Lebanon's National Strategy for Air Quality Management

2015-2030

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Lebanon's National Strategy for Air Quality Management for 2030

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Executive Summary

Legal Basis of the Strategy

In 2005, the Ministry of Environment (MoE) prepared the Draft Law on the Protection of Air Quality, which was approved by the Council of Ministers (Decree 8075 of 05/05/2012) and is still awaiting its approval by the Lebanese Parliament. Article 12-1 of this Draft Law stipulates the following:

"By a Council of Ministers (CoM) Decree, upon a proposition of the Minister of Environment, and after consultation with the Ministry of Industry, the Ministry of the Energy and Water, the Ministry of Public Works and Transport, the Ministry of Public Health and the Ministry of Agriculture, a National Strategy for Air Quality Management will be adopted..."

Accordingly, MoE has initiated the development of the **National Strategy for Air Quality Management in Lebanon** in 2015 with the support of the European Union (EU) funded programme Support to Reforms on Environmental Governance (StREG), in collaboration with the United Nations Development Programme (UNDP) project of the Environmental Resources Monitoring in Lebanon (ERML).

Air Pollution Impacts on Human Health, the Environment and the Economy

The Strategy confirms the importance of a National Strategy for Air Quality Management in light of the impact of air pollution on the health and on the environment, and which has major ramifications on the economy.

The air pollutants that are of main concern for the health of the population are Particulate Matter ($PM_{2.5}$, PM_{10}), Ozone (O_3) and Nitrogen Dioxide (NO_2). In this respect, there is widespread evidence throughout the world on the adverse health effects associated with exposure to air pollution. It has been demonstrated, for example, that PM can cause or aggravate cardiovascular and lung diseases, heart attacks and arrhythmias, as well as cancer and may lead to atherosclerosis, adverse birth outcomes and childhood respiratory disease; while NO_2 can decrease lung function, can aggravate asthma and other lung diseases and can lead to premature mortality.

Studies in Lebanon have indicated the prevalence of asthma to be at least 50% higher than that in Europe or the United States, and that if air pollution is reduced to guideline levels, the number of asthma cases could fall by 70% and those of bronchitis cases by 50%.

Studies in Lebanon also examined the relationships between emergency hospital admissions for respiratory and cardiovascular diseases and air pollution in Beirut and found significant effects of PM on emergency hospital admissions for diseases of the respiratory and cardiovascular systems.

Regarding the environmental concerns, there is evidence that acidification and eutrophication, both of which results of air pollution, can lead to loss of biodiversity through deteriorating vegetation. Agricultural production, in turn, can be hindered by acidification and eutrophication, both quantitatively (loss of yields) and qualitatively (reduced quality).

The Strategy has indicated that improving air quality leads to economic benefits for Lebanon. A World Bank report estimated that the impact of air pollution on human health in Lebanon in 2008 was in the order of US$151 million per year. Other studies also estimated that the cost of air pollution in Beirut alone was around US$10 million in 2001 and that these costs are considerably higher nowadays due to an expected increase of emissions. A cost-benefit analysis of the Draft Law on Protection of Air Quality in Lebanon determined a benefit to cost ratio of air pollution abatement for the years 2006 – 2025 of 4.6; confirming that the benefits of enhancing air quality monitoring and implementing measures largely exceed the cost of degraded air quality.

Similar studies from other countries are also provided in the Strategy, the cost of the European air quality policies was estimated at around €4.5 billion per year in 2030, while the health benefits were estimated to be about €44 billion per year, i.e. ten times the costs. Similar trends are confirmed in the United States, the Environmental Protection Agency (EPA) confirmed that the benefits of implementing air quality measures under the Clean Air Act (CAA) exceeded the costs by a factor of 30.

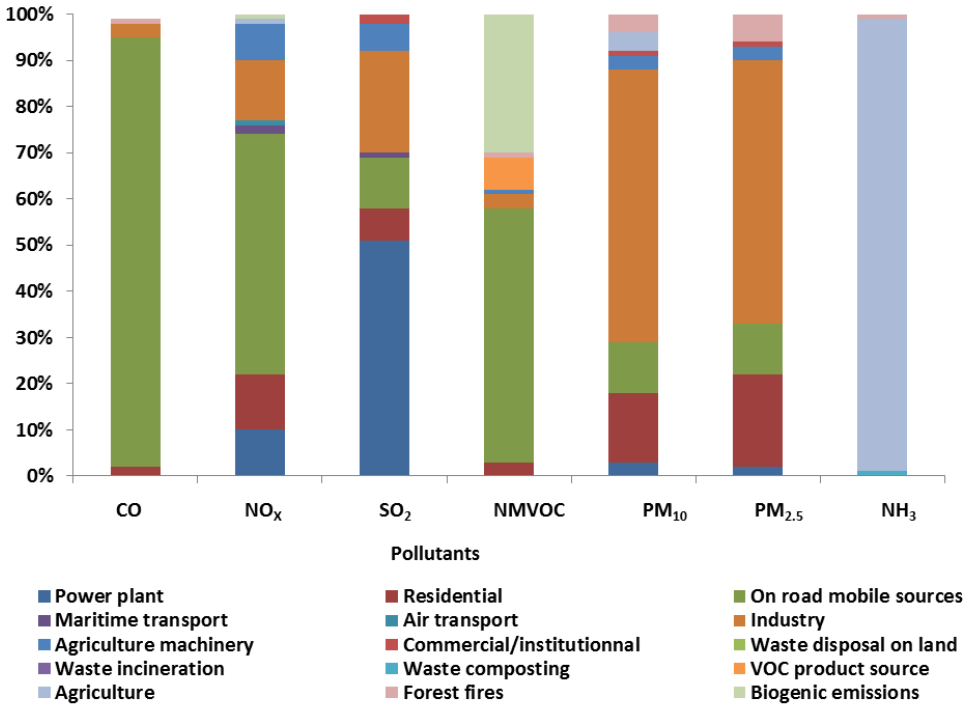
Status of Air Quality in Lebanon

The Strategy has dedicated an important section to document available data on air quality in Lebanon.

According to available studies, about 93% of the emissions of Carbon Monoxide (CO), 67% of Non-Methane Volatile Organic Compounds (NMVOC), and 52% of Nitrogen Oxide (NO_x) are estimated to originate from the on-road transport sector; while 73% of the emissions of Sulphur Dioxide (SO_2), 62% of Particulate Matter (PM_{10}) emissions and 59% of $PM_{2.5}$ are estimated to originate from power plants and industrial sources; as indicated in the Figure below.

Studies of the spatial distribution of emissions also showed that Beirut city and its suburbs encounter a large fraction of the emissions from the on-road transport sector while urban areas such as Zouk Mikael, Jiyeh, Chekka and Selaata are mostly affected by emissions originating from the industrial and energy production sectors.

A more comprehensive analysis of the status of air quality in Lebanon is further provided in the Strategy.



Emissions apportionment for the different pollutants for 2010

The Air Quality Monitoring Network and other monitoring activities

The Strategy covers Lebanon's situation regarding air quality monitoring, taking into account the existing Air Quality Monitoring Network (AQMN) which has been installed and activated by MoE over two phases. The Strategy also notes that several other academic institutions and municipalities have conducted air quality monitoring activities.

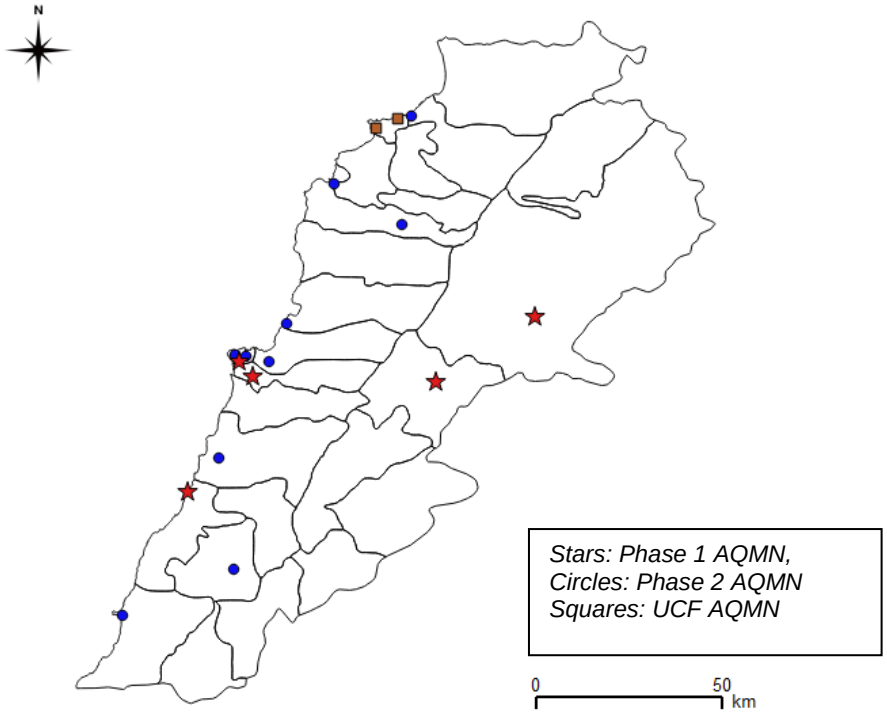
In 2013, MoE launched Phase 1 of the national AQMN with real time air quality monitoring through five stations in Lebanon, with the support of the United Nations Environment Programme (UNEP) and UNDP. These stations used online analysers connected to a supervisory control and Data Acquisition System (DAS) located at MoE.

Phase 2 of the AQMN was launched in 2017 with the support of the EU, and covered the installation of ten additional stations to monitor criteria pollutants, in addition to eight weather stations, three PM stations and one calibration station. Those are also directly connected to the DAS at MoE. The map below shows the geographical distribution of the main Air Quality Monitoring stations in Lebanon.

In 2012, a temporally-resolved and spatially-distributed emission inventory for the year 2010 was developed for Lebanon by University Saint Joseph (USJ) and provided quantitative information for air pollution studies as well as an input to air quality models. This inventory covered major anthropogenic and biogenic sources in the region with 5 km spatial resolution for Lebanon and 1 km spatial resolution for its capital city Beirut and its suburbs.

This inventory was used afterwards in modelling air quality in Lebanon. Other institutions investigated the contribution of the different sources of air pollutants including to ambient Volatile Organic Compounds (VOC) concentrations and organic aerosols through measurements and field campaigns.

Another exercise was launched in early 2014 between MoE, USJ, and the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) to determine air quality background concentrations over Lebanon. This has assessed the air quality resulting from numerous activities and which is needed in various studies including Environmental Impact Assessments (EIAs) studies until the AQMN is fully operational.



Distribution of some of the Air Quality Monitoring stations in Lebanon

Legal, policy, and institutional framework related to the Strategy

The Strategy has identified sectoral as well as cross-sectoral legal and policy frameworks related to Air Quality and which need to be addressed in order to strengthen decision-making for safeguarding Air Quality in Lebanon. It also identifies concerned institutions.

At the cross-sectoral level, the legal building block for the Strategy is the draft Law on the Protection of Air Quality and key related application decrees. Another main legal basis is Law 444/2002 on the Protection of the Environment and its application decrees. At the policy level, limited policies addressing air quality are in place in Lebanon, these include the initial efforts towards a National Sustainable Development Strategy (NSDS) as well as Lebanon's Nationally Determined Contribution (NDC) to Climate Change.

At the sectoral level, the Strategy analysed linkages to the policies and legal framework pertaining to air quality in the transport, energy, solid waste management, agriculture/forestry, and industrial sectors.

The Strategy also covers wildfires risk reduction and warning, given its direct risk of to human health, fauna, flora and estates, and its strong impact on air quality due to accompanying smoke, which can lead to high levels of PM and Polycyclic aromatic hydrocarbons (PAHs). As such, the Strategy covers the institutional set up and current situation related to wildfire risk reduction and warning.

Vision and prerogatives of the Strategy

In accordance with the Draft Law for the Protection of Air Quality, the **vision of the National Strategy for Air Quality Management is: "Every citizen has the right to enjoy clean air".**

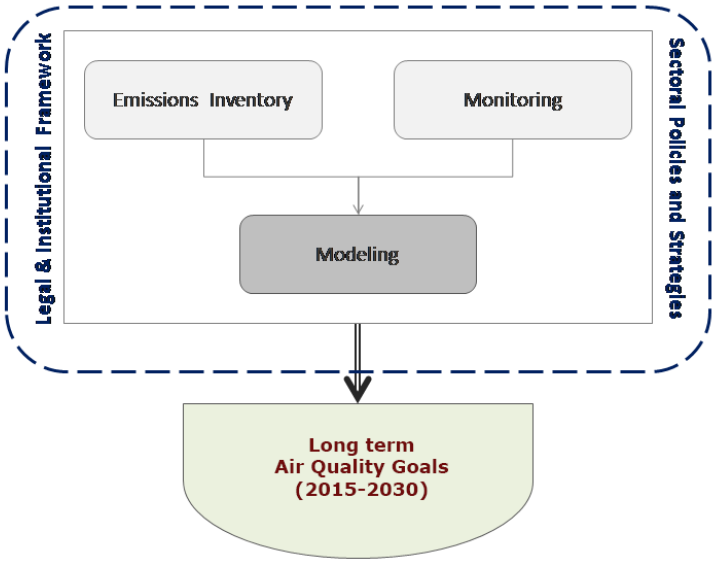
Through this strategy, the GoL is committing itself to enhance and protect ambient air quality through the adoption of long-term goals (including related outputs and priority activities) identified in this strategy, in order to reach the vision set forth in the strategy by 2030. This involves the assessment of CO, NO_x, NH_3, PM, and SO_2 which constitute the majority of the criteria pollutants.

The Strategy will also aim at assessing – in addition to the already assessed tropospheric ozone – other short-lived pollutants (black carbon, fluorinated gases, and methane) as well as greenhouse gas emissions.

The Strategy will address where possible other important aspects such as indoor air quality, at residential as well as public areas (including aspects related to smoking) which also constitute an occupational hazard in the country, in addition, it will address aspects related to noise pollution.

Besides addressing air quality issues, the Strategy highlights the need for improved wildfire risk reduction in Lebanon as a means to prevent large forest fires and avoid or mitigate the associated health and environmental impacts.

The Strategy builds upon existing and future knowledge in air quality in Lebanon as well as needed legal, institutional, and individual capacity development in order to establish a comprehensive intervention as shown in the figure below. At a broader policy level, this strategy will allow Lebanon to align itself with three Sustainable Development Goals (SDGs) and their targets, and will allow the measurement and monitoring of two key indicators under the SDGs.



Overall scheme of the National Strategy for Air Quality Management

Elements of the Strategy

The strategy is composed of 6 strategic goals and allows the GoL to identify the needed outputs and activities to meet the vision set forth in the strategy by 2030 at the level of each goal. The strategic goals together with their outputs and activities provide a framework for action at short-, medium- and long-term level and allow the concerned stakeholders to use the strategy as a basis for identification of needed interventions.

At the level of each strategic goal, impact indicators are identified to support the monitoring and evaluation system needed as part of the implementation process of the strategy.

As such, the Strategy will be used as a basis for developing a short-term action plan for MoE in line with the goals of the strategy. The Strategy will also allow developing future plans and projects for the implementation of needed measures.

The goals, indicators, and outputs identified in the strategy are summarised in the table below.

