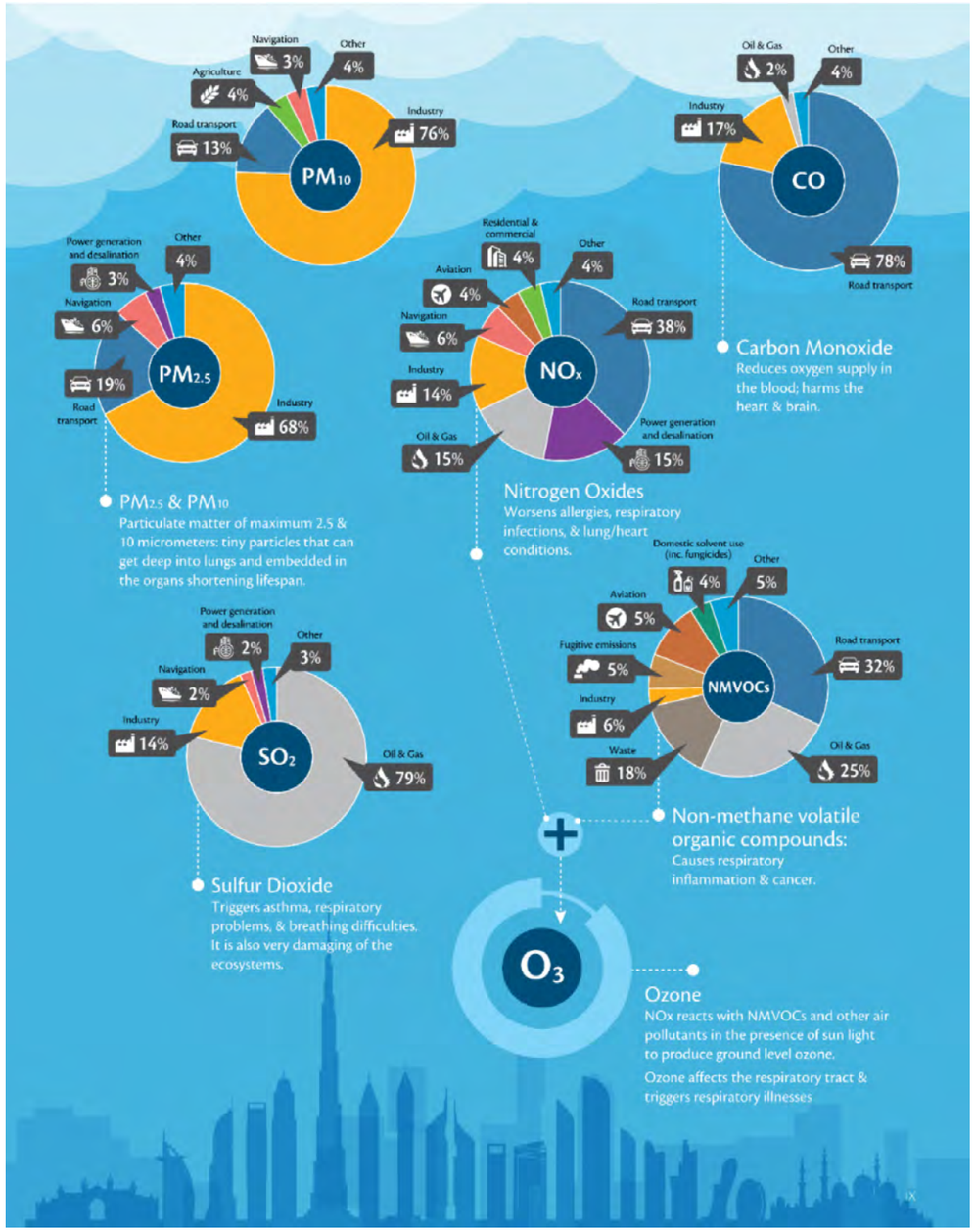


Figure 4: Sectoral contributions of pollutant emissions in 2015

[19] MOCCAE (2019). UAE National Air Emissions Inventory Project – Final Results.

[20] This project quantified emissions of six key pollutants (oxides of nitrogen (NOx), SO2, CO, non-methane volatile organic compounds (NMVOC), PM10 and PM2.5) from five anthropogenic source sectors in the UAE: energy, transport, industrial processes and product use (IPPU), agriculture and waste. It found that the energy sector and transport sectors were the greatest contributors to national emissions of NOX and SO2 CO and NMVOCs. Notably, the inventory did not include emissions from construction sector activities.

The UAE tracks outdoor air quality performance by looking at various Key Performance Indicators (KPIs). The KPIs track the number of days where measured data indicates that certain pollutants did not exceed their standards (referred to as "Green Days"). The pollutants that the UAE focuses on using this indicator include a basket of substances (NO_2, SO_2, CO and ground-level O_3) known as the "Air Performance Index" (API), PM_{10} and $PM_{2.5}$. The UAE National Agenda leading to the UAE Vision 2021 set a target of 90% for the national Air Pollution Index. In 2015 the individual emirates committed to incremental annual targets that contribute to reaching the national target.

KPI results over the period 2014 to 2020 (Figure 5) indicate that, for the API, the target percentage of "green days" has been achieved every year except 2018. Concentrations of NO_2, SO_2, and CO tended to be below the corresponding federal standards, though concentrations of ground-level O_3 were more frequently recorded at levels in excess of the standard. It has been determined that ground-level O_3 is the main driver of potential non-attainment of the set API.

Despite having met the targets for particulate matter less than 10 microns in diameter (PM10) for the past years, the country experiences high concentrations of PM_{10} in the atmosphere from natural sources due to the geographic location and weather patterns of the UAE. This makes it difficult to evaluate the improvement from other mitigation measures implemented. Changes in the PM_{10} indicator correlate better to the weather conditions experienced in that year in the UAE. This is the main reason why the indicator for particulate matter less than 10 microns in diameter (PM10) is separated from the gaseous pollutants indicator.

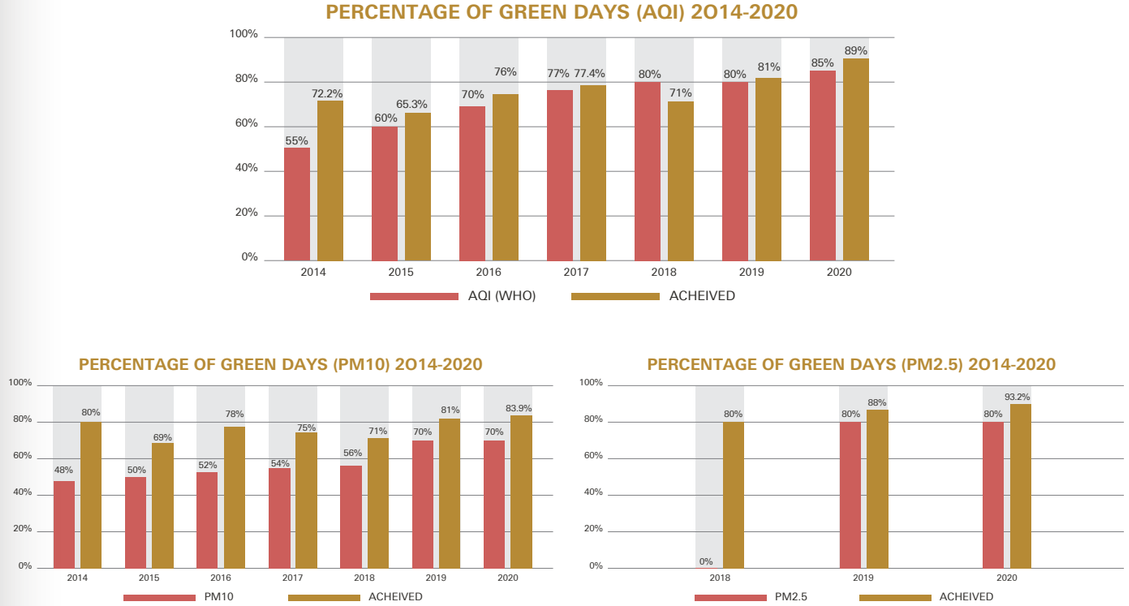


Figure 5: Key Performance Indicators Results 2014-2020

Other types of air quality (indoor, ambient odors and ambient noise) are not monitored broadly or consistently across all emirates with the result that there is comparatively little data available on these types of air quality in the UAE.