GOALS	INDICATORS	OUTPUTS
1. **Strengthening the legal and institutional framework**	• **Indicator 1.1:** the priority application decrees required for the implementation of the strategy are issued by the CoM or Ministers' Decisions • **Indicator 1.2:** 100% of the AQ Service staff are provided with needed training in line with the training plan	• **Output 1.1:** Adopting the Draft Law for the Protection of Air Quality • **Output 1.2:** Updating the NAAQS based on the Assessment of AQ throughout the Territory • **Output 1.3:** Strengthening MoE AQ department and other concerned groups • **Output 1.4:** Developing local air quality planning • **Output 1.5:** Developing measures/plans in case of High Pollution levels
2. **Improving air quality assessment throughout the territory**	• **Indicator 2.1:** by 2018, a database is established based on treated information from measurements collected by the entire AQ monitoring network • **Indicator 2.2:** by 2019, an updated national emission inventory is in place	• **Output 2.1:** Establishing, operating and maintaining (including the required QA/QC) the AQ monitoring infrastructure • **Output 2.2:** Establishing a methodology for the analysis, assessment and reporting of the ambient AQ data for MoE and affiliated monitoring systems • **Output 2.3:** Updating, improving and reviewing regularly existing initial emission inventories conducted by MoE and other stakeholders • **Output 2.4:** Developing and updating regularly a national integrated assessment and modelling system • **Output 2.5:** Producing and disseminating the National Fire Weather Index (NFWI) with the use of local networks/stations and start evaluating the performance of existing wildfire danger warning systems
3. **Solving air quality problems due to stationary sources in degraded airsheds**	• **Indicator 3.1:** by 2018, the AQ sampling methodology is issued through an MoE decision • **Indicator 3.2:** starting 2018, all environmental audits and self-monitoring reports are adopting the AQ sampling methodology of the MoE • **Indicator 3.3:** The mitigation measures requested in the issuance of compliance certificates related to AQ are approved by the AQ department	• **Output 3.1:** Adopting proposed Emission Standards for key stationary sources in line with Best Available Techniques (BATs) levels • **Output 3.2:** Developing procedures for enforcing regulations for self-monitoring, reporting and third-party verification in key sectors • **Output 3.3:** Developing the Environmental Licensing Mechanism for Emissions of Air Pollutants
4. **Solving air quality problems from mobile sources**	• **Indicator 4.1:** by 2020, the Mécanique procedures include EU standards in the issuance of Mécanique certificates • **Indicator 4.2:** CoM decisions related to fuel quality standards are issued continuously based on LIBNOR recommendations • **Indicator 4.3:** By 2020, at least one mitigation measure is implemented in the BRHIA in line with source apportionment	• **Output 4.1:** Strengthening the inspection capabilities of mobile sources at national level • **Output 4.2:** Implementing, monitoring and enforcing regulations for fuel quality • **Output 4.3:** Improving AQ from air and maritime transport
5. **Mainstreaming air quality management in priority sectors**	• **Indicator 5.1:** By 2020, at least two sectors have adopted the targets for air quality improvements in the implementation of their sectoral plans • **Indicator 5.2:** Air quality emissions and assessments are included in all climate change plans and projects starting 2018	• **Output 5.1:** Ensuring synergies with national climate change policies and plans • **Output 5.2:** Developing an SEA for the Lebanese Land Transport Strategy • **Output 5.3:** Integrating Air Quality in the Energy Sector • **Output 5.4:** Integrating Air Quality in the industrial sector • **Output 5.5:** Integrating Air Quality in the Solid Waste Management Sector • **Output 5.6:** Integrating Air Quality in the agriculture/forestry sector

GOALS	INDICATORS	OUTPUTS
6. Communication and outreach on Air Quality	• **Indicator 6.1:** By 2018, key communication tools for disseminating of the AQ index through a smartphone application, MoE's website and information panels are operational • **Indicator 6.2:** By end 2017, monthly and yearly reports are uploaded on the MoE website on continuous basis	• **Output 6.1:** Providing data and regular reports on air quality from all monitoring sites and modelling results to the public • **Output 6.2:** Linking the on-going activities at the MoE and the universities

Proposed implementation modalities of the Strategy

To implement this Strategy, multi-stakeholders meetings will be continuously conducted through an Air Quality Task Force (AQTF) which has been established at the outset of the preparation process of the Strategy and will be continued throughout its implementation and follow up.

Moreover, a detailed plan of action to be adopted by the different stakeholders will be developed by the MoE's concerned departments in consultation with all concerned stakeholders and will be used as a framework for the implementation of the strategy.

The MoE will also develop a baseline and target values for the indicators identified in the Strategy in order to monitor the progress of the implementation of the Strategy. MoE will also ensure that that the monitoring and evaluation of the Strategy as well as its updating is conducted on regular basis and will inform the follow up and reporting on the implementation of the Strategy throughout 2030.

Communication and outreach related to the Strategy

Insofar as communication and outreach are concerned, they will be conducted at four main levels, namely:

1. Providing on the MoE website updated data with near real-time air quality index and monthly data (including hourly measurements) and yearly data (AQ & meteorological);
2. Informing regularly the general public about the importance of air quality (website, newspapers, smartphone applications, etc.);
3. Disseminating information on display panels on the ambient air quality followed by awareness campaigns on the use of this information;
4. Developing an early warning system to alert the public about dust and other pollution episodes (with a clear methodology for short-term intervention).

Further to these communication activities, MoE will also make sure to link its on-going activities with universities, research centres, and other concerned institutions. This will take place through a partnership framework, cooperation on different studies, and capacity building programmes.

ملخص تنفيذي

الأساس القانوني للاستراتيجية

في عام 2005، أعدت وزارة البيئة مشروع قانون حماية نوعية الهواء الذي أقره مجلس الوزراء (المرسوم رقم 8075 المؤرخ في 2012/05/05) ولا يزال في انتظار موافقة البرلمان اللبناني عليه. تنص المادة 12-1 من مشروع القانون على ما يلي:

"تقرّ إستراتيجية وطنية لإدارة نوعية الهواء المحيط بمرسوم يتّخذ في مجلس الوزراء بناء على اقتراح وزير البيئة، وبعد استشارة وزارات الصناعة، الطاقة والمياه، الأشغال العامة والنقل، الصحة العامة، والزراعة..."

بناء على ذلك، شرعت وزارة البيئة بوضع **الإستراتيجية الوطنية لإدارة نوعية الهواء في لبنان** في عام 2015 بدعم من برنامج دعم الإصلاحات - الحوكمة البيئية (StREG) الممول من قبل الاتحاد الأوروبي، بالتعاون مع مشروع برنامج الأمم المتحدة الإنمائي لرصد الموارد البيئية في لبنان (ERML).

آثار تلوث الهواء على صحة الإنسان والبيئة والاقتصاد

تؤكد الاستراتيجية على أهمية وضع استراتيجية وطنية لإدارة نوعية الهواء في ضوء الآثار الناجمة عن تلوث الهواء على الصحة والبيئة والتي لها تداعيات كبيرة على الاقتصاد.

إن ملوثات الهواء التي تشكل مصدر قلق رئيسي لصحة السكان هي الجزئيات الصلبة ($PM_{2.5}$، PM_{10}) والأوزون (O_3) وثاني أكسيد النيتروجين (NO_2)؛ وفي هذا الصدد، ثمة أدلة واسعة النطاق في جميع أنحاء العالم على الآثار الصحية الضارة المرتبطة بالتعرض لتلوث الهواء. فقد ثبت، على سبيل المثال، أن الجزئيات الصلبة قد تسبب أو تؤدي إلى تفاقم أمراض القلب والأوعية الدموية والرئة والأزمات القلبية وعدم انتظام ضربات القلب، فضلاً عن السرطان؛ كما أنها قد تؤدي إلى تصلب الشرايين ومشاكل صحية بعد الولادة وأمراض في الجهاز التنفسي في مرحلة الطفولة؛ في حين أن ثاني أكسيد النيتروجين (NO_2) قد يؤثر على وظيفة الرئة ويؤدي إلى تفاقم الربو وأمراض الرئة الأخرى، فضلاً عن الوفاة المبكرة.

لقد أشارت الدراسات في لبنان إلى أن انتشار الربو أعلى بنسبة لا تقل عن 50% مما هو عليه في أوروبا أو الولايات المتحدة، وأنه في حال خفض تلوث الهواء إلى المستويات الموصى بها بموجب المبادئ التوجيهية، فقد ينخفض عدد حالات الربو بنسبة 70% وحالات التهاب الشعب الهوائية بنسبة 50%.

كما تناولت الدراسات التي أجريت في لبنان الارتباط بين حالات الطوارئ التي تدخل المستشفى لأمراض في الجهاز التنفسي والقلب والأوعية الدموية وتلوث الهواء في بيروت، وكشفت عن وجود آثار ملحوظة للجزئيات الصلبة على هذه الحالات.

وفيما يتعلق بالمخاوف البيئية، ثمة أدلة على وجود تحمض واتخام للمياه بالمغذيات، كلاهما من جرّاء تلوث الهواء، مما قد يؤدي إلى خسارة التنوع البيولوجي جرّاء تدهور الغطاء النباتي. كما أن الإنتاج الزراعي بدوره قد يتأثر من جرّاء التحمض واتخام المياه بالمغذيات، وذلك على المستوى الكمي (خسارة المحاصيل) والنوعي (انخفاض الجودة) على حد سواء.

لقد أشارت الاستراتيجية إلى أن تحسين نوعية الهواء يؤدي إلى منافع اقتصادية على لبنان. وقد قدّر تقرير للبنك الدولي أن تكلفة تأثير تلوث الهواء على صحة الإنسان في لبنان في عام 2008 قد بلغت 151 مليون دولار أمريكي في السنة. كما أشارت دراسات أخرى إلى أن تكلفة تلوث الهواء في بيروت وحدها بلغت حوالي 10 ملايين دولار أمريكي في عام 2001 وأن هذه التكاليف أعلى بكثير في الوقت الحاضر بسبب الزيادة المتوقعة في الانبعاثات. وقد حدد تحليل التكلفة والفوائد لمشروع قانون حماية نوعية الهواء في لبنان نسبة الفائدة إلى التكلفة لعملية خفض تلوث الهواء خلال الأعوام من 2006 إلى 2025 بحوالي 4.6؛ ما يؤكد أن فوائد تعزيز تدابير الرصد والتنفيذ المتصلة بنوعية الهواء تتجاوز إلى حد كبير تكلفة تدهور نوعية الهواء.

كما تتضمن الاستراتيجية دراسات مماثلة من بلدان أخرى، إذ تم تقدير تكلفة السياسات الأوروبية المتعلقة بنوعية الهواء بنحو 4.5 مليار يورو سنوياً في عام 2030، في حين تقدر الفوائد الصحية بنحو 44 مليار يورو سنوياً، أي عشرة أضعاف التكاليف. كما تم تأكيد اتجاهات مماثلة في الولايات المتحدة، حيث أكدت وكالة حماية البيئة (EPA) أن فوائد تنفيذ التدابير المتعلقة بنوعية الهواء في إطار قانون الهواء النظيف (CAA) قد تجاوزت التكاليف بعامل قدره 30.

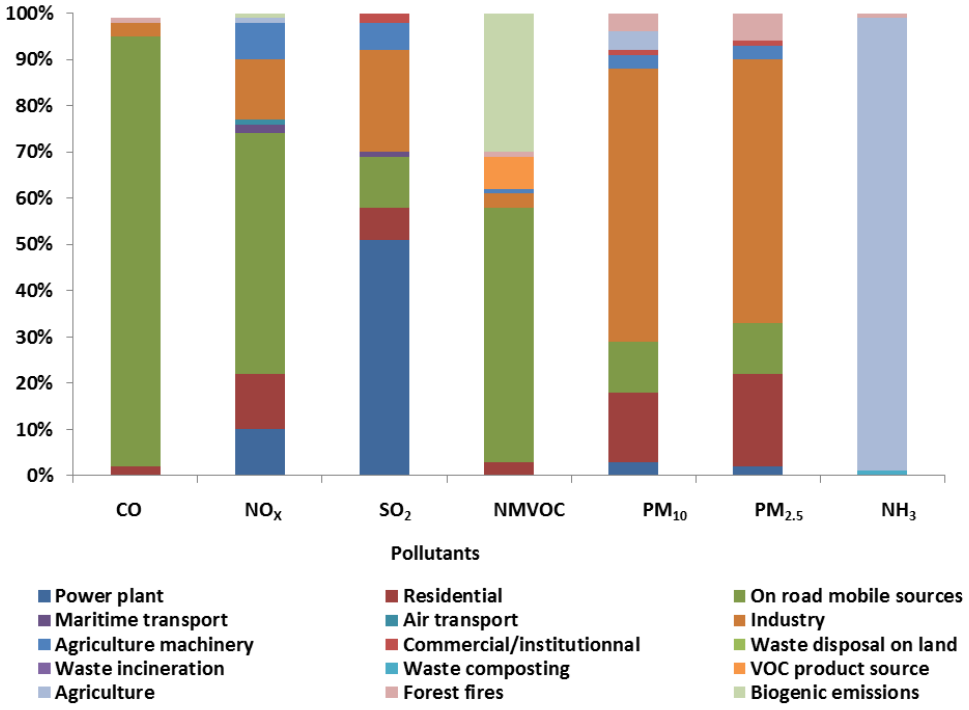
حالة نوعية الهواء في لبنان

لقد خصصت الاستراتيجية قسماً مهماً من أجل توثيق البيانات المتاحة عن نوعية الهواء في لبنان.

ووفقاً للدراسات المتاحة، يقدر أن حوالي 93% من انبعاثات أول أكسيد الكربون (CO) و67% من المركبات العضوية المتطايرة غير الميثانية و52% من أكسيد النيتروجين (NO_x) قد نشأت عن قطاع النقل البري؛ في حين أن 73% من انبعاثات ثاني أكسيد الكبريت (SO_2) و62% من انبعاثات الجزئيات الصلبة (PM_{10}) و59% من الجزئيات الصلبة $PM_{2.5}$ تتبع بحسب التقديرات من محطات توليد الطاقة والمصادر الصناعية، كما هو مبين في الرسم البياني أدناه.

لقد أظهرت دراسات التوزيع المكاني للانبعاثات أيضاً أن مدينة بيروت وضواحيها تواجه جزءاً كبيراً من الانبعاثات الناجمة عن قطاع النقل البري، في حين أن بعض المدن مثل زوق مكايل والجية وشكا وسلعاتة تتأثر بمعظمها بالانبعاثات الناجمة عن قطاعي الصناعة وإنتاج الطاقة.

ثمة تحليل أشمل لحالة نوعية الهواء في لبنان داخل الاستراتيجية.



نسب الانبعاثات بحسب مختلف الملوثات للعام 2010

الشبكة الوطنية لرصد نوعية الهواء وأنشطة الرصد الأخرى

تغطي الاستراتيجية حالة لبنان فيما يتعلق برصد نوعية الهواء، مع الأخذ بعين الاعتبار الشبكة القائمة حالياً لرصد نوعية الهواء التي تم تركيبها وتشغيلها من قبل وزارة البيئة على مرحلتين. وتلاحظ الاستراتيجية أيضاً أن عدة مؤسسات أكاديمية وبلديات أخرى قد نفذت أنشطة لرصد نوعية الهواء.

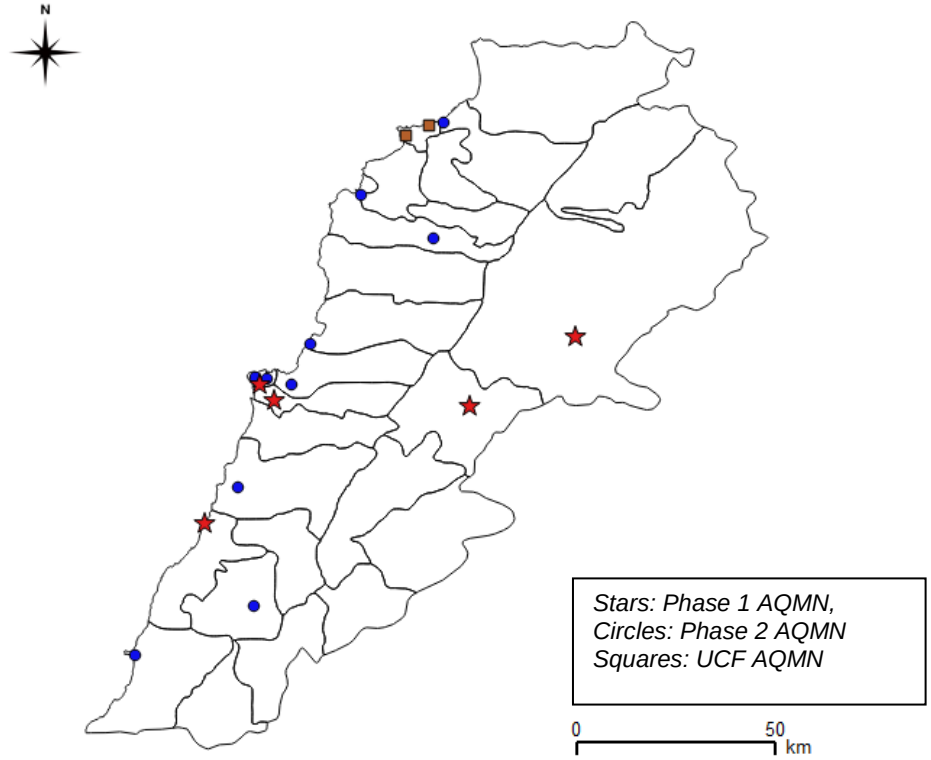
عام 2013؛ عمدت وزارة البيئة، بدعم من برنامج الأمم المتحدة للبيئة وبرنامج الأمم المتحدة الإنمائي، إلى إطلاق المرحلة الأولى من الشبكة الوطنية لرصد نوعية الهواء، بما في ذلك من رصد لنوعية الهواء بالزمن الحقيقي من خلال خمس محطات في لبنان. وقد استخدمت هذه المحطات أجهزة تحليل على شبكة الإنترنت موصولة بجهاز تحكم إشرافي ونظام للحصول على البيانات ضمن وزارة البيئة.

بدأت المرحلة الثانية من الشبكة في عام 2017 بدعم من الاتحاد الأوروبي، وشملت إنشاء عشر محطات أخرى لرصد الملوثات المعيارية، بالإضافة إلى إضافة ثماني محطات للأرصاد الجوية وثلاث محطات لرصد الجزئيات الصلبة ومحطة معايرة واحدة. وهي موصولة مباشرة أيضاً بنظام جمع البيانات في وزارة البيئة.

في العام 2012، تم وضع جردة بالانبعاثات محللة زمنياً وموزعة مكانياً للعام 2010 في لبنان من قبل جامعة القديس يوسف، وهي قد وفرت معلومات كمية للدراسات التي تتناول تلوث الهواء، فضلاً عن مدخل لنمذجة نوعية الهواء. وقد شملت هذه الجردة المصادر الرئيسية البشرية والأحيائية في المنطقة مع تحليل مكاني بقيمة 5 كم للبنان و1 كم للعاصمة بيروت وضواحيها.

تم استخدام هذه الجردة لاحقاً في نمذجة نوعية الهواء في لبنان. كما قامت مؤسسات أخرى بدراسة مساهمة مختلف مصادر ملوثات الهواء، بما في ذلك في تركيزات المكونات العضوية المتطايرة (VOC) في الهواء المحيط والهباء العضوي من خلال القياسات والحملات الميدانية.

تمّ إطلاق عملية أخرى في مطلع العام 2014 بالتعاون بين وزارة البيئة وجامعة القديس يوسف والوكالة الوطنية الإيطالية للتكنولوجيا الجديدة والطاقة والتنمية الاقتصادية المستدامة (ENEA) من أجل تحديد التركيزات الأساسية لنوعية الهواء في لبنان. وقد أسفرت هذه العملية عن تقييم نوعية الهواء الناتجة عن العديد من الأنشطة، وهوم تقييم مطلوب في دراسات مختلفة بما في ذلك دراسات تقييم الأثر البيئي ريثما يتم تفعيل الشبكة الوطنية لرصد نوعية الهواء بشكل كامل.



توزيع بعض محطات شبكة رصد نوعية الهواء في لبنان

الإطار القانوني والسياسي والمؤسسي المتصل بالاستراتيجية

لقد حددت الاستراتيجية الأطر القانونية والسياسية القطاعية والمتعددة القطاعات المتعلقة بنوعية الهواء والتي يجب معالجتها من أجل تعزيز عملية اتخاذ القرارات لحماية نوعية الهواء في لبنان. كما أنها تحدد المؤسسات المعنية.

وعلى المستوى المشترك بين القطاعات، فإن حجر الأساس القانوني للاستراتيجية هو مسودة قانون حماية نوعية الهواء والمراسيم التطبيقية الرئيسية ذات الصلة. كما هنالك أساس قانوني رئيسي آخر هو القانون رقم 2002/444 بشأن حماية البيئة ومراسيمه التطبيقية. أما على مستوى السياسات، فثمة عدد محدود من السياسات التي تتناول نوعية الهواء في لبنان؛ وهي تشمل الجهود الأولية الرامية إلى وضع استراتيجية وطنية للتنمية المستدامة، فضلاً عن مساهمة لبنان المحددة وطنياً لمكافحة تغير المناخ.

على المستوى القطاعي، قامت الاستراتيجية بتحليل الصلات بالسياسات والأطر القانونية المتعلقة بنوعية الهواء في قطاعات النقل والطاقة وإدارة النفايات الصلبة والزراعة/الحراجة والقطاعات الصناعية.

كما تشمل الاستراتيجية مسألة الحد من مخاطر حرائق الغابات والإنذار بها، نظراً لخطرها المباشر على صحة الإنسان والحيوانات والنباتات والعقارات وتأثيرها القوي على نوعية الهواء بسبب الدخان المرافق لها والذي يمكن أن يؤدي إلى مستويات عالية من الجزئيات والهيدروكربونات العطرية متعددة الحلقات. على هذا النحو، تتناول الاستراتيجية الهيكلية المؤسسية والوضع الراهن المتصل بالحد من مخاطر حرائق الغابات والإنذار بها.

رؤية الاستراتيجية واختصاصاتها

تماشياً مع مشروع قانون حماية نوعية الهواء، **تتمثل رؤية الاستراتيجية بكون "لكل مواطن الحق في التمتع بهواء نظيف وصحي".**

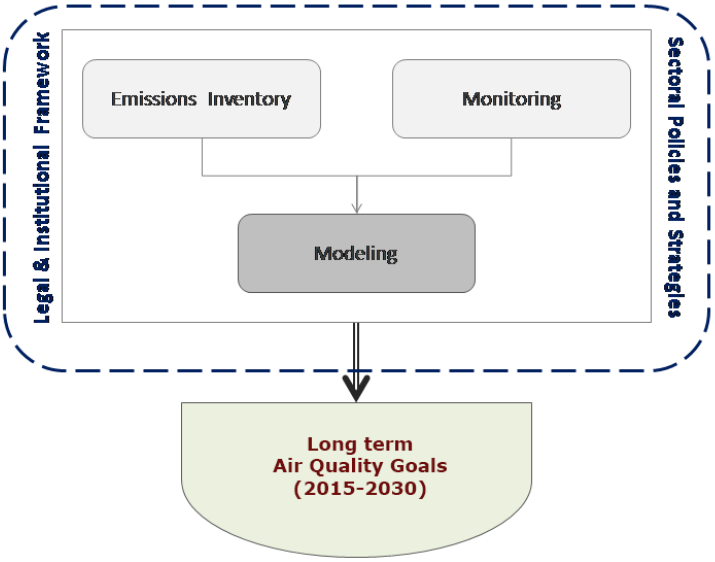
من خلال هذه الاستراتيجية، تلتزم الحكومة اللبنانية بتعزيز وحماية نوعية الهواء المحيط من خلال اعتماد أهداف طويلة الأمد (بما في ذلك الإجراءات ذات الصلة والأنشطة ذات الأولوية) محددة في هذه الاستراتيجية، وذلك بغية تحقيق الرؤية المنصوص عليها في الاستراتيجية بحلول عام 2030. يشمل هذا تقييم أحادي أكسيد الكربون، وثاني أكسيد النيتروجين، والأوزون، وانبعاثات الجزئيات، وثاني أكسيد الكبريت التي تشكل أغلبية الملوثات المعتمدة تقييميًا.

كما تهدف الاستراتيجية إلى تقييم - فضلًا عن أوزون التروبوسفير - بعض الملوثات الأخرى قصيرة الحياة (الكربون الأسود، الغازات الفلورين، الميثان)، فضلًا عن انبعاثات غازات الدفيئة.

ستتناول الاستراتيجية حيثما أمكن نوعية الهواء الداخلي، سواء في المناطق السكنية والأمكنة العامة (بما في ذلك الجوانب المتصلة بالتدخين)، والتي تشكل أيضاً مخاطر مهنية في البلاد، فضلاً عن تناول الجوانب المتصلة بالتلوث السمعي.

وإلى جانب معالجة المسائل المتصلة بنوعية الهواء، تسلط الاستراتيجية الضوء على الحاجة إلى تعزيز تدابير الحد من مخاطر حرائق الغابات في لبنان كوسيلة لمنع حرائق الغابات الكبيرة وتجنب أو التخفيف من الآثار الصحية والبيئية المرتبطة بها.

تستند الاستراتيجية إلى المعارف الحالية والمستقبلية في مجال نوعية الهواء في لبنان، فضلاً عن الحاجة إلى تطوير القدرات القانونية والمؤسسية والفردية من أجل تصميم تدخل شامل كما هو مبين في الرسم البياني أدناه. وعلى مستوى السياسات الأوسع نطاقاً، ستسمح هذه الاستراتيجية للبنان بالامتثال لثلاثة أهداف للتنمية المستدامة، كما أنها ستسمح بقياس ورصد مؤشرين رئيسيين في إطار أهداف التنمية المستدامة.



الخطة العامة للاستراتيجية الوطنية لإدارة نوعية الهواء

عناصر الاستراتيجية

تتألف الاستراتيجية من 6 أهداف استراتيجية، وهي تسمح للحكومة اللبنانية بتحديد المخرجات والأنشطة اللازمة لتحقيق الرؤية المحددة في الاستراتيجية بحلول عام 2030 على مستوى كل هدف.

توفر الأهداف الاستراتيجية إلى جانب مخرجاتها وأنشطتها إطاراً للعمل على كل من المدى القصير والمتوسط والطويل، وتسمح للجهات المعنية باستخدام الاستراتيجية كأساس لتحديد التدخلات اللازمة.

وعلى مستوى كل هدف استراتيجي، يتم تحديد مؤشرات الآثار لدعم نظام الرصد والتقييم المطلوب كجزء من عملية تنفيذ الاستراتيجية.

وعلى هذا النحو، يمكن استخدام الاستراتيجية كأساس لوضع خطة عمل قصيرة الأجل لوزارة التربية بما يتماشى مع أهداف الاستراتيجية. ويمكن أن تستخدم أيضا كأساس لوضع خطط ومشاريع مستقبلية لتنفيذ الاستراتيجية.

وعلى هذا النحو، سيتم استخدام الاستراتيجية كأساس لوضع خطة عمل قصيرة الأمد لوزارة بما يتماشى مع أهداف الاستراتيجية. سوف يتم أيضاً استخدام الاستراتيجية كأساس لوضع الخطط والمشاريع المستقبلية من أجل تنفيذ التدابير اللازمة.

يلخص الجدول أدناه الأهداف والمؤشرات والمخرجات المحددة في الاستراتيجية:

الأهداف	المؤشرات	المخرجات
7. **تعزيز الإطار القانوني والمؤسسي**	• **المؤشر 1.1**: قيام مجلس الوزراء أو الوزراء المعنيين بإصدار المراسيم التطبيقية ذات الأولوية المطلوبة لتنفيذ الاستراتيجية • **المؤشر 1.2**: تزويد 100% من طاقم دائرة نوعية الهواء بالتدريب اللازم بالتماشي مع خطة التدريب	• **المُخرَج 1.1**: اعتماد مشروع قانون حماية نوعية الهواء • **المُخرَج 1.2**: تحديث المعايير الوطنية لنوعية الهواء المحيط على أساس تقييم نوعية الهواء في جميع أنحاء البلاد • **المُخرَج 1.3**: تعزيز دائرة نوعية الهواء في وزارة البيئة والهيئات المسؤولة عن رصد تلوث الهواء • **المُخرَج 1.4**: وضع خطط محلية لنوعية الهواء • **المُخرَج 1.5**: وضع تدابير/خطط في حالة ارتفاع مستويات التلوث
8. **تحسين تقييم نوعية الهواء في مختلف أنحاء البلاد**	• **المؤشر 2.1**: بحلول 2018، إستحداث قاعدة للبيانات مبنية على المعلومات التي قد تمت معالجتها انطلاقًا من القياسات الخاصة بشبكة رصد نوعية الهواء	• **المُخرَج 2.1**: إنشاء وتشغيل وصيانة (بما في ذلك ضمان/مراقبة الجودة) البنية التحتية لرصد نوعية الهواء • **المُخرَج 2.2**: وضع منهجية لتحليل وتقييم والإبلاغ

الأهداف	المؤشرات	المخرجات
	• **المؤشر 2.2**: بحلول 2019، إرساء جردة وطنية محدّثة للانبعاثات	عن بيانات نوعية الهواء لأنظمة الرصد التابعة لوزارة البيئة وتلك المتفرعة • **المُخرَج 2.3**: التحديث والتحسين والمراجعة المنتظمة لجردات الانبعاثات الأولية القائمة والمنتجة من قبل وزارة البيئة وغيرها من الجهات العنية • **المُخرَج 2.4**: وضع نظام تقييم ونمذجة وطني متكامل وتحديثه بانتظام • **المُخرَج 2.5**: توليد مؤشر محلي لخطر اندلاع الحرائق من محطات الأرصاد الجوية القائمة، والبدء بتقييم أداء نظم الإنذار بالحرائق القائمة في التنبؤ بمخاطر الحرائق
9. إيجاد الحلول لمشاكل نوعية الهواء الناجمة عن المصادر الثابتة في السقائف الهوائية الملوثة	• **المؤشر 3.1**: بحلول عام 2018، إصدار منهجية لعينات نوعية الهواء عبر قرار لوزير البيئة • **المؤشر 3.2**: بدءًا من عام 2018، إصدار جميع الكشوفات والتقارير الذاتية البيئية بحسب منهجية عينات نوعية الهواء الخاصة بوزارة البيئة • **المؤشر 3.3**: موافقة دائرة نوعية الهواء فيما يختص بتدابير الحد من المخاطر المطلوبة لإصدار شهادات الالتزام البيئي المتعلقة بنوعية الهواء	• **المُخرَج 3.1**: اعتماد القيم الحدية المقترحة للانبعاثات للقطاعات الصناعية الرئيسية على أن تتماشى مع مستويات أفضل التقنيات المتاحة • **المُخرَج 3.2**: وضع الإجراءات اللازمة لإنفاذ التشريعات للرصد الذاتي والإبلاغ وعمليات التحقق من قبل أطراف ثالثة في القطاعات الرئيسية • **المُخرَج 3.3**: وضع آلية منح الرخص البيئية لانبعاثات ملوثات الهواء
10.إيجاد الحلول لمشاكل نوعية الهواء الناجمة عن المصادر المتحركة	• **المؤشر 4.1**: بحلول عام 2020، اعتماد معايير الاتحاد الأوروبي في إجراءات الميكانيك لإصدار شهادات الترخيص • **المؤشر 4.2**: إصدار جميع قرارات مجلس الوزراء المتعلقة بمعايير جودة الوقود بناءً على توصيات ليبنور • **المؤشر 4.3**: بحلول عام 2020، تنفيذ ما لا يقل عن إجراء واحد للحد من المخاطر في مطار رفيق الحريري الدولي بيروت بالتماشي مع مبدأ توزيع المصادر	• **المُخرَج 4.1**: تعزيز قدرات التفتيش عن المصادر المتحركة على المستوى الوطني • **المُخرَج 4.2**: تنفيذ ورصد وإنفاذ التشريعات المتعلقة بنوعية الوقود • **المُخرَج 4.3**: تحسين نوعية الهواء من النقل الجوي والبحري
11.تعميم إدارة نوعية الهواء في القطاعات ذات الأولوية	• **المؤشر 5.1**: بحلول عام 2020، اعتماد أهداف تحسين نوعية الهواء في الخطط القطاعية لدى ما لا يقل عن قطاعين • **المؤشر 5.2**: ضم انبعاثات وتقاييم نوعية الهواء في جميع مشاريع وخطط تغير المناخ بدءًا من 2018	• **المُخرَج 5.1**: ضمان التعاون مع السياسات والخطط الوطنية المتعلقة بتغير المناخ • **المُخرَج 5.2**: وضع تقييم بيئي استراتيجي لاستراتيجية النقل البري في لبنان • **المُخرَج 5.3**: دمج نوعية الهواء في قطاع الطاقة • **المُخرَج 5.4**: دمج نوعية الهواء في القطاع الصناعي • **المُخرَج 5.5**: دمج نوعية الهواء في قطاع إدارة النفايات الصلبة • **المُخرَج 5.6**: دمج نوعية الهواء في قطاعي الزراعة والحراجة
12. التواصل والتوعية بشأن نوعية الهواء	• **المؤشر 6.1**: بحلول عام 2018، تشغيل عدد من أدوات التواصل الرئيسية لنشر مؤشر نوعية الهواء عبر تطبيق للهواتف الذكية وموقع وزارة البيئة الإلكتروني ولوحات المعلومات • **المؤشر 6.2**: بحلول نهاية 2017، وضع التقارير الشهرية والسنوية على الموقع الإلكتروني الخاص بوزارة البيئة بشكل مستمر	• **المُخرَج 6.1**: توفير بيانات وتقارير منتظمة عن نوعية الهواء لسائر مواقع الرصد ونمذجة النتائج للجمهور العريض • **المُخرَج 6.2**: ربط الأنشطة الجارية في وزارة البيئة والجامعات

الطرائق المقترحة لتنفيذ الاستراتيجية

لتنفيذ هذه الاستراتيجية، سيتم عقد اجتماعات متعددة الجهات المعنية بشكل مستمر من خلال فريق العمل المعني بنوعية الهواء (AQTF) الذي تم إنشاؤه في بداية عملية الإعداد للاستراتيجية، وستستمر هذه الاجتماعات خلال مرحلة التنفيذ والمتابعة.