3. Gaps and Areas for Improvement in UAE

Through benchmarking current practices for managing air quality in the UAE to international best practices, several gaps and areas for improvement were identified. These are presented in the following subsections, one for each of the four air quality focus areas.

3.1 Gaps relating to Outdoor Air Quality

- Outdoor air quality limits: The current federal limits for certain pollutants are not as stringent as corresponding international benchmark values (e.g. SO_2, NO_2, O_3 and CO are less stringent than corresponding WHO guidelines). Furthermore, some important pollutants are currently not afforded federal limits (e.g. $PM_{2.5}$, benzene and H_2S).

- Source emission limits: Federal source emission limits are currently set for a limited number of source types. These limits may not be applicable or appropriate for the wide range of source types / sectors that are present or emerging in the UAE (e.g. these do not specifically cover emerging technologies in alternative fuels or may not fully reflect currently emission performance achievable by reasonable means)[21].

- National emission ceilings / targets: Several countries track national emission totals of key pollutants / groups, however this is not currently done in the UAE. While such metrics do require quite comprehensive data collection and reporting (e.g. regular updating of a national-level air emissions inventory), they can provide useful metrics for target setting and progress tracking for emission reductions. The process could potentially adopt the Measurement, Reporting and Verification (MRV) approach to ensure robustness, consistency and transparency.

- Federal versus local approach to air quality management: As described above, UAE manages air quality at the federal level though MOCCAE, however certain roles and responsibilities are devolved to other agencies. This approach is successfully adopted elsewhere, however the absence of a clear framework setting out these roles and responsibilities and ensuring alignment between all stakeholders is currently identified as a gap.

- Air quality monitoring and modelling standards: A number of countries (or in some cases regional-level agencies) have developed standards for air quality monitoring and/or modelling activities. These provide clear and consistent requirements for services and studies relating to this topic and would be expected to improve the quality of data generated. There are currently no standards adopted consistently throughout the UAE.

- Lack of economic evaluation: There is currently insufficient information to fully support the understanding of the relationship between outdoor air quality and effects on public health to support decision-making.

- Early warning system to reduce public exposure: There is currently no system to warn the public about inevitable high-level pollution episodes (e.g. dust storms) and to provide guidance on how to reduce personal exposure to pollution.

[21] Several countries have compiled sector / industry specific source emission limits to ensure that these are directly applicable and are representative of the current and future planned state of the sector. Related to this could be the adoption of a formalised standard of source emission test methods (such as those published by US EPA which have since been adopted by several jurisdictions outside of the USA).

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3.2 Gaps relating to Indoor Air Quality

- A comprehensive set of standards setting relevant and appropriate use and/or composition- or emission-related limits for construction materials, furniture and decoration materials and cleaning products is missing in the country, with information scattered through different guidelines, product standards and voluntary building guidelines.
- Lack of comprehensive and universally applicable codes of practice or standards covering building maintenance activities (as relates to indoor air quality).
- Absence of a clearly defined strategy and framework for responsibilities in respect of the above points and indoor space ventilation design requirements.
- Lack of public awareness on the topic of indoor air quality.

3.3 Gaps relating to Ambient Odor

- Absence of specific regulation, standards and/or guidelines relating to the monitoring, mitigation and management of odors (or indicator pollutants e.g. H_2S).
- Apparent inconsistent approach to receiving, processing, investigating and actioning odor-related complaints.
- Unclear framework for roles and responsibilities for monitoring odors and the scope of such monitoring.
- Lack of public awareness on the topic of ambient odor.

3.4 Gaps relating to Ambient Noise

- Noise emission standards for all of the main noise sources / sectors including (but not limited to):
  - Transportation sector (vehicles (including motorbikes), rail, navigation and aviation);
  - Construction activities;
  - Domestic noise sources (e.g. air conditioning);
  - Commercial and outdoor practices;
  - Other sources (e.g. alarms, sirens, public address systems).
- Federal standards not aligned with global best practice benchmark.
- Managing the implementation and enforcement of existing limits and guidelines.
- Lack of communication of and increasing the awareness of the importance of an appropriate noise environment and the potential adverse health implications (both physical and mental).
- Lack of noise mapping to assist in the planning and assessment process to mitigate and control gradual increase in noise emissions which results form a marginal increase in emissions with each development.
- Lack of public awareness on the topic of ambient noise.

4. Challenges facing the UAE

Various challenges that the UAE is likely to face in relation to each of the four air quality focus areas have been identified and are summarized in the following:

4.1 Challenges in relation to Outdoor Air Quality

- Population growth and city expansion causing an increase in demand for resources and transportation, and encroachment of sensitive receptors to pollution sources.
- Dependence on private cars and preference for large SUV models (with significantly higher emissions).
- Allocation of suitable resources and/or maintaining technical capacity for air quality monitoring, management and air pollution mitigation planning/ enforcement within several emirates.
- Potential lack of support for significant investment in industry (reducing emissions and improving sustainability). Many industries may perceive emissions controls/reductions as secondary issues as opposed to opportunities to ensure the long-term performance and sustainability of their business.
- Identified gaps in the regulatory framework (in terms of outdoor air pollutant limits and source emission limits, as well as sectoral guidelines on emissions control / management).
- Transboundary pollution (both in terms of international transboundary issues and those between emirates).
- Natural sources of pollution (specifically the regional phenomenon of elevated particulate matter levels attributable to the arid and often windy climate[22]) which significantly influence levels of key outdoor air pollutants. Land management practices such as overgrazing of the desert and loss of vegetation are also known contributors to pollution levels. Changing topography (e.g. shifting of sand dunes) can also have an influence on local-scale air circulation, and thus on pollutant levels experienced by receptors.
- Inadequate communication and identification of clear roles and responsibilities within intra- and inter-emirate level stakeholders.

4.2 Challenges in relation to Outdoor Air Quality

- Absence of comprehensive federal level guideline or regulation relating to indoor air quality.
- Vague or uncertain allocation of responsibilities for indoor air quality monitoring, management and mitigation.
- A relatively small and disparate body of indoor air quality monitoring data across the country.
- Potentially large range of materials and products, that if regulated under the requirements for having low emissions, would likely need a form of validation. Similarly, there may be challenges, at least initially, to limit the use of such 'approved' products within the market.
- Numerous aging residential buildings with indoor air quality issues[23].
- Entrenched cultural practices (e.g. incense burning) and potential shortcoming in general public awareness about indoor air quality issues.
- Entrainment of elevated levels of pollutants from outdoors into indoor spaces.
- UAE climate often results in limited potential to use natural ventilation for indoor spaces.
- Allocation of suitable resources and/or maintaining technical capacity for indoor air quality monitoring, management and mitigation planning/ enforcement within several emirates.
- Limited definition of roles and poor evidence connection between environmental factors and health effects in the country.

[22] Including mineral dust and naturally occurring aerosols.

[23] Many older existing buildings do not meet minimum requirements for ventilation due to the lack of mechanical ventilation units in building designs to provide the building with the required amount of fresh air and expel pollutants.