بالإضافة إلى ذلك، سيتم وضع خطة عمل تفصيلية لاعتمادها من قبل مختلف الجهات المعنية؛ وسيتولى وضعها الإدارات المعنية في وزارة البيئة بالتشاور مع جميع الجهات المعنية لتكون بمثابة إطار لتنفيذ الاستراتيجية.

كما أن وزارة البيئة ستضع خط أساس ومجموعة من القيم المستهدفة للمؤشرات المحددة فيها من أجل رصد التقدم المحرز في تنفيذ الاستراتيجية. وستكفل وزارة البيئة أيضاً رصد وتقييم الاستراتيجية وتحديثها بشكل منتظم، كما أنها ستؤمن المعلومات اللازمة للمتابعة وإعداد التقارير عن تنفيذ الاستراتيجية حتى عام 2030.

التواصل والتوعية بشأن الاستراتيجية

وفيما يتعلق بجهود التواصل والتوعية، سيتم تنفيذها على أربعة مستويات رئيسية هي:

1. تزويد الموقع الإلكتروني لوزارة البيئة ببيانات محدثة باستمرار عن نوعية الهواء تقارب الوقت الحقيقي وبيانات شهرية (بما في ذلك قياسات يتم إجراؤها كل ساعة) وسنوية (بشأن نوعية الهواء والأرصاد الجوية)؛
2. إبلاغ بانتظام الجمهور العريض عن أهمية نوعية الهواء الجيدة (عبر الإنترنت والصحف وتطبيقات الهواتف الذكية، وغيرها)؛
3. نشر معلومات على اللوحات عن نوعية الهواء المحيط، تليها حملات توعية على استخدام هذه المعلومات؛
4. تطوير نظام للإنذار المبكر من أجل تنبيه الجمهور العريض من الغبار وغيرها من الملوثات (مع منهجية واضحة للتدخلات قصيرة الأجل).

وبالإضافة إلى هذه أنشطة التواصل هذه، ستحرص وزارة البيئة أيضاً على ربط أنشطتها الجارية بالتعاون مع الجامعات ومراكز البحوث والمؤسسات المعنية الأخرى. وسيجري ذلك من خلال إطار للشراكة والتعاون في مختلف الدراسات وبرامج بناء القدرات.

Abbreviations

ALI	Association for Lebanese Industrialists
AQ	Air Quality
AQI	Air Quality Index
AQMN	Air Quality Monitoring Network
AQTF	Air Quality Task Force
AUB	American University of Beirut
AWFS	Autonomous Early Warning System for Forest Fires
BAT	Best Available Technique
BAU	Business As Usual
BOT	Build, Operate and Transfer
UoB	University of Balamand
C_6H_6	Benzene
CAA	Clean Air Act
CAP	Compliance Action Plan
CDR	Council for Development and Reconstruction
CFC	Chlorofluorocarbon
CNRS	National Council for Scientific Research
CO	Carbon monoxide
CoM	Council of Ministers
COP	Conference Of the Parties
DAS	Data Acquisition System
DGCA	Directorate General for Civil Aviation
DGLMT	Directorate General for Land and Maritime Transport
DGUP	Directorate General of Urban Planning
EC	European Commission
ECC	Environmental Compliance Certificate
EDL	Electricite du Liban
EEA	European Environment Agency
EFFIS	European Forest Fires Information System
EFL	Environmental Fund for Lebanon
EIA	Environmental Impact Assessment
EIONET	European Environment Information and Observation Network
ELVs	Emission Limit Values
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EMP	Environmental Management Plan
ENEA	Italian National Agency for New Technologies, Energy and Sustainable Economic Development
EPA	Environmental Protection Agency
ERML	Environmental Resources Monitoring in Lebanon
ESCO	Energy audit and Energy Service Companies
ETC/ATM	European Topic Centre for Air Pollution and Climate Change Mitigation
EU	European Union
FWI	Fire Weather Index
GBA	Greater Beirut Area
Gg	Gigagram
GHG	Greenhouse Gases

GIZ	Deutsche Gesellschaftfür Internationale Zusammenarbeit
GLFL	Grand Lycée Franco Libanais
GoL	Government of Lebanon
HCFCs	Hydrofluorocarbons
HSE	Health, Safety, and Environment
IEE	Initial Environmental Examination
INFOCA	Plan de Protección Civil y Atención de Emergencias por Incendios Forestales
IPCC	Intergovernmental Panel on Climate Change
ISF	Internal Security Forces
LARI	Lebanese Agriculture Research Institute
LCEC	Lebanese Centre for Energy Conservation
LCRP	Lebanon Crisis Response Plan
LEPAP	Lebanon Environmental Pollution Abatement Project
LPA	Lebanese Petroleum Administration
LRTAP	Long-range Transboundary Air Pollution
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoI	Ministry of Industry
MoIM	Ministry of Interior and Municipalities
MoPH	Ministry of Public Health
MoPWT	Public Works and Transport
NAAQS	National Ambient Air Quality Standards
NAMAs	National Appropriate Mitigation Actions
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NFP	National Forestry Program
NH_3	Ammonia
NMVOC	Non-Methane Volatile Organic Compounds
NO_2	Nitrogen dioxide
NREAP	National Renewable Energy Action Plan
NSAQM	National Strategy for Air Quality Management
NSDS	National Sustainable Development Strategy
O_3	Ozone
PAHs	Polycyclic Aromatic Hydrocarbons
PM	Particulate matter
PPES	Policy Paper for the Electricity Sector
SEA	Strategic Environmental Assessment
SISSAF	Support for Infrastructure Sector Strategies and Alternative Financing
SLMQ	Sustainable Land Management in the Qaraoun
SO_2	Sulfur dioxide
StREG	Support to Reforms on Environmental Governance
SWM	Solid Waste Management
TSP	Total Suspended Particles
UCF	Urban Community of Al-Fayhaa
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UoB	University of Balamand

USJ	Université Saint Joseph
VOC	Volatile Organic Compounds
WB	World Bank
WHO	World Health Organization

Definitions

The following definitions are provided in the framework of the National Strategy for Air Quality Management in Lebanon and are consistent with those indicated in the Draft Law on the Protection of Air Quality.

Environment: (As defined in the Environmental Protection Law- Law 444/2002): the natural (i.e. physical, chemical and biological) and social surroundings where all living beings live, and the interaction systems within the surroundings and between the living beings; and between the surroundings and the living beings.

Natural Resources: (As defined in the Environmental Protection Law- Law 444/2002): the following environmental elements: air, water, earth and the living beings.

Environmental Impact Assessment (EIA): (As defined in Decree 8633/2012 on the Fundamentals of EIA): Assessment of the likely environmental consequences of a proposed project, and determination of necessary measures for mitigating negative environmental consequences and increasing positive impact on the environment and natural resources before approving or disapproving the project.

Ambient Air: The external air in the troposphere, with the exception of the air inside the work environment.

Ambient Air Quality: Physical, chemical or biological characteristics that distinguish the ambient air state, which are assessed on the basis of limit values.

Pollutants: Any material that enters, directly or indirectly, to an environmental area, which can constitute a damage to the environment in general – affects the natural resources or ecosystems and other common legal means of environmental use; contributes to climate change; or emits bad or harmful odours – or can be particularly harmful to the human health or to properties.

Ambient Air Pollution: Any changes in the ambient air quality resulting from air pollutants.

Pollution Level: Pollutants concentration level in the ambient air or pollutants deposits a specific area during a specific period of time, which will be determined according to the adopted method of measuring the pollution levels.

Emission Source: Any point, line or area from which pollutants are released into the ambient air.

Installation: Any permanent place where equipments and vehicles are used to produce a specific product.

Stationary Source (or Stationary Emission Source): Any construction, installation or intervention in the natural environment that constitutes, by itself or any related activities, an emission source.

Mobile Source (Mobile Emission Source): Any land, sea or air machinery equipped with an inside combustion engine, where solid, liquid or gas fuel is used and constitutes an emission source.

Emissions: Any discharge, from a defined source, of solid, liquid or gas pollutants in the ambient air.

Limit Value: Pollutants level defined on the basis of scientific research and information, in order to avoid, prevent or mitigate the negative impact of ambient air pollutants on the environment in general and on public health in particular; which must be reached in a specific period of time and must not be exceeded after that.

Emission Limit Values: Pollutants levels contained in the emissions that are allowed to be discharged in a specific period of time and must not be exceeded.

Threshold Limit Values: Pollutants levels which, when exceeded, would constitute a limited hazard to the public health when exposed to these pollutants for a short period, it is the level that requires, when exceeded, notifying and advising those exposed to the pollutants to reduce their exposure period to the ambient air.

Information Threshold Limit Values: Pollutants levels which constitutes, when exceeded a serious hazard to the public health when exposed to these pollutants for a short period, it is the level that requires, when exceeded, notifying and recommending those exposed to the pollutants to take precautionary measures for sensitive persons (the elderly, pregnant women, children, ill persons) to reduce their period of exposure to the ambient air.

Alert Threshold Limit Values: Pollutants levels which constitutes, when exceeded a critical hazard to the public health when exposed to these pollutants for a short period, it is the level that requires, when exceeded, the implementation of emergency procedures to protect the public health from the exposure dangers to the ambient air.

Target Limit Values: The pollutants level is defined in order to avoid the long-term negative impacts of the ambient air pollutants on the environment in general and on the public health in particular, which must be reached when possible, in a specific period of time.

Specification: (As defined in a draft law on technical norms, specifications and rules and matching assessment procedures): A document determining the characteristics, performance, production method of a particular product or providing a particular service, or specifying the examination, testing or analysis methods, or determining the terminology, symbols, measurements, dimensions, label contents or procedures of a specific job or system.

Environmental Permit for Emissions: Permit issued by the ministry of the environment for every construction, installation or intervention in the natural environment that might, or its related activities, launch pollutants in the ambient air; it is detailed in article 16 of this law.

1 Introduction

1.1 Background

Air quality has substantial impact on human health and the environment; it is thus the environmental factor most adverse to human health (see Section 1.2.1). The World Health Organization (WHO) estimates that 3.7 million deaths each year worldwide are attributable to ambient (outdoor) air pollution and 4.3 million deaths from exposure to household (indoor) air pollution (WHO, 2015). Ninety percent of the health impacts are usually attributed to $PM_{2.5}$; particles that penetrate deep into the human respiratory system and furthermore affect the cardiovascular system.

Ground level ozone (O_3) can lead to premature mortality. Ozone affects forests and plants leading to a substantial crop yield loss (European Commission 2013; Van Dingenen *et al.* 2009).

These health impacts of air pollutants have substantial costs for the society. For the European Union it is estimated that total health-related external costs are in the range of €330-940 bn per year, including direct economic damages of €15 bn from lost workdays, €4 bn healthcare costs, €3 bn crop yield loss and €1bn damage to buildings (European Commission, 2013).

A World Bank report estimated that the impact of air pollution on human health in Lebanon in 2008 was in the order $151 million per year (World Bank, 2011). A study between 2008 and 2010 at the American University of Beirut (AUB) with the Université Saint Joseph (USJ) in collaboration with the National Council for Scientific Research (CNRS) estimated the cost of air pollution in Beirut in 2001 at around $10 million[1]. It can be expected that these costs are considerably higher nowadays due to an expected increase of emissions.

In light of the above background, the Ministry of Environment (MoE) prepared in 2005 the draft Law on the Protection of Air Quality. Article 12-1 of this draft Law stipulates the following:

"By a Council of Ministers (CoM) Decree, upon a proposition of the Minister of Environment, and after consultation with the Ministry of Industry, the Ministry of the Energy and Water, the Ministry of Public Works and Transport, the Ministry of Public Health and the Ministry of Agriculture, a National Strategy for Air Quality Management will be adopted...."

Accordingly, MoE has initiated the development of the **National Strategy for Air Quality Management in Lebanon (refered to as the Strategy in this document)** in 2015 with the support of the European Union (EU) funded programme Support to Reforms on Environmental Governance (StREG), in collaboration with the United Nations Development Programme (UNDP) project of the Environmental Resources Monitoring in Lebanon (ERML), the collaboration with UNDP was continued through the Sustainable Land Management in the Qaraoun (SLMQ) project since 2016.

Besides addressing air quality issues, this Strategy highlights the need for improved wildfire risk reduction in Lebanon as a means to prevent large forest fires and avoid or mitigate the associated health and environmental impacts. The need for an integrated system of fire danger forecast comes in line with the needs for improved fire risk management as highlighted in Lebanon's National Strategy for Forest Fire Management (approved by CoM Decision No. 52 dated 13/5/2009).

[1] https://website.aub.edu.lb/communications/media/Documents/May_2011/air-pollution-Beirutis-EN.pdf

1.2 Impacts of Air quality on Human Health and the Environment

1.2.1 Impacts on Human Health

As described in Section 1.1, air pollutants of main concern for the general population are $PM_{2.5}$, PM_{10}, O_3 and NO_2.

There is widespread evidence throughout the world on adverse health effects associated with exposure to ambient $PM_{2.5}$ (WHO, 2006). Recent studies conducted by WHO concluded that long-term exposure to $PM_{2.5}$ is a cause of both cardiovascular mortality and morbidity (i.e. there is a clear causal relationship). Moreover, for $PM_{2.5}$, health effects have been found to occur at fairly low levels, which were only a little above low background concentrations (WHO, 2013a). Thus, it has not been possible for WHO to propose guidelines that provide complete health protection. Also, the dose response function of health impacts for $PM_{2.5}$ is more or less linear over a wide range of pollutant levels. This means that a reduction of $PM_{2.5}$ levels is of benefit for the population irrespective of concentration levels. The epidemiological evidence shows that effects are possible after both short- and long-term exposure.

As for ozone and based on newly accumulated evidence from epidemiological time series studies, WHO lowered the guideline value in the global update for the daily maximum 8-hour mean for ozone from 120 µg/m³ to 100 µg/m³. Effects on daily mortality were observed at ozone concentrations below the previous guideline but without clear evidence of a threshold. Therefore, health effects might occur in some sensitive individuals even below the guideline level.

For nitrogen dioxide (NO_2), mainly the respiratory system is affected by this pollutant. Hence, associations were found between short- and long-term exposure to NO_2 and mortality and morbidity (WHO, 2013a). These effects were found in areas where concentrations were at or below the current standard values. However, as NO_2 is associated with other complex combustion-generated air pollutant mixtures, these effects could not be unequivocally attributed to NO_2 only.

A summary of impact of various air pollutants on human health is provided in Table 1.

Table 1: Impact of the main air pollutants on human health (source: EEA, 2014).

POLLUTANT	HEALTH EFFECTS
Particulate matter (PM)	Can cause or aggravate cardiovascular and lung diseases, heart attacks and arrhythmias. Can cause cancer. May lead to atherosclerosis, adverse birth outcomes and childhood respiratory disease. The outcome can be premature death.
Ozone (O_3).	Can decrease lung function. Can aggravate asthma and other lung diseases. Can lead to premature mortality.
Nitrogen dioxide (NO_2)	Exposure to NO_2 is associated with increased all-cause, cardiovascular and respiratory mortality and respiratory morbidity.
Sulphur dioxide (SO_2)	Aggravates asthma and can reduce lung function and inflame the respiratory tract. Can cause headaches, general discomfort and anxiety.
Carbon monoxide (CO)	May lead to heart disease and damage to the nervous system; can also cause headache and fatigue.
Benzene (C_6H_6)	Is a human carcinogen.

When compared to different risk factors for human health, it becomes clear that ambient air pollution is the major environmental risk factor: It ranked 9th in a list of 67 risk factors on a global scale (Lim *et al.*, 2012).

According to a WHO study, Lebanon is one of the countries in the Eastern Mediterranean being most affected by outdoor air pollution (WHO, 2013b). However, the study also mentions that the

health impact of air pollution might even be much larger than the estimations provided. Thus, WHO provided the following objectives in relation to air quality in Lebanon:

- Strengthen the regulatory capacity and partnership building roles of the public health sector for establishing and monitoring national air quality standards in line with WHO air quality norms;
- Develop/strengthen the surveillance function of the public health sector with regards to air quality;
- Increase the awareness of all stakeholders (including the public) about air pollution risks.

The joint study by AUB, USJ and CNRS between 2008 and 2010 indicated the prevalence of asthma to be at least 50% higher than that in Europe or the United States, and that if air pollution is reduced to guideline levels, the number of asthma cases could fall by 70% and bronchitis cases by 50%. A more recent study examined the relationships between emergency hospital admissions for respiratory and cardiovascular diseases and air pollution in Beirut (Nakhlé *et al.,* 2015, 2015b). The authors found significant effects of PM on emergency hospital admissions for diseases of the respiratory and cardiovascular systems. The results are in line with that of other studies throughout the world.

1.2.2 Impacts on the Environment

Besides their adverse impact on human health, air pollutants are also a threat to the environment. Acidification, which is caused by emissions of sulphur dioxide and nitrogen oxides, leads to changes of aquatic and forest ecosystems, which caused the extinction of fish in many Scandinavian lakes and damages of forests especially in Eastern European countries. Thus these pollutants often impact far away from where these gases are released (United Nations, 2004).

Eutrophication is caused by excess nitrogen deposition and causes large ecosystem changes, in particular on heathlands with poor soils where the traditional vegetation dominated by heather had turned into grasslands. Eutrophication thus can cause a loss of biodiversity.

Ground-level ozone leads to damages both of vegetation and human health. Above a certain level, ozone pollution damages crop plants by, for example, causing a yellowing of leaves and premature leaf loss, decreased seed production and reduced root growth, resulting in reduced yield quantity and/or quality and reduced resilience to other stress such as drought (ICP Vegetation, 2011; Van Dingenen et al., 2009).

1.2.3 Benefits Compared to Air Pollution Control Costs

The effectiveness and the efficiency of the European air quality policies were reviewed in detail in 2011 to 2013 in the light of new scientific findings on the impact of air pollution[2]. The emission reduction cost of this policy package would amount to €4.5 billion/year in 2030. However, the health benefits are estimated to be about €44 billion/year, i.e. ten times the costs[3].

For the US, the Environmental Protection Agency (EPA) confirmed that the benefits of implementing air quality measures under the Clean Air Act (CAA) exceeded the costs by a factor of 30 (US EPA, 2011) [4].

A cost-benefit analysis was specifically done for the Draft Law on Protection of Air Quality in Lebanon (SELDAS, 2005). This study determined a benefit to cost ratio of air pollution abatement for the years 2006 – 2025 of 4.6; i.e. in this case the benefits largely exceed the cost of enhancing air quality monitoring and implementing measures.

The costs for air quality abatement measures are further reduced by implementing measures to address climate change. This is especially true when dealing with short-lived climate forcers (in-

[2] http://ec.europa.eu/environment/air/review_air_policy.htm

[3] Non-health benefits could not be expressed in monetary terms

[4] The estimated benefits to costs ratios are in range of 4 to 92, with the most likely value of 32 for the years from 1990 to 2020.

cluding black carbon, ozone, methane). Certain measures such as improving energy efficiency usually result in net savings. Overall, the implementation of ambitious measures to reduce the emissions of greenhouse gases is of large benefit to air quality and energy security as well[5].

1.3 Legal basis of the Strategy for Air Quality Management in Lebanon

The need for the Strategy for Air Quality Management in Lebanon is stipulated in "**Article 12: The National Strategy for Air Quality Management" of the draft Law for the Protection of Air Quality.** This article includes several provisions which will be covered in different sections of this strategy; more specifically sub-section (12-2) of article 12 of the draft law calls for the following provisions to be achieved through the Strategy for Air Quality Management:

- Article12-2-1. Respecting Lebanon's international engagements, particularly as pertaining to the international treaties, conventions and protocols whose provisions touch upon air quality management, such as the United Nations Framework Convention on Climate Change (UNFCCC);
- Article 12-2-2. Preservation of the ambient air quality in regions corresponding to the limit values related to the ambient air quality;
- Article 12-2-3. Improve the ambient air quality in regions that do not correspond to the limit values related to the ambient air quality;
- Article12-2-4. Taking measures that reduce the ambient air pollution as a first step towards eradicating the negative impacts incumbent on the environment and public health.

1.4 Structure of the Strategy

Chapter 1 of this Strategy describes its background and legal basis. Chapter 2 provides an overview of the current status of air quality management in Lebanon including an assessment of the current situation of air quality in Lebanon, the institutional and legal framework related to air quality as well as wildfire risk management in the country. Chapter 3 describes the vision and long-term goals that should be achieved through the implementation of the strategy by 2030. Chapter 4 provides the proposed modalities for the implemention, monitoring and evaluation as well as information sharing related to the Strategy.

[5] The main exception is biomass burning, which in general is advantageous to GHG emissions but can result in the deterioration of air quality.

2 Status of Air Quality Management in Lebanon

2.1 Assessment of Air Quality in Lebanon

The following sections describe the influences on air quality and the framework considered in the assessment of air quality in Lebanon.

2.1.1 Climate and Meteorology

Air quality in general is influenced by climatic conditions and topography. Lebanon's climate is affected by its unique topography composed of the coastal strip, the Lebanon and Anti-Lebanon mountains, and the Bekaa valley. The mountain range, West Lebanon and the coastal area have maritime characteristics, while East Lebanon exhibits a continental climate (MoE/UNDP, 2015).

Steady winds originating from Eastern Europe as well as intense solar radiation during summer months contribute to the formation of high levels of secondary particles and ozone (Waked et al., 2013a), in addition to sulphur dioxide transport from Central Europe (Afif et al., 2008). Moreover, desert dust episodes in fall and spring contribute to elevated PM levels (Saliba et al., 2010).

2.1.2 Current National Ambient Air Quality Standards and Emission Limit Values

The WHO recommends not exceeding certain concentrations of air pollutants since they may have adverse health effects (WHO, 2006, 2013a). Those are issued in the form of guidelines based on expert assessment of the latest scientific findings. The WHO air quality guidelines can be used anywhere in the world but they have been developed to support actions in order to achieve good air quality in order to protect public health[6]. Air quality standards are also set by each country to protect the public health of its citizens playing an important role in risk management and national environmental policies.

National standards vary depending on the strategy adopted to achieve a balance between health risks, technological feasibility, economic considerations, and various other political and social factors which, in turn, depend, *inter alia*, on the level of development and national capacity of air quality management.

With respect to the developing strategic targets in light of the guideline values recommended by WHO, it is recognized that governments should carefully study their local situation before adopting the guidelines directly as legally binding standards. Although there are still gaps and uncertainties in the scientific database, it provides a solid foundation for the recommended guidelines (WHO, 2006).

In 1996, MoE issued Decision 52/1 (dated 12/09/1996) covering the National Ambient Air Quality Standards (NAAQS) for Lebanon based on a review of several international standards at that time including WHO guidelines. Today, twenty years later, these standards are still adopted. Table 2 shows the NAAQS compared to WHO guidelines issued in 2000 and 2006, which confirms that the NAAQS are much higher for several pollutants than those of WHO.

In 2001, MoE amended Decision 52/1 by Decision 8/1 dated 01/03/2001 which defined Emission Limit Values (ELVs) for point sources in Lebanon covering stack emissions and effluent discharge from new and existing industrial establishments.

Although the ELVs are currently being updated by MoE and will be replaced by Emmissions Standards in line with internation practice, to date, the current NAAQS and ELVs remain applicable until new related legally biding decisions are issued.

[6] As an example, a study by the European Parliament describes the differences between WHO guidelines and AQ standards. http://www.europarl.europa.eu/RegData/etudes/STUD/2014/536285/IPOL_STU(2014)536285_EN.pdf

Table 2 NAAQS (1996) and WHO Guidelines (2005)

PARAMETER	NAAQS (1996) MAXIMUM LEVELS (µG/M³)	WHO (2000, 2006) GUIDELINES (µG/M³)
Sulfur dioxide (SO_2)	350 (1 hr) 120 (24 hrs) 80 (annual)	500 (10 minutes) 20 (24 hrs)
Nitrogen dioxide (NO_2)	200 (1 hr) 150 (24 hrs) 100 (Annual)	200(1 hr) 40(Annual)
Carbon Monoxide (CO)	30,000 (1 hr) 10,000 (8 hrs)	30,000 (1 hr) 10,000 (8 hrs)
Ground-level Ozone (O_3)	150 (1 hr) 100 (8 hrs)	 100 (8 hrs)
Total Suspended Particles (TSP)	120 (24 hrs)	150 (24 hrs)
PM_{10}	80 (24 hrs)	50 (24 hrs) 20 (Annual)
$PM_{2.5}$	NA	25 (24 hrs) 10 (Annual)
Lead	1 (annual)	0.5 (annual)
Benzene	5 ppb (annual) (equivalent to 16.2 µg/m³)	UR[7] Life 6.10^{-6}

2.1.3 Sources and Emissions of Air Pollutants

Emissions to air emanate from a very large number of activities, e.g. combustion of fuel, industrial processes, dust re-suspension from roads, vehicles brakes, etc. These sources of pollution are listed along with the amount of pollutant discharged into the atmosphere during a given timein databases called emission inventories. Different methodologies exist for the calculation of the emissions depending on the data available and resources. The development of a complete emission inventory is an important step in an air quality management process. Emission inventories are of multiple functions and are commonly utilized to help determine significant sources of air pollutants; establish emission trends over time, target regulatory actions, and estimate air quality through air quality modelling.

Until 2012, the only reported emissions were those prepared under the National Communications for the United Nations Convetion for Climate Change (UNFCCC) and computed according to the Intergovernmental Panel on Climate Change (IPCC) methodology that focuses on Greenhouse Gases (GHG) emissions and is less appropriate to the indirect GHG, notably CO, NO_x, SO_2, and Non-Methane Volatile Organic Compounds (NMVOC).

[7] UR: Unit risk (UR) estimated for an air pollutant. It is defined as "the additional lifetime cancer risk occurring in a hypothetical population in which all individuals are exposed continuously from birth throughout their lifetimes to a concentration of 1 µg/m³ of the agent in the air they breathe".

In 2012, a temporally-resolved and spatially-distributed emission inventory for the year 2010 was developed for Lebanon by Université Saint Joseph (USJ). It provides quantitative information for air pollution studies as well as an input to air quality models (Waked *et al.*, 2012; Waked and Afif, 2012). This inventory covered major anthropogenic and biogenic sources in the region with 5 km spatial resolution for Lebanon and 1 km spatial resolution for its capital city Beirut and its suburbs. The results obtained for CO, NO_x, SO_2, NMVOC, NH_3, PM_{10} and $PM_{2.5}$ for the year 2010 were 563, 75, 62, 115, 4, 12, and 9 Gigagram (Gg), respectively.

About 93% of CO emissions, 67 % of NMVOC emissions and 52 % of NO_x emissions are calculated to originate from the on-road transport sector while 73 % of SO_2 emissions, 62 % of PM_{10} emissions and 59 % of $PM_{2.5}$ emissions are calculated to originate from power plants and industrial sources (**Figure 1**).

The spatial allocation of emissions shows that Beirut city and its suburbs encounter a large fraction of the emissions from the on-road transport sector while urban areas such as Zouk Mikael, Jiyeh, Chekka and Selaata are mostly affected by emissions originating from the industrial and energy production sectors.

This inventory was used afterwards in modelling air quality in Lebanon (see Section 2.1.5). Other conducted studies investigated the contribution of the different sources in Greater Beirut Area (GBA) to ambient Volatile Organic Compounds (VOC) concentrations and to organic aerosols (Salameh *et al.*, 2015, 2016, Waked *et al.*, 2013b, 2014, 2015) through measurements and field campaigns.

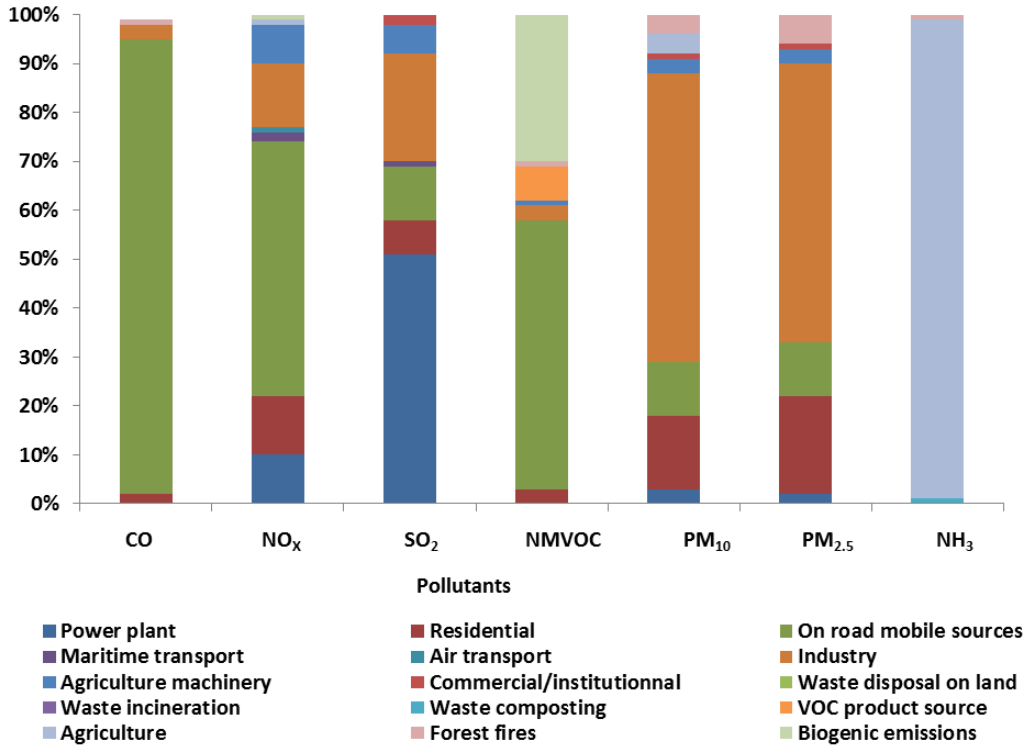


Figure 1: Emissions apportionment for the different pollutants for 2010 (Waked et al., 2012)

2.1.4 Air Quality Monitoring

According to MoE Decision 52/1 dated 12/09/1996, air quality should be monitored to assess compliance with ambient air quality standards stipulated in its Annex 14. Since 2001, Lebanon's capabilities in air quality monitoring have vastly improved. Although the country lacked a government-driven program for air quality monitoring at that time, several universities and institutions have launched short-term research projects on air pollution in Lebanon and started coordinating related activities. However, the research studies focused mainly on Beirut.