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4.3 Challenges in relation to Ambient Odor

- Regulatory gap for odor at a federal level.
- Inconsistency of odor monitoring data quality and availability across the UAE.
- Allocation of suitable resources and/or maintaining technical capacity for odor monitoring, management and mitigation planning/enforcement within several emirates.
- City expansion and population growth causing encroachment issues for existing odor generating facilities and putting more pressure on existing infrastructure (i.e. generating more odors).

4.4 Challenges in relation to Ambient Noise

- Population growth and city expansion causing an increase in demand for resources and transportation.
- Regulatory gaps (e.g. for thresholds relating to specific transportation modes – rail, air etc. described above).
- Retrospectively implementing source mitigation measures (e.g. traffic calming measures, construction controls).
- Holistically managing the introduction of new noise sources into the environment to limit the slow steady increase in harmful noise emissions, or creeping noise levels, as a result of growth (construction) and expansion (commercial, industrial and residential) through source or propagation controls.
- Lack of buffers / noise attenuation along most major highways.
- Inconsistency of noise monitoring data and noise assessment quality and availability across the UAE.
- Allocation of suitable resources and/or maintaining technical capacity for noise monitoring, management and mitigation planning/enforcement within several emirates.
- Lack of public awareness on health effects of noise.

5. Linking the National Air Quality Agenda to the National Strategic directions

In its drive towards achieving the country's vision, the UAE government has launched several strategies. The Agenda is directly or indirectly linked to these strategies. Table (1) below shows the relationship between the national strategies and the Air Quality Agenda.

Strategy	Brief description of the relationship to the National Air Quality Agenda
UAE Centennial 2071	The National Air Quality Agenda is aligned with the three main pillars that the UAE Centennial 2071 focuses on. The governance pillar focuses on pushing the UAE government to be one of the best countries in the world. Accordingly, the National Air Quality Agenda aims to enhance air quality governance and strengthen cooperation between federal and local authorities in order to ensure the success and efficiency of air quality management in the country and improve it. The agenda also seeks to encourage the adoption of clean and innovative technologies that contribute to the country's sustainable economic growth. This was outlined in the framework of the second pillar of the Centennial Plan, which aims to achieve a diversified knowledge-based economy by raising the level of productivity in all sectors. The ultimate goal of the National Air Quality Agenda is to improve air quality, contribute to a safe and healthy environment and raise the quality of life. Which directly contributes to achieving the centenary goal of "a happy and cohesive society by the year 2071".
Green Agenda (2015-2030)	The Green Agenda 2015-2030 aims to enhance the country's capability and provide the appropriate environment to achieve a green economy. Within the framework of the strategic direction of clean energy and climate action, the agenda included pillars such as green life and optimal use of resources, sustainable environment and valuation of natural resources, clean energies and adaptation to climate change and a competitive knowledge-based economy. In turn, the implementation of the air quality agenda will contribute to achieving the objectives of the 2030 Green Agenda programs.
The General Environmental Policy	The policy aims to improve the quality of life, support the implementation of the 2030 Sustainable Development Goals, promote economic diversification and prosperity, and preserve ecosystems and their environmental goods and services. There are eight main priorities that the policy focuses on, one of which is "promoting air quality". The Air Quality Agenda will contribute directly to achieving this priority, in addition to contributing to achieving the priority of mitigating the effects of climate change, preserving the natural environment, and integrated waste management.

Strategy	Brief description of the relationship to the National Air Quality Agenda
National Innovation Strategy	The National Innovation Strategy aims to elevate innovation in the UAE to new heights, where the culture of innovation is integrated between individuals, companies and governments. The strategy mainly focuses on identified priority sectors that will drive innovation in the future including, but not limited to, renewable and clean energy, transportation, technology and health. Many efforts are being made to promote innovation in these sectors, and the air quality agenda will contribute to supporting the achievement of the objectives of the National Innovation Strategy through the initiatives identified in the implementation plan.
UAE Energy Strategy 2050	The strategy seeks to significantly change the energy mix in the UAE, with a focus on moving away from fossil fuels and thus promoting renewable/clean technologies for power generation. The strategy also aims to improve energy efficiency in the main consumer sectors. Efforts to achieve the objectives of this strategy will have synergies with the National Air Quality Agenda.
National Climate Change Plan (2017-2050)	This plan defines the UAE's strategy to address the causes and effects of climate change, and contributes to promoting the transition towards a green economy and providing a better quality of life. Efforts to reduce greenhouse gas emissions will have benefits in improving air quality and reducing pollutants.
UAE's Fourth Industrial Revolution Strategy	The UAE's Fourth Industrial Revolution Strategy aims to strengthen the UAE's position as a global hub for the Fourth Industrial Revolution, and to contribute to achieving a competitive national economy based on knowledge, innovation and future technological applications that integrate physical, digital and vital technologies. The National Air Quality Agenda supports the goal of the UAE's Fourth Industrial Revolution Strategy by emphasizing the importance of transforming to sustainable industries based on innovative clean technology.
The National Smart Mobility Strategy 2030	The strategy aims to develop a seamless, safe, efficient, reliable and more sustainable transport network. The implementation of the two strategies will have common benefits, as they both seek to achieve sustainability in the transport sector, with the aim of protecting the environment and reducing the pollutants emitted from this sector.
National Environmental Education and Awareness Strategy	The strategy aims to raise awareness of environmental issues (including air quality) in the UAE to achieve more sustainable behaviors which will have a positive impact on improving energy efficiency and making better choices regarding rationalizing energy consumption, consumer purchases, and others. The National Air Quality Agenda will contribute to raising awareness of air quality issues as part of its initiatives.
National Strategy to Combat Non-Communicable Diseases (2017-2021)	The National Strategy to Combat Non-Communicable Diseases aims to create a healthy Emirati society free from the complications and burden of avoidable non-communicable diseases through activating partnership with relevant sectors to reduce risk factors for non-communicable diseases and the rate of mortality and morbidity resulting from them. The National Strategy to Combat Non-Communicable Diseases indicated that air pollution is one of the main factors for the development of chronic respiratory diseases in the country. Accordingly, the National Air Quality Agenda will positively affect the treduction of ambient air pollution, which will contribute to the reduction of non-communicable diseases associated with air pollution.

6. Strategy Framework

The framework for the UAE Air Quality Agenda was built upon the existing air quality legislations and national/sectoral strategies and was developed through extensive consultation with federal and local government and through careful review of international best practices including in the EU, the UK, Canada, Singapore, South Korea, China and the GCC. The legislation, strategies and stakeholders consulted with to develop this Agenda are presented in Table (2) below.

Legislation Reviewed and Built upon	Strategies Reviewed and Built upon	Stakeholders Consulted
• Federal Law No. (24) of 1999 on the Protection and Development of the Environment • Federal Law No. (11) of 2006 amending provisions of Federal Law No. (24) of 1999 • Cabinet Decree No. (12) of 2006 regarding Regulation Concerning Protection of Air from Pollution • Ministerial Resolution 359/2015 regarding the technical requirements for air quality monitoring devices (applicable for quarries and crushers) • Other legislation concerning the EIA and Sectoral decrees (e.g. mining, transport, waste, etc.)	• National Green Agenda 2015-2030 • National Environmental Policy • National Climate Change Plan of the UAE 2017-2050 • UAE National Energy Strategy 2050 • National Non-Communicable Diseases - NCD Plan (2017-2021) • UAE National Smart Mobility Strategy 2030 • UAE Strategy for the Fourth Industrial Revolution • UAE National Innovation Strategy • National Environmental Education and Awareness Strategy	• Abu Dhabi Department of Municipalities and Transport • Abu Dhabi Waste Management Center - Tadweer • Ajman Municipality • Dibba Al Fujairah Municipality • Dubai Municipality • Ministry of Interior • Ministry of Industry and Advanced Technology • Environment Agency - Abu Dhabi • Environment Protection and Development Authority - RAK • Fujairah Municipality • General Civil Aviation Authority • Ministry of Energy and Infrastructure • Ministry of Health and Prevention • Sharjah Environment and Protected Areas Authority • Umm Al Quwain Municipality • Sharjah Municipality • Beea'h - Sharjah • Abu Dhabi Public Health Centre

Table 2: Consulted legislation, strategies and partners for developing the Agenda

Accordingly, the UAE Air Quality Agenda is built upon three pillars:

	The **Monitoring** pillar relates to the actual measurement of air pollution and related parameters[24].
	The **Mitigation** pillar relates to a broad range of existing, planned and/or required actions that will be taken to reduce levels of emissions / pollutants, and also reduce exposure to these pollutants.
	The **Management** pillar relates to measures that will allow for interventions and initiatives to be effectively implemented, tracked, and controlled to achieve the overall goal of improved air quality.