In 2013, the MoE launched its first phase of the Air Quality Monitoring Network (AQMN), under the ERML project with the support of the United Nations Environment Programme (UNEP) and UNDP. This Phase 1 AQMN provided real time air quality monitoring through five urban background air quality monitoring stations of which two are also equipped with meteorological stations. The stations use online analysers connected to a supervisory control and Data Acquisition System (DAS) located at MoE.

Phase 2 of the AQMN was launched in 2017 and coverd the installation of ten additional stations with the support of the EU/StREG programme. Moreover, eight additional standalone meteorological stations were added within Phase 2 to expand the meteorological network in Lebanon. Those will be directly connected to the DAS at MoE.

In addition to MoE's AQMN, several other institutions have acquired air quality monitoring facilities; these include the following:

- In North Lebanon, the Urban Community of Al-Fayhaa (UCF) is currently installing three air quality monitoring statios in Tripoli (including a meteorological station), Mina, and Beddawi under the European Union's Gouv'AIRnance project. UCF's stations will be connected to a DAS within its premises. Data generated from the UCF's stations will be communicated to the MoE's DAS to centralise all air quality parameters. All installed analysers within the stations are based on reference methods which meet the requirements of the EU Air Quality Directive 2008/50/EC.
- It is also worth noting that some of the universities, local authorities, and companies have few instruments for the measurements of the airborne pollutants, these include Saint Joseph University (USJ), American University of Beirut (AUB), University of Balamand (UoB), etc.

As shown in **Figure 2**, the air quality monitoring stations are located based on the technical requirements of the EU directives as well as a pre-assessment of the existing situation (previous research, pollution sources and modelling results) where potential degraded airsheds were identified[8].

[8]Degraded airsheds are areas and regions in Lebanon where national air quality standards are persistently breached due to emissions from stationary and/or mobile sources.

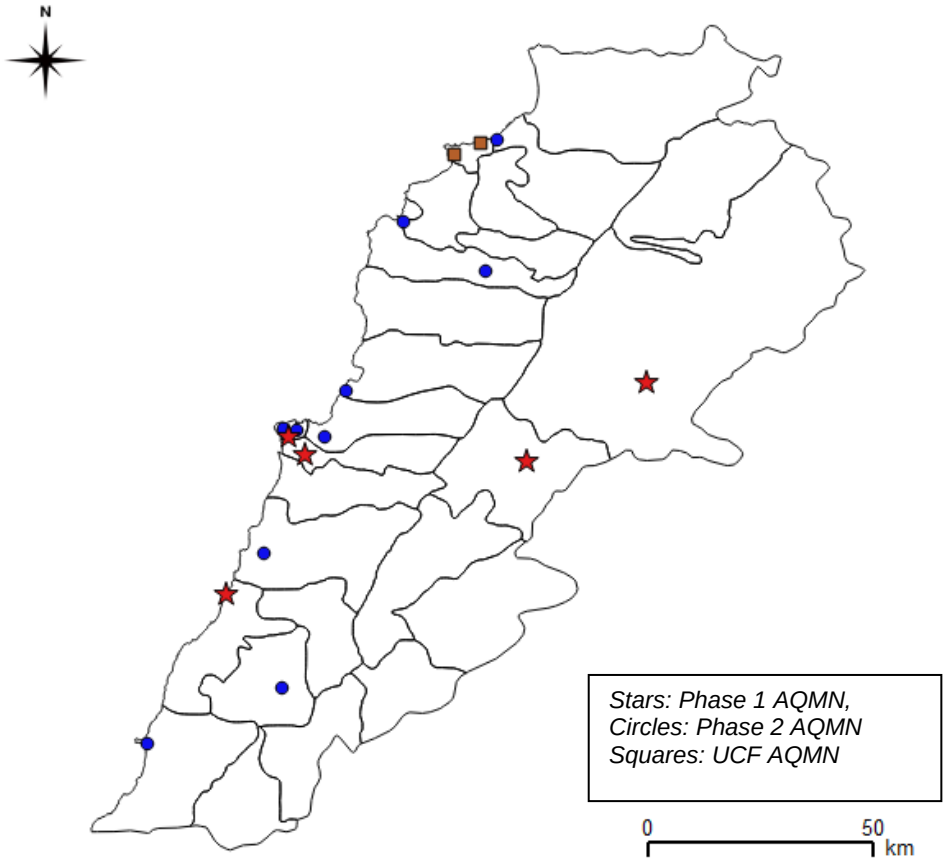


Figure 2: Distribution of some of the Air Quality Monitoring stations in Lebanon

2.1.5 Air Quality Monitoring and Modelling Results

The following sections summarise the air quality situation in Lebanon.

High concentrations of Ozone are not expected in urban areas unless special meteorological conditions occur (temperature inversion, etc.). Ozone monitored in Beirut Pine Forest from May 2004 to February 2006 (Afif, 2008) showed few exceedances during that period both for the 1-hour and 8-hour averaging periods with 135 and 18 exceedances respectively, while the monitoring results from the Phase I AQMN which started in September 2013 show few exceedances[9]. However, for the same period, results show higher values in Baalbeck than in Beirut with 44 and 116 exceedances for the 1-hour and 8-hour averaging periods respectively. Highest values are observed in the summer as meteorological conditions are more favourable for the formation of ozone far from the emission sources of its precursors (NO_x and VOCs).

NO_2 has a longer history of monitoring in Beirut/GBA. First measurements were conducted in Beirut Pine Forest in May 2004 (Afif, 2008). Other field campaigns followed in few sites (Afif *et al.*, 2009, Badaro-Saliba *et al.*, 2014). As of 2013, NO_2 data is available from the National AQMN.

Figure 3 presents the yearly averages in Beirut which exceed WHO recommended value of 40 $\mu g.m^{-3}$. For 2014, when considering WHO recommended values, values higher than 40 $\mu g.m^{-3}$ were recorded in Zahle, Hadath, and Beirut of 59 $\mu g.m^{-3}$, 50 $\mu g.m^{-3}$, and 49 $\mu g.m^{-3}$, respectively but were all compliant with Lebanese national ambient air quality standards for NO_2 of 100$\mu g.m^{-3}$(MoE Decision 52/1).

[9] Reference to Decision 52/1 of 1996 including the NAAQS

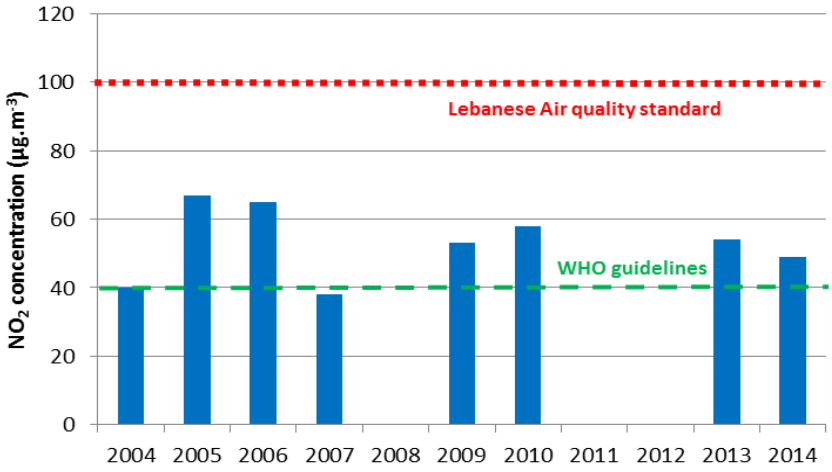


Figure 3: NO_2 annual values over Greater Beirut Area[10].

PM measurements comprise many years of observation from short to medium term field campaigns in different locations of GBA with different measurement technologies (Afif, 2008, Saliba et al., 2010, Kouyoumjian and Saliba, 2006, MoE, 2015).

Some of these sites are more influenced by traffic and some are urban background sites which explain the heterogeneity of the results presented in **Figure 4**. These values show in some cases yearly exceedances of the Lebanese standards and the WHO recommended values for PM_{10} and $PM_{2.5}$. Long range transport of Saharian dust occurs (Saliba *et al.,* 2007, Kouyoumjian and Saliba, 2006) increasing PM levels for several days (sometimes).

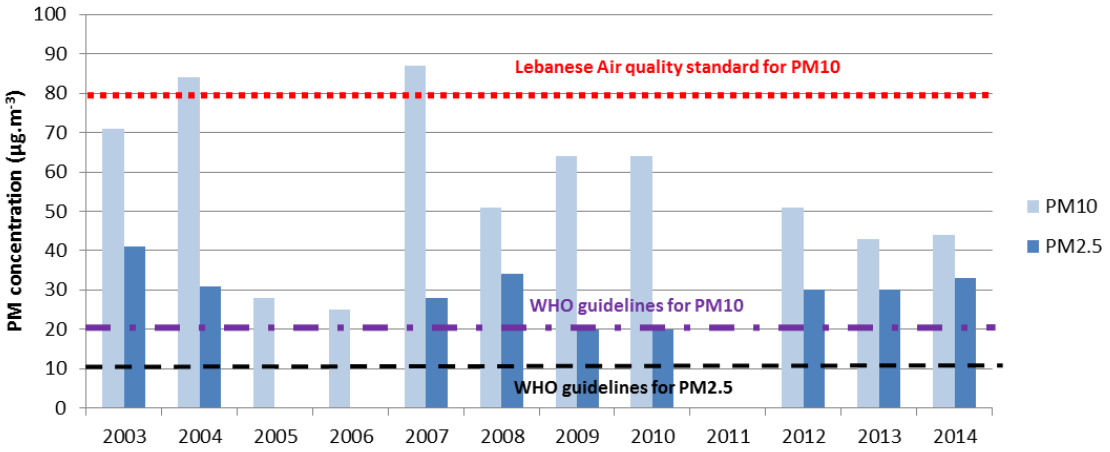


Figure 4: PM annual values over Greater Beirut area[11]

[10] Urban measurements were conducted: at Beirut Pine Forest in 2004 from May 2004 to December 2004 (Afif, 2008), in 20 locations in Beirut in 2005 all year (Afif et al., 2009), in 20 locations in Beirut in 2006 from January to June 2006 (Afif et al., 2009), in 21locations in Beirut in 2007 (Air pollution hotspots in Lebanon progress report, 2011), in 21locations in Beirut in 2009 (Air pollution hotspots in Lebanon progress report, 2011), in 52 locations in Beirut February 17 to April 14, June 2 to July 28, and October 20 to December 15 (Badaro-Saliba et al., 2014), at Beirut Pine Forest in 2013 from September to December 2004 (MoE, Unpublished data), at Beirut Pine Forest in 2014 all year (MoE, Unpublished data).

[11] Urban measurements were conducted: in Beirut at AUB in 2003 using gravimetric and beta-gauge methods for PM_{10} and $PM_{2.5}$ (Air pollution hotspots in Lebanon progress report, 2011), in BourjHammoud using the gravimetric method for PM_{10} and $PM_{2.5}$ from February 2004 to January 2005 (Kouyoumdjian and Saliba, 2006), in Beirut Pine Forest in 2005 for January, February, October, November, and December 2005 for PM_{10} using beta-gauge (Afif, 2008), at Beirut Pine Forest in 2006 from January to April 2006 for PM_{10} using beta-gauge (Afif, 2008), in Haret Hreik from December 2006 to August 2007 using gravimetric method for PM_{10} and $PM_{2.5}$ (Saliba et al., 2010), in Greater Beirut Area at different locations in 2008 using gravimetric and beta-gauge methods for PM_{10} and $PM_{2.5}$ (Air pollution hotspots in Lebanon progress report, 2011), in Beirut AUB, Lycée Abel

Historic measurements of $PM_{2.5}$ and PM_{10} were conducted at different locations in Tripoli. Figure 5 shows the different annual concentrations recorded in Tripoli Urban Center: values higher than the Lebanese standard and WHO recommended values were recorded.

PM_{10} and $PM_{2.5}$ were measured at different sites in 2014 using the AQMN with exceedances of the Lebanese standard for PM_{10}, and consequently WHO recommended values. WHO $PM_{2.5}$ guidelines were also breached on the entire set of measuring sites.

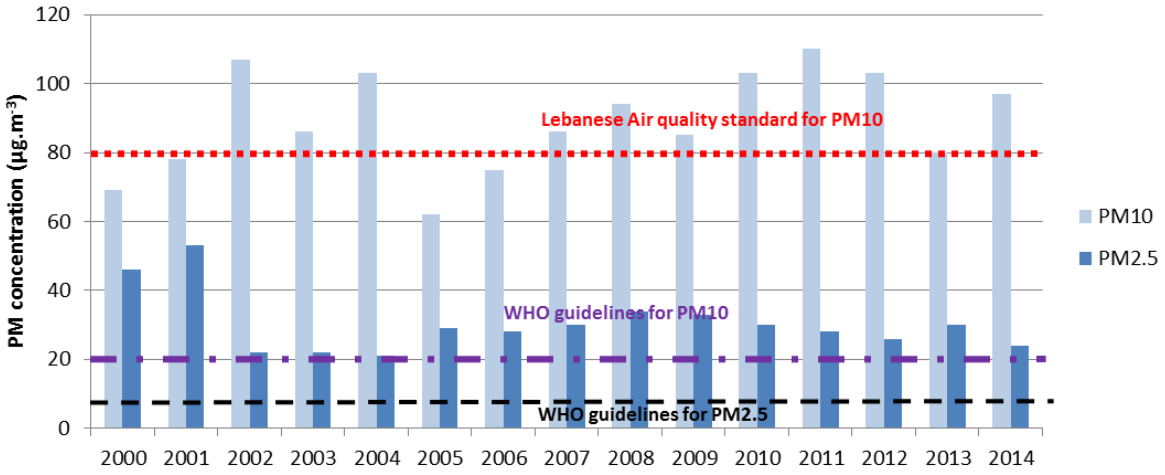


Figure 5: PM annual values over Tripoli (UCF, 2015)

Results from measuring ground level concentration of SO_2 (from December 2004 till July 2006) within the city of Beirut showed low SO_2 concentrations of 8 $\mu g.m^{-3}$ (Afif *et al.*, 2008) compliant with SO_2 air quality limits of MoE Decision 52/1- dated 12/09/1996. Beside local sources, long-range transport can account for an important source of SO_2 in Beirut (Afif *et al.,* 2008). Sulphur dioxide measuring instruments are installed in three locations: Zahle, Hadath, and Saida. The observed values in 2014 were all compliant with the Lebanese standards for the different averaging periods with a yearly average of 12.5 $\mu g.m^{-3}$, 15 $\mu g.m^{-3}$, and 4.68 $\mu g.m^{-3}$ in Zahle, Hadath, and Saida, respectively.

Carbon monoxide which is mainly emitted by traffic (Waked *et al.,* 2012) was continuously measured by USJ from May 2004 to June 2006 at Beirut Pine Forest. Results did not show any important concentrations in Beirut background even at peak hours (Afif, 2008), hence always being compliant with Decision 52/1. Phase I of the AQMN confirmed the previous findings.