The Agenda defines four focus areas: Outdoor Air Quality, Indoor Air Quality, Ambient Odor, and Ambient Noise; each comprising several key priority sectors representing major sources of pollution and each with an overarching target and several supporting goals set across a range of action themes. This is summarized in Figure 6:

Strategic Pillars	Monitoring	Mitigation	Management

Main Focus Areas	Outdoor Air Quality	Indoor Air Quality	Ambient Odor	Ambient Noise
Supporting Goals	8	3	4	5
Action Themes	29	6	10	16
Key Sectors	Transport, energy and electricity generation, waste, construction	Construction supplies, Materials used in household products and maintenance	Waste management, wastewater treatment, industries	Transport, construction, industrial sector

Figure 6: Number of initiatives in each of the main focus areas

[24] It is highlighted that the "Management" pillar includes a monitoring aspect, however within the context of the three pillars of the Strategy, the "Monitoring" pillar specifically relates to physical monitoring / measurement of air pollutants or related criteria.

6.1 Governance Mechanism

The UAE Council for Environmental and Municipal Work is responsible for laying down the general foundations for promoting joint action in the field of environment and municipal services. The Council will act as the steering committee for the implementation and follow-up of the Agenda as a permanent item on the Council's agenda.

Given the cross-sectoral nature of air quality and the different partners in each of the four focus areas: outdoor air quality, indoor air quality, odors and ambient noise; national working groups/committees will be established to manage matters of a particular area that require additional action at national level. Roles and responsibilities for implementation have also been defined in the implementation plan. Implementation relies on the successful completion of the initiatives through the cooperation and commitment of the concerned authorities. The Ministry of Climate Change & Environment will act as the lead entity of the Agenda, it will follow up on its implementation, and will submit a report on the progress of the action plan to the UAE Council for Environmental and Municipal Work.

The Agenda defined the roles and responsibilities in its implementation plan. The success of the Agenda depends on achieving the initiatives by the concerned authorities by including it in their annual plans and allocating the necessary financial, human and technical resources to implement these initiatives. The Ministry of Climate Change and Environments is the designated body to follow-up on the progress of the initiatives in cooperation with the concerned authorities to implement the Agenda.

6.2 Enablers for the implementation of the Agenda

To provide the most effective environment for the Agenda to be implemented, and to ensure that positive outcomes are maximized, seven critical success factors have been identified. These were developed based on the identified key gaps and challenges in respect of improving air quality in the UAE (see Sections 3 and 4) and feedback from the stakeholder engagement process. These success factors fall into three overall themes presented in the table below: Institutional Framework, Communication and Engagement, and Science, Technology, Research and Training.

		Institutional Framework	Communication and Engagement	Science, Technology, Research and Training
Enablers	An integrated governance policy and system that includes a clear institutional framework to enhance cooperation between partners	✓	✓	
	Enhancing technical and human capabilities within the field of effective air quality management	✓	✓	✓
	Encouraging scientific and academic research in the fields of monitoring, mitigation and management		✓	✓
	Promoting, adopting and applying advanced technology and innovation		✓	✓
	Facilitating and providing financial resources	✓		
	Raising community awareness of air quality issues		✓	✓

Figure 7: Key enablers for implementing the strategy

- An integrated governance policy and system that includes a clear institutional framework to enhance cooperation between partners

It is important for the institutional framework to define the information and requirements for all partners. Topics to be included in the institutional framework include: policies at the federal level, regional and international obligations, roles, responsibilities and obligations of each partner, provisions for monitoring compliance, ensuring enforcement of regulations and legislation, sanctions and incentives, and mechanisms to enhance and enable the governance of issues related to air quality management within the federal and local government and those concerned with implementing the Agenda in various sectors, in addition to provisions for managing data and information related to air quality.

- Enhancing technical and human capabilities within the effective management of air quality

Activities related to monitoring and managing air quality, reviewing and advising on air pollution or exposure mitigation measures, and maintaining an appropriate level of enforcement required varying degrees of specialized skills and techniques. Therefore, it is important for the authorities concerned with implementing the Agenda to strengthen the technical and human capabilities necessary to carry out the tasks of monitoring, observing and managing air quality in an efficient and effective manner.

- Encouraging scientific and academic research in the fields of monitoring, mitigation and management

Having access to current, robust and relevant scientific and academic research is essential to ensuring sustained and effective efforts are made towards improving air quality. Accordingly, it will be necessary to encourage scientific and academic research and consider aspects of cross-disciplinary cooperation, where the integrated outputs and findings provide meaningful and useful information for decision makers. It should also be noted the importance of activating these channels and benefiting from these studies by strengthening the partnership between government agencies and relevant universities to ensure effective partnership.

- Promoting, adopting and applying advanced technology and innovation

Efforts to improve air quality will require adopting advanced technology and artificial intelligence in order to achieve the Agenda's goals. Applications fir advanced technology span many aspects of the Agenda's framework, including, but not limited to: enhancing capabilities while reducing costs in air quality monitoring, providing innovative technology that contributes to sustainable growth in all sectors, such as transportation, energy, building and construction, while controlling emissions of air pollutants, and facilitating effective management through data modeling and forecasts.

- Facilitating and providing financial resources

Managing and monitoring air quality and mitigating pollution requires many resources, the most important of which are financial resources. Financial resources will enable to keep pace with the continuous development in various sectors affecting air quality, and developing specific and innovative solutions to ensure the achievement of the Agenda's goals in the four areas. It should be noted that the implementation of the agenda depends on the availability of financial resources in each of the entities concerned.

- Raising community awareness of air quality issues

There is an urgent need to raise awareness of air quality issues across the board to drive a more holistic and integrated approach across government (e.g., explicitly integrating air quality management concepts into strategic work across disciplines such as urban planning, health and education). This enhances the harmonization of strategies and policies to achieve the greatest efficiency in the efforts made in each of the fields. It is necessary to implement measures to raise society's awareness of air quality issues with the aim of changing consumer choices, habits/behaviors and a push to make informed decisions that will limit air pollution and reduce exposure to pollutants. Air quality is one of the main issues that various segments of society must be made aware of, especially children and youth. Raising awareness and providing good knowledge among community members is important to change behaviors that will reduce air pollution resulting from various sectors such as transportation, energy generation and waste.

6.3 Key Programs and Action

6.3.1. Outdoor Air Quality

Table (3) sets out the first strategic goal for outdoor air quality in the UAE and includes eight key programs along with the action required to achieve the strategic goal.

Outdoor Air Quality

	Key Programs	Action	Monitoring	Management	Mitigation
P1	Strengthen the institutional framework, human resource and technical capacity, and scope of government agencies to effectively monitor and manage outdoor air quality.	Strengthen the framework for coordination and collaboration of outdoor air quality management activities	✓		✓
		Enhance human resource and technical capacities of the government entities in outdoor air monitoring and management	✓	✓	✓
		Review and update national air quality limits / standards			✓
		Develop the National Air Emissions Inventory guide for periodic data collection and inventory development			✓
P2	Ensure that air quality is a key consideration during the development and implementation of strategic projects, and that it is acknowledged as an important factor for sustainable urban development.	Utilize planning policy to effectively consider air quality			✓
		Evaluate air quality impacts of developments using consistent criteria			✓
		Define air quality "critical zones"	✓	✓	✓
P3	Reduce emissions arising activities relating to the transport sector	Reduce emissions from road transport	✓	✓	✓
		Reduce emissions from off-road mobile machinery/vehicles		✓	✓
		Reduce emissions from aviation sector activities		✓	✓
		Reduce emissions from maritime transport		✓	✓
		Reduce emissions from rail transport		✓	✓

P4	Reduce emissions arising from activities of the electricity generation sector	Adopt cleaner technology to generate electricity			✓
		Increase understanding and regulation of 'non-utility' electricity generation activities			✓
		Develop sectoral source emission limits	✓		✓
		Reduce demand side electricity use		✓	✓
P5	Reduce emissions arising from the industrial processes and product use (IPPU) sector and energy generation (other than for electricity generation)	Develop and adopt sector-specific guidelines	✓	✓	✓
		Review and update sectoral source emission limits	✓		✓
		Operators to develop emission reduction plans		✓	
		Control/prevent air quality impacts through planning and/or permitting			✓
P6	Reduce emissions arising from waste sector activities and maximize the environmental benefits of the valorization of materials recovered from waste.	Develop and adopt sector-specific guidelines aimed at reducing the air emissions from waste management tasks	✓	✓	✓
		Review and update sectoral source emission limits	✓		✓
		Control/prevent air quality impacts through planning and/or permitting			✓
P7	Control and reduce emissions arising from the construction sector activities	Develop and adopt sector-specific guidelines	✓	✓	✓
		Monitor and report emissions	✓		✓
P8	Regional cooperation to manage and reduce the impacts of transboundary pollution	Participate in international forums influencing air quality and transboundary pollution			✓
		Develop measures to combat desertification and associated air quality impacts		✓	✓
		Alignment of regional norms and standards and emission reduction initiatives			✓
		Cooperation in research and scientific studies undertaken by the relevant regional coordinating entities			✓

Table 3: Key programs and action related to outdoor air quality

The (P1) key program of the Agenda is to help ensure adequate institutional and technical capacity in tackling outdoor air quality issues.

As population and infrastructure demand grows, the (P2) key program focuses on ensuring that air quality considerations are properly taken into account in urban development plans.

The (P3) key program recognizes emissions from the transport sector as a significant source of air pollution in the UAE and calls for urban planners, transport and housing authorities and other stakeholders to collaborate effectively to develop plans to improve air quality and reduce population exposure to pollution.

The (P4) key program identifies that the electricity generation sector, including the use of generators for residential, commercial and/or industrial use, is a major source of air pollutant emissions in the UAE and that planning policies and permitting requirements should play a role in ensuring that such activities are appropriate within the context of both local and regional air quality. Energy demand reduction strategies and government policies are envisaged to help to drive the change towards less polluting and more sustainable energy generation technologies.

The (P5) key program highlights the importance of reducing emissions from the industrial processes and product use (IPPU) sector. Pollution mitigation efforts will consider the use of Best Available Techniques (BAT) to benchmark what can be reasonably achieved to control emissions.

The (P6) key program focuses on policies and strategies that mitigate emissions from the waste sector, with particular emphasis on coordination between sectors (e.g. electricity generation in the case of waste-to-energy) and key strategies (e.g. odors) as there are several overlaps since emissions associated with waste sector activities are affected by the type of processes and materials used. Efforts in this sector will include enabling the use of innovative technology and effective practices to reduce emissions associated with waste treatment and disposal and to maximize the benefits that can be obtained from waste reuse.

The (P7) key program recognizes that the construction sector (including demolition) in the UAE is a significant contributor of outdoor air pollutants but has historically seen less focus in terms of air quality monitoring and management. Project construction programs can span several years and emissions can change throughout the life of construction and arise from a range of sources including exhaust emissions from equipment and vehicles used on-site, changes in on-road traffic flows (due to construction-related traffic or from traffic management measures), or dust generated on-site during construction or demolition activities.

The (P8) key program emphasizes on the importance of transboundary pollution within the Gulf region and that reducing its impacts is a priority that will require coordinated and sustained efforts from multiple stakeholders in the region. Pollutants released within many of the countries in the region have the potential to cause impacts long distances away from the point of emission (including across national borders). Therefore, the UAE should continue to participate in regional forums and alliances which have the potential to reduce the impacts of transboundary pollution, however effective multilateral participation across several key priority areas shall be targeted. One such area relates to implementing an integrated approach to addressing air pollution and climate change as a linked problem.

6.3.2 Indoor Air Quality

Table (4) sets out the second strategic goal for indoor air quality in the UAE and includes three key programs along with the action required to achieve the strategic goal.

Indoor Air Quality					
	Key Programs	**Action**	**Monitoring**	**Management**	**Mitigation**
P1	Strengthen the institutional framework and human resources and technical capacity of government agencies to effectively monitor and manage indoor air quality and mitigate indoor air pollution.	Develop and implement a framework structure for monitoring and management	✓		✓
		Enhance human resources and technical capacity of the government agencies in indoor air quality monitoring and management	✓	✓	✓
P2	Have access to a compendium of standards setting-out relevant and appropriate use and/or low-emission specifications for construction materials, substances used in furniture and decoration and cleaning products.	Review and conduct a gap analysis of existing standards			✓
		Increase scope and coverage of standards		✓	✓
P3	Have access to a compendium of standards / codes of practice on building design and maintenance	Review and conduct a gap analysis of existing standards/codes of practice			✓
		Increase the scope and coverage of the standards/codes of practice		✓	✓

Table 4: Key programs and action related to indoor air quality

The (P1) key program arose from the stakeholders highlighting at the uncertainties around the roles and responsibilities in relation to indoor air quality issues. A clearer and stronger regulatory and administrative framework will define roles and responsibilities for indoor air quality monitoring and management and pollution mitigation among relevant stakeholders. Collaborative efforts and enhanced knowledge sharing from key stakeholders will however been necessary to ensure that sufficient technical and human resource capacity are available.

The (P2) key program recognizes that controlling emissions of indoor air pollutants at source has the greatest potential to reduce human exposure across various indoor settings. Actions to support this goal will focus on ensuring that adequate standards are in place to limit the content of substances which could give rise to harmful pollutant emissions in a variety of materials used in construction, furnishings and decorations and from the use of consumer products. Efforts will also cover where, when and how these standards are expected to be complied with.

The (P3) key program recognizes that to ensure buildings are designed, operated and maintained in a manner which provides safe ventilation for occupants it will be necessary to build upon existing codes of practice and standards that have been developed by certain agencies and stakeholders. A clear and comprehensive framework of documents which sets out applicable requirements for providing a sufficiently high standard of building ventilation design, operation and maintenance will be compiled and this will be communicated to relevant stakeholders for use across all emirates.

6.3.3 Ambient Odor

Table (5) sets out the third strategic goal for Ambient Odor in the UAE and four key programs along with the actions required to achieve the strategic goal.