Measurements of benzene were conducted in suburban Beirut in summer 2011 and winter 2012 (Salameh *et al.*, 2015). The levels of benzene varied from 0.25 $\mu g.m^{-3}$ to 7.83 $\mu g.m^{-3}$ on an hourly basis with an average of 2 $\mu g.m^{-3}$ over the two campaigns (Salameh *et al.,* 2015). This observed value is compliant with the Lebanese standards but is associated with an excess lifetime risk of leukaemia of less than 1/100,000 according to WHO standards (2000).

As measurements cannot be carried in every point nationwide, modelling is an essential tool to assess air quality. Unlike dispersion models used for permitting purposes, air quality models are more sophisticated and resource demanding tools as they integrate full chemistry and transport. The first air quality modelling exercise was carried out by Waked and co-workers (2013b) for a summer field campaign in 2011 using the only highly resolved emission inventory for Lebanon (Waked *et al.,* 2012).

Kader (LAK), and Grand Lycée Franco Libanais (GLFL) from May 2009 and April 2010 (Massoud et al., 2011), in Beirut measured all year using beta-gauge method for PM_{10} and $PM_{2.5}$ (Mrad Nakhlé et al., 2015), in Beirut Pine Forest in 2013 for September, October, November, and December 2013 for PM_{10} and $PM_{2.5}$ using beta-gauge method (MoE, Unpublished data), in Beirut Pine Forest in 2014 measured all year for PM_{10} and $PM_{2.5}$ using beta-gauge method (MoE, Unpublished data)

Whilst waiting for the AQMN to be fully operational and since air quality background concentrations are needed in the Environmental Impact Assessment (EIA) studies to assess the air quality resulting in the implementation of new industries, changes in industries' fuel type, changes in industrial processes or addition of units, planning of roads, etc.; another exercise was launched early 2014 between MoE, USJ, and the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) to determine air quality background concentrations over Lebanon.

This was the first step of an integration process between measuring and modelling air quality in Lebanon, taking advantage of local scientific skills and up-to-date assessment tools. The ensemble modelling exercise resulted in gridded maps for the different pollutants (O_3, NO_2, PM_{10}, $PM_{2.5}$, SO_2, and CO) as annual averages.

Although the exploration and exploitation of offshore oil and gas resources in Lebanon are still underway, the sources of air emissions which can be generated from this sector from primary and secondary sources (such as venting, flaring, blowouts and fugitive emissions), and which should be taken into consideration in furture air quality monitoring programmes, include the following:

- Criteria pollutants (CO, SO_x, NO_x, PM_{10}, VOCs)
- GHGs (CO_2, CH_4)
- Hazardous & toxic air pollutants (H_2S, formaldehyde, organo-metallic compounds, polycyclic aromatic HCs (benzene, toluene, ethylbenzene and xylene (BTEX))
- Heavy metals (Hg, Ar, Pb, Cu, Ag) + methyl mercury
- Fugitive emissions

Another important sector which also merits to be monitored include the quarrying activities which constitute an important contributor to the degradation of air quality in Lebanon.

2.1.6 Impact of the Syrian crisis on Air Quality in Lebanon

In 2014, the MoE, with support from the EU and the UNDP, published the Environmental Assessment of the Syrian Conflict & Priority Interventions (EASC), which provided an extensive analysis of the incremental environmental impacts of the Syrian conflict (MoE, 2014).

The assessment established a baseline to determine the environmental pre-crisis situation in 2010 or 2011 and determined the incremental impacts of the Syrian conflict at the level of all four areas covered by the assessment, namely Solid waste management, Water and wastewater management, Air quality, Land use and ecosystems. The assessment proposed an Environmental Management Plan for each area including recommendations of priority interventions and their time frame.

With regards to Air Quality, the Environmental Assessment of the Syrian Conflict estimated that, in 2014, the Syrian conflict resulted in an increase of up to 20% in emission of air pollutants in Lebanon leading to a significant degradation of air quality. The main sectors affecting air pollution in Lebanon due to the Syrian conflict are attributed to the following:

- **On-road Transport.** An estimated 5% increase in traffic is expected to result from the Syrian conflict on the main national axes in Lebanon; this will lead to an increase in Nitrogen Oxide (NO_x) and Particulate Matter (PM).
- **Residential Heating.** The assessment has estimated 5% increase in SO_2 emissions which will add up to existing national SO_2 emission levels.
- **Open Burning of Solid Waste.** The release of very toxic and carcinogenic compounds including dioxins and furans due to increased open burning of waste (with more than 300 open dumps in Lebanon) will negatively affect the health of the population living nearby open dumps.
- **Electricity Production.** The incremental quantities of air pollutants originating from private generators have been estimated to be 10% for NO_x and around 2% of the remaining pollutants.

The assessment also estimated that main cities such as Zahle, Baalbeck, Tripoli and Saida will specifically witness a significant degradation in air quality.

While the findings of the assessment were based on a number of displaced of 1.8 million in 2014, the same estimation of the number of displaced is still applicable in 2017 and it has been adopted by the Lebanese Government as part of the Lebanon Crisis Response Plan (LCRP) for 2017-2020 (GoL, 2017) as indicated in Table 3.

As such, and although a more in-depth assessment of the Syrian crisis on air quality in Lebanon should be conducted, it is expected that the impact of the Syrian crisis identified in 2014 still prevails in 2017, and merits to be addressed as part of the Government's response to the crisis

Table 3 - Comparison between the numbers of displaced in the EASC and the LCRP

	Estimated Nbr of Displaced (EASC, 2014)	**Estimated Nbr of Displaced (LCRP, 2017)**
Displaced Syrians	1,730,000	1,500,000
Displaced Palestinians	55,000 (only Palestinian Returnees from Syria-PRS)	310,000 (including PRS & Palestinian Refugees in Lebanon-PRL)
Lebanese Returnees	50,000	35,000
Total	**1,835,000**	**1,845,000**

2.2 Institutional, Policy and Legal Framework related to Air Quality Management

This section provides an overview of the existing institutional and legal framework as well as sectoral policies and strategies related to air quality management.

2.2.1 Institutional Framework

With growing populations, the impending impact of the Syrian crisis, the political instability, and increased use and exploitation of natural resources in Lebanon, institutions realise more than ever the urgency of coordinating and working together for environmental protection. Air quality legislation in Lebanon has evolved over the years to protect populations sharing the medium of breath and life. Government agencies are becoming more aware of the ramifications of national policies and strategies on the surrounding air quality.

A multitude of laws, decrees, and ministerial decisions orchestrate and govern environmental management in Lebanon. Primordial among those are laws, decrees, decisions and circulars promulgated under the Ministry of Environment. Other legal instruments and institutions produce laws, decrees, decisions and circulars to help stipulating action for protection of the environment and human health from nefarious air emissions.

The Strategy is also based on the institutional and legal framework governing air quality and wildfire risk management.

Ministry of Environment

According to Decree 2275 dated 25/06/2009 related to the Organizational Structure of the MoE, the Service of Environmental Technology hosts an Air Quality (AQ) Department which has the following roles and responsibilities:

1. Preparing strategies, plans, programs, operational projects, activities and studies for the sustainable management of air quality, through raising awareness, monitoring, evaluation, prevention, control, and follow-up on implementation.
2. Identifying the sources, causes, methods and places of surrounding air pollution.
3. Monitoring surrounding air quality through the development and implementation of a National Monitoring Program that includes a National Monitoring Network and a National Emissions Inventory.
4. Fixing threshold values relating to ambient air quality and those relating to emissions resulting from fixed and mobile sources of air pollution, by virtue of a decision of the Minister of Environment upon the proposal of the Director General of Environment and after consultation with the Council of State.
5. Identifying the classified industrial and non-industrial establishments that require environmental permits with regards to emissions release, by virtue of a decision of the Minister of Environment upon the proposal of the Director General of Environment and after consultation with the Council of State.
6. Determining the mechanism of environmental licensing with regards to the release of emissions and the basis on emissions trading, by virtue of a decree or decrees issued by the Council of Ministers upon the proposal of the Ministers of Environment and Finance and following consultation with the Council of State.

Ministry of Public Health

The Ministry of Public Health (MoPH) is responsible for establishing guidelines and regulations regarding indoor air quality (indoor spaces include workspace, malls, restaurants, etc.). For example, MoPH and the WHO established jointly in 2009 the National Program for Tobacco Control. The program was launched after the GoL signed in December 2005 the WHO Framework Convention on Tobacco Control, to counter the increasing prevalence of smoking in Lebanon, as well as to reduce the burden of tobacco-related diseases, including their impact on human health and economy.

Ministry of Energy and Water

In the energy sector, the Ministry of Energy and Water (MoEW) is responsible for the installation of power plants. Those are handed over to Electricite du Liban (EDL) for operation. Although the MoE Decision 8/1 of 2001 provided Emissions Limit Values (ELVs) for power plants between 100MW and 300MW which also covers combustion processes in the industrial sector; to date, there are no emission standards for large power plants (above 300 MW).

In the oil and gas sector, the Lebanese Petroleum Administration (LPA) was established by the CoM under tutelage of MoEW to oversee the sector. The licensing round for the awarding of exploration licenses is expected to close by September 2017 and activities to kick-off at the end of 2017. It should also be noted that the monitoring and enforcement of environment aspects related to this sector are to be undertaken in coordination with the MoE.

Other ministries

In the transport sector, the Ministry of Interior and Municipalities (MoIM) as well as the Ministry of Public Works and Transport (MoPWT) play a major role in managing the sector. For example, the MoIM contracted in 2004 a national vehicle inspection program to a private Joint Venture (called *mécanique*) on the basis of Build, Operate and Transfer (BOT), and for a period of nine years (2004-2013), and the contract was further extended in 2014.Vehicle inspection includes examination of brakes, lights and emissions from tailpipes.

This inspection aims to reduce emissions from vehicles by adopting the Lebanese pass-or-fail values for CO, CO_2, and HC[12].

In the industry sector, the Ministry of Industry (MoI) is responsible for issuing industrial permits. The MoE is included in the industrial permitting process through a permitting committee that examines applications received from new and existing industrial establishments. The committee operates under the MoI and brings together representatives from the ministries of Industry, Public Health, Environment, Public Works and Transport including the Directorate General of Urban Planning (DGUP). The committee can approve new permit applications, as well as renew or cancel existing permits based on environmental, health and safety criteria.

Other institutions involved in air quality management

As presented in the previous sections of this report, several research and academic institutions are active in the field of air quality monitoring and play an important role the development and implementation of this strategy.

2.2.2 Cross-Sectoral Policy and Legal Framework

This Strategy constitutes the GoL's strategy to protect air quality in Lebanon. It complements other national and sectoral laws, policies and strategies related to air quality management in Lebanon and should be integrated within coming up national plans and policies.

At the legal level, the building block for the Strategy is the Law on the Protection of the Environment and key related application decrees which as well as the draft law for the protection of air quality.

At the policy level, limited policies which address air quality are in place in Lebanon, although sectoral policies have addressed air quality where applicable; it is however worth noting national cross-sectoral initiatives which support a national policy process for the protection of air quality and which are covered in this section.

[12] It should be noted that there is high uncertainty in the measurements of HC, depending on the equipment used.

Draft Law for the Protection of Air Quality

As previously stated, the National Strategy for Air Quality Management in Lebanon derives from Article 12 of the Draft Law. Annex 1 of this strategy provides the priority legal texts/implementation decrees and decisions of the Draft Law for the Protection of Air Quality.

In 2005, the MoE prepared the Draft Law on the Protection of Air Quality. In 2012, the CoM approved the draft Law through Decision 34 (dated 10/01/2012) and forwarded it to the parliament through Decree 8075 (dated 05/05/2012) for discussions in the relevant parliamentary committees.Thus, the draft law awaits formal approval by the Lebanese Parliament.

The draft law comprises of 34 articles related to ambient air pollution (including fixed and mobile sources), monitoring air pollutants (National Program for Ambient Air Quality Monitoring, National Network for Ambient Air Quality Monitoring, National emission inventory, National report on the Ambient Air Quality), assessment of their levels in the Lebanese atmosphere (Setting Limit Values and Thresholds of Ambient Air Pollutants including CO, NO_x, O_3, Particles, SO_2, NMVOC and Pb, emission limit values of fixed sources, emission limit values of mobile sources, specifications of harmful material in fuel, etc.), prevention, control and surveillance of the ambient air pollution resulting from human activities.

Law 444/2002 on the Protection of the Environment

In 2002, the Lebanese Parliament enacted Law 444 dated 29/07/2002 on the Protection of the Environment. It is an overarching legal instrument for environmental protection and management.

Of importance is Section V of Law 444 dated 29/07/2002 on the protection of environmental resources, whereby Chapter One of Section V relates to the Protection of Air Quality and Control of Unpleasant odours. Specifically, Article 24 prohibits every private or public, natural or legal person, to cause any emission or leak of any pollutant to the air environment and stated clearly that emissions shall not exceed the limit values of environmental quality standards including NAAQS. Article 25 stated that emissions from the burning of any kind of fuel or others in industry, energy production facilities or for any other purpose shall remain within the allowed limits.

Key application decrees related to air quality

Among the major achievements in environmental regulation and which play an important role in air quality management are the application decrees and their related decisions which ensure that environmental safeguards including air quality are integrated within all national development activities, these include the following:

- Decree 8633/2012 on the Fundamentals for Environmental Impact Assessment (EIA) and which defines environmental assessment procedures in Lebanon and specifies which projects require an EIA or an Initial Environmental Examination (IEE).
- Decree 8213/2012 on the Strategic Environmental Assessment (SEA) and which sets principles and measures necessary to assess the environmental impacts of policies and developments planned for a large area or a whole sector in Lebanon.
- Decree 8471/2012 on the Environmental Compliance for Establishments and which provides a mechanism for obtaining an Environmental Compliance Certificate (ECC) to existing classified establishments and classified industrial establishments from MoE.

Towards a National Sustainable Development Strategy (NSDS)

In March 2015, the Presidency of the Council of Ministers and the MoE initiated the development of the National Sustainable Development Strategy (NSDS) for Lebanon. Among the efforts made to establish an NSDS, background papers were developed covering seven Strategic Objectives and forty-one Initiatives[13].

Although, the NSDS did not dedicate a stand-alone "Initiative" to air quality management, it tackled air quality within various Initiatives including Sustainable Cities, Energy, and Transport. In the Transport Initiative, the key priority action is the need to structure transport policies and practices taking into consideration the improvement of air quality and reduction of air emissions (NO_x, SO_2, and PM). The background papers prepared as part of the NSDS will contitute an integral part of future national planning processes.

Lebanon's Nationally Determined Contribution to Climate Change

The GoL signed and ratified the UNFCCC in 1994. As a non-Annex I country, the GoL submits National Communications to the UNFCCC which includees Lebanon's greenhouse gas (GHG) emission inventory and mitigation analysis.

GHG inventories not only estimate emissions of main GHGs, CO_2, N_2O, CH_4 and fluorinated gases, but also other air emissons such as CO, NO_x, SO_2 and NMVOCs from the energy, agriculture, industrial, waste sectors and land use change and forestry. The latest inventory in Lebanon was updated in 2016 in the 3rd National Communication where emissions of the year 2012 are reported with a trend analysis for the period 1994-2012. Moreover, Lebanon prepared National Appropriate Mitigation Actions (NAMAs) which aim to reduce GHG emissions in the waste and transport sectors.

In April 2016, the GoL signed the Paris Agreement, under which it submitted its Nationally Determined Contribution (NDC) (GoL, 2015). The NDC aims at reducing national GHG emissions by 15% compared to the Business-As-Usual (BAU) scenario as an unconditional target and by 30% conditional to financial and technical support by 2030. The reduction will emanate from the implementation of policies and activities under the power, transport, waste and forestry sectors, as presented in Table 4 below. These climate change mitigation measures will improve indirectly air quality through the reduction of consumption of fossil fuel in thermal power plants and private generators, the improvement of public transport, and renewal of fleet and reduction in forest fires.