Ambient Odor

	Key Programs	Action	Monitoring	Management	Mitigation
P1	Strengthen the institutional framework, human resource and technical capacity of government agencies to effectively monitor and manage odor.	Develop and implement odor monitoring and management framework	✓		✓
		Develop odor standards, policy and assessment criteria			✓
		Control/prevent odor impacts through planning and/or permitting	✓	✓	✓
		Enhance human resource and technical capacity of the government agencies in odor monitoring and management	✓	✓	✓
P2	Reduce odor emissions arising from waste management and disposal, and wastewater treatment activities.	Develop and adopt sector-specific guidelines for controlling odor impacts	✓	✓	✓
		Operators to develop emission reduction plans		✓	
P3	Reduce odor emissions arising from oil and gas sector and fuel storage and distribution activities.	Develop and adopt sector-specific guidelines for controlling odor impacts	✓	✓	✓
		Operators to develop emission reduction plans		✓	
P4	Reduce odor emissions arising from industrial and manufacturing activities.	Develop and adopt sub-sector-specific guidance	✓	✓	✓
		Operators to develop emission reduction plans		✓	

Table 5: Key programs and action related to ambient odor

The (P1) key program focuses on the importance of a regulatory and administrative framework that includes clear and precise standards and guidelines at the federal level, and clarifies the roles and responsibilities of relevant partners. In addition, it also provides the necessary technical and human resources to implement and maintain the initiatives. On the other hand, the presence of the regulatory framework will ensure that efforts are coordinated more efficiently, by establishing and adopting a clear and structured framework to cover all aspects related to odor management and monitoring, so that they are effectively addressed.

The (P2) key program recognizes that minimizing odors from existing waste sites without significant modifications poses a major challenge. It also recognizes a need for an integrated approach to odor assessment, management and mitigation to be taken to ensure that controls are put in place to improve public health and perception. Any actions to be taken need to ensure that measures are appropriate for the facility, cost effective and will achieve the required improvement with the minimum disruption to the facility. Innovative technologies can offer potential solutions for odor emission reductions such as retrofits for existing facilities. New proposed facilities represent opportunities to incorporate such technologies into their design during project planning to ensure that measures to reduce potential odor impacts form an integral part of the project development as early in the process as possible. The program also highlights the importance of developing strategies to convert certain waste streams into energy to reduce odor emissions from landfills.

The (P3) key program addresses the reduction of odors emanating from the oil and gas sector, storage and fuel distribution activities and their negative impacts on society through the development and adoption of special guidelines to control emissions of odors emanating from this sector, in addition to developing plans to reduce emissions by operators at all stages, including planning, implementation and operation.

The (P4) key program deals with odor emissions resulting from industrial activities and manufacturing processes, with some activities (such as the production of chemicals, fertilizers and food processing) considered the main cause of odor emissions in the country due to their wide spread. Thus, the focus should be on those activities through planning/licensing controls and emission reduction measures to ensure that the impacts of odors are minimized.

6.3.4 Ambient Noise

Table (6) for Ambient Noise in the UAE and five key programs along with the actions required to achieve the strategic goal.

Ambient Noise

	Key Programs	Action	Monitoring	Management	Mitigation
P1	Strengthen the institutional framework, human resources and technical capacity of government agencies to effectively monitor and manage ambient noise	Develop and refine noise criteria and standard methodologies for measuring and assessing ambient noise	✓		✓
		Monitor noise levels nationally for compliance with federal standards	✓		
		Control and prevent ambient noise impacts through planning and/or permitting	✓		✓
		Develop noise mapping for new major / strategic projects	✓		✓
		Enhance human resources and technical capacity of government agencies	✓		✓
P2	Reduce noise impacts arising from transport sector	Reduce noise impacts from road transportation		✓	✓
		Reduce noise impacts from the aviation sector		✓	✓
		Reduce noise impacts from rail transportation		✓	✓
P3	Reduce noise impacts arising from the construction sector	Promote good international industry practices		✓	
		Develop and implement plans to manage noise in the construction sector	✓	✓	✓
P4	Reduce noise impacts arising from the industrial sector	Control industrial noise through planning			✓
		Promote mitigation of industrial sector noise by design		✓	
		Develop noise monitoring measures in the industrial sector	✓		
		Develop noise management plans			✓
P 5	Develop standards to control noise arising from consumer and household products and appliances	Develop and adopt guidelines for air conditioning units			✓
		Develop and enforce noise limits for consumer products and appliances			✓

Table 6: Key programs and action related to ambient noise

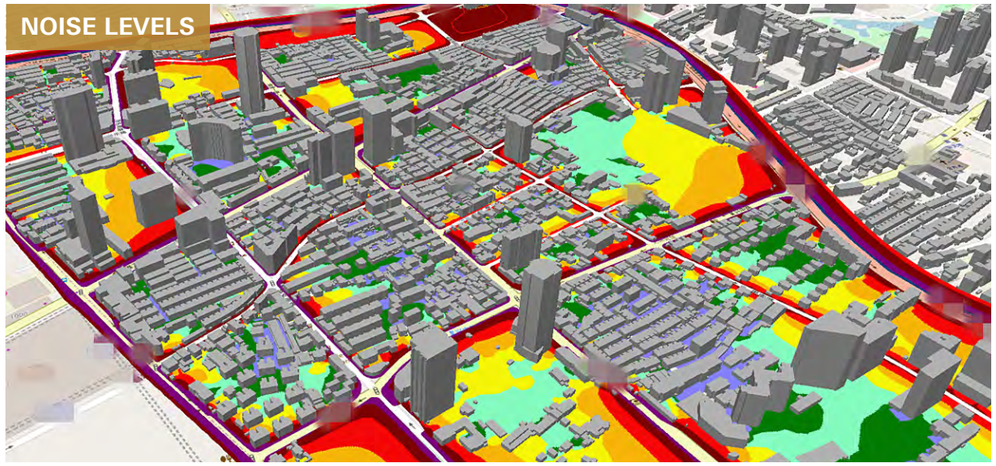
The (P1) key program focuses on ensuring effective noise management through developing criteria that are comparable with international standards, the establishment of recognized guideline for measurement and assessment of environmental noise and the enhancement of technical capacities of regulators assessing ambient noise.

The (P2) key program recognizes that noise levels are expected to be higher in the more urbanized and densely populated areas, particularly in areas located in proximity to major roads, railways or airports, Careful planning and management of transportation related noise is required to ensure the comfort and health of the population.

The (P3) key program recognizes that building construction and excavation work causes considerable noise emissions. A variety of sounds come from the operation of cranes, cement mixers, welding, hammering, boring and other work processes.

The (P4) key program recognizes that mechanized industry has the potential to create serious noise problems and can be responsible for high noise levels outdoors. Noise from industrial sector activities can arise from a wide range of machinery and power generation equipment and often increases according to the power of the machines.

The (P5) key program indicates that noise in residential areas may arise from mechanical devices (e.g. pumps, ventilation systems and air conditioning units), as well as other kinds of sounds generated by household equipment. To control noise from such devices and to minimize adverse noise-related impacts in domestic environments, interventions focused on two distinct areas shall be implemented –noise control measures/limits at source and measures to influence behaviors and practices in relation to using noise-generating equipment.



6.3.5 Promote community awareness of air quality issues

To improve and promote the community awareness on air quality issues, specific key programs have been listed in Table (7).

Programs to enhance community awareness of air quality issues

	Key Programs	Action	Monitoring	Management	Mitigation
P1	Improve understanding of key topics relating to outdoor air pollution through research and scientific studies.	Promote air quality research and scientific studies			✓
P2	Improve awareness of outdoor air quality issues within government and society	Increase awareness and engagement on air quality issues within government and society			✓
P3	Improve understanding of key topics relating to indoor air pollution through research and scientific studies.	Promote indoor air quality research and scientific studies			✓
P4	Improve awareness of indoor air quality issues within government and society	Increase awareness and engagement on indoor air quality issues			✓
P5	Improve awareness of odor issues within government and society	Increase awareness and engagement on odor issues			✓
P6	Improve awareness of ambient noise issues within government and society	Increase public awareness and involvement in noise issues			✓

Table (7): key programs action to raise community awareness of air quality issues

The (P1) key program recognizes that improving knowledge on scientific aspects of air quality management of greatest relevance to the UAE context will help make policies and strategies more effective, through ensuring that actions are most appropriately targeted to deliver air quality improvements. This may include research on topics such as linking KPI for health and air quality, and PM2.5 speciation.

The (P2) key program recognizes that despite efforts to reduce man-made pollution, the UAE population may still be at risk of adverse health effects from exposure to residual, natural pollution, or extreme natural events (e.g. dust storms). Awareness of air quality issues, both within government and the broader UAE population will benefit from the implementation of structured measures to enhance understanding structured measures to enhance understanding of key topics, such as the relationship between outdoor air pollution, health and well-being, and the importance of ensuring alignment of government policies and strategies to maximize positive outcomes for all stakeholders.

The (P3) key program r recognizes that since there are a significant number of variables that influence indoor air quality across spaces within the country, there are still certain gaps in scientific understanding and that there is a need for further research and studies. In many instances this will require collaboration between specialists in complementary fields (e.g. building / material design, environmental scientists, health and socio-economics). Developing a more extensive and robust understanding of the factors resulting in poor indoor air quality, and the consequent risks of exposure causing adverse human health effects, will help make policies and strategies more effective, through ensuring that actions are most appropriately targeted to deliver improvements.

The (P4) key program aims to raise awareness of indoor air quality issues, as achieving this will help to drive procedural and behavioral changes at the government level and society in general, which should reduce the incidence of poor indoor air quality. The factors that influence and relate to indoor air quality include many disciplines handled by different government ministries or departments. Therefore, efforts will be made to provide the basic level of knowledge of the subject to relevant bodies, and to promote the recognition of poor indoor air quality as an environmental hazard that must be controlled. At the community level, awareness of indoor air quality issues will be enhanced through initiatives aimed at incorporating elements of indoor air quality into the formal training of some key professions (e.g. environmental researchers / health officials, medical sciences, building designers and urban planners), as well as at a foundation level within the school curricula.

The (P5) key program stresses the significance of awareness of odor issues to ensure that this topic is given adequate coverage and importance. Improvements in odor management will be more easily achieved at the government level if there is at least a basic level of knowledge of the subject within the relevant bodies. Odor-related topics will be integrated into the formal training of some key professions (e.g. environmental researchers and urban planners), and at a foundation level within the curriculum.

The (P6) key program relates to the measures to be taken to raise awareness of ambient noise as an environmental, health and well-being hazard, which must be controlled by raising awareness of key issues within various government institutions and the wider society.

6.4 Strategic Indicators

Strategic objectives have been defined for each of the four main areas covered by the agenda. In addition, strategic indicators have been developed to follow up on the progress made by the implementation plan of the agenda (Table 8), and two other indicators will be set during the implementation period in agreement with the concerned entities.

Strategic Objectives	Strategic Indicator	Target
Reducing outdoor air pollution levels and exposure	Percentage of compliance with the national standards	- 100% compliance with national standards for gaseous pollutants by 2040 - 90% compliance with national standard of PM2.5 by 2040
	PM2.5 concentration in residential areas	Reach 35 µg/m3 annual average concentration of PM2.5 in residential areas by 2030.
Improving indoor air quality and reducing its risks to human health	Number of national standards related to safeguard indoor air quality	Increase the number of national standards issued/updated relating to safeguarding indoor air quality
Reducing levels of exposure to ambient odors	Percentage of hourly mean concentration of hydrogen sulfide (H2S) below 10 µg/m3 (Details not yet unavailable)	The target will be determined later as part of the implementation of the agenda, in consultation with stakeholders.
Reducing ambient noise levels and keeping them within permissible limits	Details not yet available The target will be determined later as part of the implementation of the agenda, in consultation with stakeholders	The target will be determined later as part of the implementation of the agenda, in consultation with stakeholders

Table 8: Strategic indicators of the National Air Quality Agenda 2031

A combined indicator that includes the four pillars (outdoor air quality, indoor air quality, ambient odors, and ambient noise) is not appropriate at this stage, as the monitoring and observation infrastructure is at different levels of maturity across the four sectors. In addition, there is not yet a defined frame of reference common to all sectors that allows for an integrated evaluation of the status of air quality or the magnitude of its impacts. However, a big objective of the Strategy is to define the frameworks, metrics, methods and tracking mechanism for the newly introduced elements, and for stakeholders to undertake cooperative work that allows for the evaluation of the impact of air quality on the welfare of the population.

6.5 Alignment with the SDGs Indicators

The UAE had an active role in the developing and negotiation of the Sustainable Development Goals (SDGs), and since then it has been committed to pursuing the SDGs. Below is a presentation of the SDGs and their main indicators related to the air quality issue, in addition to the latest information on the UAE performance within these standards. It should also be noted that these indicators are related to indoor and outdoor air quality only. Table (9) shows these indicators.

SDG	Indicator	Value (2017)	Trend	Remarks
3.9 "By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination"	3.9.1 "Mortality rate attributed to household and ambient air pollution"	64.8 deaths per 100,000	Decreasing	There has been an overall decreasing (improving) trend in mortality rates attributed to air pollution over the past 30 years, and this trend is projected to continue.
11.6 "By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management"	11.6.2 "Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)"	40.9 µg/m^3	Increasing	A slight upward trend currently expected in average concentrations of particulate matter less than 2.5 microns in diameter (PM2.5).

Table 9: SDGs indicators related to the air quality issue[25]

[25] UAE scoring data obtained from Institute of Health Metrics and Evaluation website: https://vizhub.healthdata.org/sdg/. Indicator 3.9.1 refers to a combined metric of ambient (outdoor) and indoor air pollutant exposure

6.6 Anticipated Impacts from the implementation of the Agenda

6.6.1. Health impacts

The implementation of the Agenda is expected to lead to a reduced incidence of respiratory diseases and other non-communicable diseases (e.g. stroke, ischemic heart disease, diabetes), and subsequent decrease in the number of premature deaths / reduced life expectancy attributable to exposure to outdoor and indoor air pollution[26]. Improvement of air quality in indoor environments is particularly important considering that people spend most of their time indoors (especially in the summer) and in some areas where certain portions of the population are at a higher risk to outdoor air pollution due to their location. This point has been made even more critical in light of the COVID-19 pandemic, where the low/poor ventilation of indoor spaces could increase transmission of the virus[27]. Lowering the population's exposure to odors and ambient noise can also deliver positive health outcomes, enabling better health and wellbeing for community members.

The Agenda is also expected to support the development and implementation of appropriate methods for prevention and mitigation of exposure to air pollution. This is anticipated to enhance proactive and reactive capabilities in the health sector and therefore provide a more effective service.

6.6.2 Environmental impacts

- Biodiversity and Natural Resources

The UAE enjoys a biodiversity that includes a wide range of terrestrial and marine habitats across a range of ecosystems.[28] According to reports issued in 2020, the UAE includes 49 protected areas covering 15.53% of the country's territory. The protected areas contain the main types of terrain that the country comprises (mountains, deserts, and coastal areas) and include many environmental habitats with varying degrees of sensitivity.

The National Air Quality Agenda attaches importance to initiatives related to reducing major emissions of air pollutants such as nitrogen oxides and volatile organic compounds, as these pollutants are the primary sources contributing to the formation of the ground-level ozone. Ground-level ozone is harmful to plants as it inhibits plant growth and affects both agricultural flora as well as natural ecosystems. Emissions controls on ozone precursor pollutants could help protect sensitive and/or valuable ecological resources.

Other air pollutants such SO_2 have the potential to directly or indirectly affect habitat area or biodiversity indices (a scale of diversity of plant and animal species)[29]. Industrial and oil and gas operations are a major source of SO_2 in the UAE and therefore efforts to reduce emissions of this pollutant may reduce biodiversity losses. Reduction in emissions of SO_2, NO_x and ammonia (primarily from the agricultural sector) are also likely to reduce sulphur and nitrogen (acid and nutrient) deposition, which also have the potential to affect biodiversity.

[26] It is noted that specific population groups such as the elderly, young children and people with pre-existing respiratory or cardiovascular conditions, are more likely to experience adverse health effects due to exposure to air pollution.
[27] The comprehensive package of preventive measures promoted in the country include physical distancing, wearing a mask, frequent hand cleaning or sneezing into bent elbow.
[28] Beeatna (2020). Biodiversity and Environment. Available at: https://beeatna.ae/en/Biodiversity-and-Environment
[29] Bhuiyan, M.A. et al. (2018). Measuring the impact of global tropospheric ozone, carbon dioxide and sulfur dioxide concentrations on biodiversity loss. Environmental Research, 160.

- Agriculture

Agriculture represents a relatively small part of the economy in the UAE, with about 160,000 hectares (400,000 acres) of cultivated land, but this sector covers a large proportion of the local demand for fruits and vegetables[30] and is therefore considered a highly important sector. After the adoption of the National Air Quality Agenda, it is expected that work will be undertaken on initiatives to reduce the primary sources that contribute to the formation of the ground-level ozone pollutant. These measures and initiatives will contribute to reducing agricultural losses resulting from phytotoxicity, in addition to enhancing the ability to better meet local demand in the medium and long term.

There is a number of livestock and poultry farms which cover a large proportion of the local demand for dairy, poultry and eggs products in the UAE. Agricultural emissions such as ammonia associated with livestock farming can affect natural habitats and plant health, and can also contribute to the formation of secondary particulate matter. The Agenda addresses these emissions even though they constitute a relatively small part of the overall air quality problem in the UAE. Similarly, the problem of odors associated with activities related to the agricultural sector may require regulatory or control measures under the Agenda, but are not considered as major issues. On the other hand, fisheries and aquaculture are not expected to be affected by the implementation of the National Air Quality Agenda.

- Climate Change

The UAE's total GHG emissions are expected to continue rising in line with projected economic and population growth[31]. In terms of its Nationally Determined Contributions (NDCs) target, the UAE intends to reduce its GHG emissions for the year 2030 by 23.5%, relative to the Business-As-Usual (BAU) scenario[32].

The UAE Air Quality Agenda will see the implementation of measures and initiatives to reduce emissions of air pollutants across several sectors (including some which represent major contributors to GHG emissions, such as the energy, transportation and industry sectors). Therefore, in some instances these reductions are expected to deliver co-benefits in terms of reducing GHG emissions (e.g. shifts away from fossil fuel to clean energy sources in the energy and transport sectors), and this complements and supports measures contained within other federal strategies which are collectively anticipated to inherently reduce long-term emissions of GHGs, thereby slowing the rate of climate change.

Furthermore, the measures included in the UAE Air Quality Agenda could also directly support the reduction in emissions of certain substances known to cause global warming, such as black carbon and methane, that belong to the group of short-lived climate pollutants (SLCPs), in addition to ground-level ozone.

Implementing the Agenda is also likely to have adaptation co-benefits in relation to reducing the burden of respiratory diseases. As climate change worsens, respiratory diseases may pose an increased level of public health risk, however the reduced burden expected to be achieved by implementing the Agenda could reduce health vulnerability and improve resilience[33].

[30] Nations Encyclopedia (2010). United Arab Emirates - Agriculture.
[31] MOCCAE (2017). National Climate Change Plan of the United Arab Emirates 2017-2050.
[32] Key sectors covered: Energy, Industry Processes and Product Use, Waste, Agriculture, Land Use Change & Forestry. Greenhouse gases covered: Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), Perfluorocarbons (PFCs).
[33] MOCCAE (2019). Adaptation of the UAE's Public Health to Climate Change.

6.6.3 Socioeconomic impacts

In addition to the health impacts that were discussed earlier, the resultant reduced air pollution related morbidity burden within the country would be anticipated to have a direct impact of lowering public and private healthcare costs/expenditure. Additionally, a healthier and happier workforce is likely to possess enhanced ability / capability, which can further strengthen economic performance. Furthermore, improving outdoor air quality and reducing emissions of odors and noise should support an overall perception (by UAE residents and visitors) of a more attractive and healthier environment. This in turn lends itself to further enhance the potential for tourism, and also presents a more attractive opportunity for overseas investment[34].

Improved air quality can also increase the value of real estate. More importantly, there is the prospect of "unlocking" portions of land that were previously considered unsuitable for certain types of higher-value development based on air pollution constraints. This could be particularly important in certain emirates where developable land is scarce.

Strengthened regulations relating to air quality are anticipated to give rise to enhanced opportunities for providing goods and services associated with controlling emissions of outdoor air pollutants (including odor and noise). Similar opportunities could be expected in relation to managing indoor air quality (e.g. air conditioning/ handling system installation and maintenance). These enhanced opportunities could emerge across a range of domestic and non-domestic environments (e.g. residential developments, commercial premises, hotels, malls, schools, construction).

In many instances, the monetary costs associated with implementing measures to improve air quality could be significant. For example, operators of industrial facilities may need to invest in new emission abatement devices or improved process technologies to achieve regulatory compliance or meet revised emission targets. Public and private enterprises providing transportation related services may also experience potential initial increases in capital and/or operating costs to account for emission control technologies or retrofits applicable to the mode of transport. These costs are expected to largely be passed onto consumers.

[34] This could be realised by not only being seen as a global leader in environmental performance and governance, but also in terms of the perceived quality of life in the UAE.

6.7 International conventions in the environmental field

The UAE is engaged in many international conventions related to air pollution or climate change[35], which may have an indirect impact on air quality, including, but not limited to:

- The United Nations Convention to Combat Desertification
- The Stockholm Convention on Persistent Organic Pollutants
- The United Nations Framework Convention on Climate Change
- The Minamata Convention on Mercury
- The Kuwait Regional Agreement for Cooperation on the Protection of the Marine Environment from Pollution and its Protocols
- The International Convention for the Prevention of Pollution from Ships (MARPOL 1973/1978)

Since reviewing and evaluating all related international conventions is not relevant to this document, the relationship between these agreements and the National Air Quality Agenda is mainly focused on limiting and reducing emissions.

As indicated above, the Agenda is expected to support the reduction of GHG emissions in the medium and long term as a co-benefit. This result is also consistent with the goals set out in international agreements on climate change action.

On the other hand, other agreements focus broadly on reducing or limiting emissions of specific pollutants harmful to the environment (such as persistent organic pollutants (POPs) and mercury compounds), and the National Air Quality Agenda supports the goals and responsibilities included in these agreements.

Two of the above conventions focus specifically on controlling emissions in marine environments or affecting them. An example of this is the Kuwait Regional Convention, which sets out measures and commitments to prevent pollution from affecting the regional marine environment, which is one of the goals supported by the National Air Quality Agenda. The UAE is also committed to implementing the regulations included in the International Annex VI for the Prevention of Air Pollution from Ships (MARPOL), and the Agenda aims through its initiatives to support this commitment.

Overall, the implementation of the National Air Quality Agenda will contribute in a positive way to support the aforementioned international agreements. On a larger scale, the efforts that will be made by the UAE government and strategic partners to implement the Agenda will achieve multiple benefits in improving air quality inside and outside the UAE borders (by reducing pollutants that can cause transboundary effects), thus strengthening relations with neighboring countries.

[35] U.ae (2020). Environment budget, policy and laws. Available at: https://u.ae/en/information-and-services/environment-and-energy/environment-budget-policy-and-laws

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