Table 4 . Emission Reductions in the Nationally Determined Contribution in 2015

Sector	Unconditional/ Conditional	Cumulative emission reductions* (Gg)				
		CO_2 eq.	NO_x	CO	NMVOC	SO_2
Energy	Unconditional	1,508,797	4,062	304	101	13,317
	Conditional	3,603,603	9,703	727	242	31,808
Transport	Unconditional	1,696	14	101	20	2
	Conditional	6,321	55	379	76	6
Forestry	Unconditional	466	0	3		
	Conditional	606	0	4		
	Total unconditional	**1,511,675**	**4,077**	**410**	**122**	**13,319**
	Total conditional	**3,616,075**	**9,758**	**1,111**	**319**	**31,814**

*total cumulative emission reduction in 2030 compared to the business-as-usual scenario.

[13] www.nsds.pcm.gov.lb

2.2.3 Policies and legal framework in the Transport Sector

Policies and Strategies

Draft Transport Policy

In 2001, the Directorate General for Land and Maritime Transport at the Ministry of Public Works and Transport (MoPWT) submitted to the GoL a draft transport policy that aims to promote the economic, financial, environmental and social sustainability of the land transport sector in Lebanon. However, to date, no action has been taken by the GoL and the draft policy was never enacted nor approved.

Land Transport Strategy

In 2016, the EU Programme for the "Support for Infrastructure Sector Strategies and Alternative Financing" (SISSAF) implemented a component under the MoPWT which developed a Draft Sector Policy and Strategy for the Lebanese Land Transport Sector with three main objectives including:

1. Provide improved and safer land transportation services to the Lebanese citizens,
2. Promote the development of the economy,
3. Introduce Institutional Reform and foster Human Resources Development with short (next 5 years), medium (next 10 years) and long-term (next 15 years) concepts.

Moreover, the Strategy was complemented with an SEA, which identified mitigation measures most of which were related to the construction phase of the transport infrastructure interventions. The SEA also provided an Environmental Monitoring Plan for Air quality/ air pollution which focused on the following aspects:

- Decrease of emissions (e.g. CO_2, SO_2, NO_x, HCs, TSP) tonnes/year
- Emissions of particulates in the air
- Energy consumption per vehicle-km driven
- Energy use by the transport sector as a percentage of Total Final Energy Consumption
- Consumption of road fuels

Legal Instruments

Since 1992, the GoL has been issuing legal texts to protect air quality.

Law no. 150/1992 (ban import of old cars)

Law 150/1992 banned the import of cars which date of manufacturing exceeds 8 years. This Law has reduced the import of old polluting vehicles.

MoE's Decision No.9/2000 (public transport)

MoE's Decision No.9/2000 reforms and organizes Land Public Transport sector in Lebanon and proposes a reduction in number of public transport vehicles.

Law 341 dated 06/08/2001 (reduce air pollution from transport sector and encourage the use of less polluting fuel)

In 2001, the Lebanese Parliament enacted Law 341 amended by Law 380 (14/12/2001) and Law 453 (16/8/2002). Specifically, the law banned

1. the import of minivans and buses (less than 15 passengers & driver) operating on Diesel oil,
2. the import of old and new Diesel engines for private passenger cars and minivans,
3. the use of Diesel in private vehicles, and

4. the use of leaded gasoline in all vehicles.

It also made catalytic converters a mandatory requirement in all vehicle categories and reinstated the mandatory vehicle inspection (*mécanique*) for gasoline engines (annual inspection) and Diesel engines (every six months), see also Section 2.2.1. In 2010, a draft Law amending Law 341/2001 has been prepared and still awaits parliament approval. It provides the following:

- Providing incentives (tax cuts, tariff exemption and mécanique exemption for first registration) to private and public vehicle owners to switch to hybrid electric, fuel cell/Hydrogen and Natural Gas vehicle,
- Setting permissible exhaust limit values will be determined by MoEW, MoI and MoE,
- Banning the operation of Diesel buses in urban cities, etc.
- As a follow up to Law 341/2001, Decree No. 8243/2003 was endorsed by the CoM and enforces mandatory mechanical inspection.

Decree 8442/2002 (standards for gasoline and diesel)

In 2002, the CoM enacted Decree 8442 (dated 13/08/2002) which defined standards for gasoline and Diesel oil used in vehicles including their Sulfur content; 0.05 % by weight in gasoline 92, 95 and 98 Octane and 0.035 % by weight in Diesel oil.

Decree 8941/2012 (public transport incentives)

In 2012, the CoM approved Decree 8941 (21/9/2012) on the "Draft Law which aims to incentivize the public transport sector (public transport vehicles and buses)" through various exemptions and government support of low interest loans. However, this Decree awaits parliament approval.

Law 243/2012 (new traffic law)

In 2012, the GoL issued Law 243 (dated 25/10/2012), the "New Traffic Law". Of importance, the Law reinstated the installation of catalytic converters in all gasoline vehicles (Article 89; Item 3) and exempted new vehicles from inspection for the first 3 years after registration (Article 159).

2.2.4 Policies and legal framework in the Energy Sector

Policies and Strategies

Policy Paper for the Electricity Sector (PPES)

At the Copenhagen Climate Change Conference of Parties(COP15) in 2009, Lebanon officially pledged to cover by 2020, 12% of its energy mix from renewable energy sources in a bid to reduce the environmental footprint of its energy sector and align itself with international efforts to reduce global GH emissions. In 2010, the MoEW developed the Policy Paper for the Electricity Sector (PPES) which seeks to redress the country's ailing electricity sector by 2015 and achieve the 12% renewable energy contribution. The PPES was unanimously approved by COM the electricity sector in Lebanon. It includes 10 strategic initiatives to improve sector performance, improve supply/demand (fuel sourcing, renewable energy including wind, biomass, solar and hydro, etc.), and revamp the legal and institutional framework for energy production. It formulates actions over three time horizons (short 2010-2012, medium 2012-2014, and Long-term 2015 and beyond).

The National Energy Efficiency Action Plan (NEEAP)

The Second National Energy Efficiency Action Plan for the Republic of Lebanon (NEEAP 2016-2020) was published in March 2016. It builds on the energy efficiency initiatives proposed in the first NEEAP 2011-2015 and complements them. NEEAP 2016 – 2020 is divided into two main sections: the power sector measures and the end use measures. The power sector measures tackle energy efficiency in electricity generation, transmission, and distribution. The end-use section includes five chapters: (1) horizontal end-use measures (2) end-use measures in the building sector, (3) end-use measures in industry and agriculture, (4) measures in mobility and transport, and (5) end-use measures in the public sector.

Moreover, NEEAP 2016–2020 includes different types of measures regarding policies, regulations, action plans, and implementation. The sum of the overall estimated savings of the proposed measures over the five years of the second NEEAP's implementation are 686.1 GWh for the power sector and 828.1 GWh for end-use energy which implies a total saving of 1,514.2 GWh over the five years and leading to average yearly savings of 302.9 GWh. By implementing the second NEEAP's 26 initiatives, the actual electric power growth rate of 7% could be reduced to 5.81% in 2020 (MoEW, 2016).

The National Renewable Energy Action Plan (NREAP)

The Ministry of Energy and Water (MoEW)/Lebanese Centre for Energy Conservation (LCEC) prepared Lebanon's National Renewable Energy Action Plan (NREAP 2016 – 2020). The NREAP is the main national document that will lead the way for Lebanon to develop the different renewable energy technologies needed to reach the 12% target by the year 2020. By adopting this document, the MoEW is creating the path that all national efforts and international support need to follow to develop renewable energy in Lebanon. Being the main authority to develop the energy sector, MoEW, through the work of LCEC, is striving to align all efforts towards sustainable energy.

Moreover, the Country Energy Efficiency and Renewable Energy Demonstration for the Recovery of Lebanon (CEDRO) project implemented by the United Nations Development Programme (UNDP) has been examining Lebanon's potential from various renewable energy sources (wind power, hydro power, geothermal power, solar power and bioenergy). It should also be noted that in 2014, an SEA for the renewable energy sector has been prepared (UNDP; 2014).

Strategic Environmental Assessment of the oil and gas sector

Given that the oil and gas sector, depending on the level of activity, could be a major contributor to air pollution from drilling activities, processing and maritime and air transport as well as auxiliary industrial activities, an SEA for the sector was conducted in 2012, which identified environmental considerations to be taken into account.

Legal Instruments

Law 132/2010 (oil and gas activities)

In 2010, the GoL enacted Law 132 dated 24/08/2010 relating to oil and gas activities from granting rights to production and to de-commissioning of oil and gas facilities. According to this law, all licensing or exploratory activity must be preceded by an SEA (Article 7 Clause 2). Additionally, the Development and Production Plan must contain an EIA (Article 29), whilst any plan pertaining to development, production, transfer, storage, or use must include a detailed EIA (Article 32). The law provides the necessary framework for safety and environmental protection legislation during the production as well as at de-commissioning stages of a well (Articles 54 to 60).

Decree 10289/2013 (petroleum activity regulations)

Decree 10289/2013 comprises 165 articles that organise various aspects pertaining to petroleum resources in the offshore. None of these articles addresses directly aspects related to air quality as such, although several articles address aspects related to environmental management including exhaust systems, as well as SEA and EIA procedures, whilst Articles 141 through 143 address environmental protection, violation of environmental criteria, and protected areas, respectively.

Worth noting is that oil and gas regulations grant rights for petroleum activities which include reconnaissance, exploration, appraisal, production, and decommissioning. All stages are subject to Health, Safety, and Environment (HSE) regulations including permits and requirements with full-fledged EIAs requested at the production and decommissioning phases. The regulations set forth provisions to prohibit flaring except for safety issues and testing. They also require permits for discharges and emissions where relevant laws are applicable.

MoE Decision 8/1-2001 (ELVs for stack emissions and effluent discharge)

MoE Decision 8/1 (dated 30/01/2001) defined ELVs for stack emissions and effluent discharge from classified ***new*** and ***existing*** combustion plants including Fuel-oil power station: boilers, steam generators, power generators between 1MW and 50MW, as well as Fuel-oil power generators between 50MW and 300MW, however, to date, there are no emission standards for large power plants (above 300 MW).

MoE Circular 11/1-2013 (operation of electric generators)

In an effort to curb air pollution from private generators, MoE issued Circular 11 / 1 – 2013 (dated 29 July 2013) which relates to the control of operation of electric generators in Lebanon (capacity more than 0.25 MW). The circular specifies ELVs and monitoring requirements of air pollutants. Efforts by MoE are underway to update it and disseminate the Circular to municipalities and concerned stakeholders.

2.2.5 Policies and legal framework in the Industrial Sector and other combustion sources

Policies and Strategies

In 2015, the MoI developed "The Integrated Vision for Lebanese Industrial Sector 2025" with a mission, vision as well as several detailed objectives as follows:

- Expanding domestic market,
- Increase industrial exports,
- Increase competitiveness of the national industry,
- Increase the investment and financing of the industrial sector,
- Encourage Green Industry,
- Encourage New knowledge industry, and
- Media for the industry.

Steps, tools as well as the partners needed for the implementation of every objective were also identified by MoI as part of this Integrated Vision document.

From an environmental perspective and to limit industrial pollution, the MoE in collaboration with donor agencies and implemented many initiatives and projects, the on-going Lebanon Environmental Pollution Abatement Project (LEPAP) is jointly supported by MoE, the World Bank, the Italian Government and UNDP. Several studies are also available including the Policy Paper for Industrial Wastewater Management (MoE/GIZ, 2013), the Sustainable Consumption and Production Action Plan for the Industrial Sector in Lebanon (MoE/MoI/UNEP, 2015). Moreover, the StREG Programme has also supported activities aiming at strengthening the role of MoE in permitting, monitoring, inspection and enforcement of industrial establishments.

Legal Instruments

MoE Decision 8/1-2001 (ELV for stack emissions and effluent discharge)

MoE Decision 8/1 (dated 30/01/2001) defined ELVs for stack emissions and effluent discharge from classified ***new*** and ***existing*** industrial establishments including: Cement, Glass, Manufacturing of Batteries, Electroplating, Manufacturing of Aluminium, Food, and Municipal Solid Waste Incinerators.

In the framework of the MoE/EU StREG Programme, support to Inspection and Enforcement of Industrial Establishments has initiated the updating of the ELVs for selected sectors were developed covering the following: Cement production, Co-incineration, Power generation, Municipal solid waste incineration, Fertiliser production, Food, drink and milk production, Pulp and paper production, Tanneries, Vegetable oil production, and Mobile generators. It is expected that the ELVs will be revised as Emission Standards and will be issued by MoE Decision by end 2017, thus amending MoE Decision 8/1-2001.

MoE Decisions related to the Industrial Sector

Between 2000 and 2010, the MoE prepared environmental guidelines for establishing and operating several types of industries in the form of Ministerial Decisions (i.e. dairy industries). In 2015, the LEPAP started developing guidelines for several industrial sectors.

Decree 8633/2012 – Environmental Impact Assessment

According to the EIA Decree, industrial establishments (Class I and II) including combustion plants require full EIA studies. The MoE, member of the Permitting Committee, requests from new industrial establishments the preparation of IEE / EIA as part of the approval/rejection process on the establishment permit. For existing establishments, the MoE requests an Environmental Audit which may include data on emissions.

Decree 8471/2012 – Compliance of Industrial Establishments

The Environmental Compliance Decree is applicable to *existing* classified establishments (Class I and II according to Decree 4917 dated 24/03/1994) and classified *industrial* establishments (Class I, II and III according to Decree 5243 dated 05/04/2001). According to MoE Decision 202/1-2013 which defined the Enforcement Mechanism for Environmental Compliance, and to obtain the ECC (voluntary until 31/12/2015), every industrial establishment would need to submit to the MoE (1) the establishment a/o operation permits obtained from MoI, and (2) an EA report prepared by pre-qualified environmental firms (listed and approved by CDR; list retrieved from MoE website) to determine their environmental performance (emissions of air pollutants, water consumption, waste and wastewater generation, etc.). In 2015, the MoE issued decision 539/1 which stipulated the compliance deadlines for Class I (30/12/2018), II (30/12/2019) and III (30/12/2020) establishments subject to Decree 8471/2012. It should be noted that since 1997, cement industries (5 in total) and the only fertilizer industry in the country, report monthly on their air emissions to the MoE.

2.2.6 Policies and legal framework in the Municipal Solid WasteSector

Policies and Strategies

The GoL has developed several plans, decisions, and circulars related to Solid Waste Management (SWM), although these have not been fully covered air quality related aspects.

A historical overview of the different attempts to develop a SWM Strategy and Plan for the are summarised in the MoE report on the Assessment of SWM Practices in 2015 (MoE; 2017) and covers the following strategies and plans related to SWM:

- The 1997 Emergency Plan;
- The 2006 Master Plan for SWM;
- The 2010 Strategy for SWM (according to CoM Decision 55/2010, dated on 01/09/2010);
- The CoM Endorsement of the draft Law on ISWM in Lebanon, dated 10/01/2012;
- The 2013 Draft National Master Plan;
- The CoM Decision 46 dated 30/10/2014 as amended by CoM Decision 1 dated 12/01/2015;
- Other major developments to the sector since September 2015.

It should be noted that in July 2015, a waste crisis was witnessed in Lebanon with the closure of the Naameh Sanitary Land Fill which aggravated the solid waste management situation in the country, impacting the air quality sector due to the indiscriminate open burning of solid wastes.

Legal Instruments

There are significant gaps on the Lebanese legislative framework regarding solid waste management. The main existing legislation dedicated to SWM are the following:

- The draft Law for Integrated SWM (ISWM) was prepared in 2005 and was approved by the CoM in 2012 (under decree number 8003 dated 23/4/2012) but is still awaiting approval by the Parliament
- The MoE of Circular No. 8/1 dated 16/11/2015 related to guidance on integrated management of municipal solid waste as published in issue No. 47 of the Official Gazette dated 19/11/2015.

Other legislation consists of fragmented regulations not specifically related to solid waste but are rather dealing with environmental and/or are relevant to the waste sector and are covered in several sectoral legal frameworks including the following topics: Healthcare Waste; Industrial / Hazardous waste; Energy; ELVs; Compost Ordinance.

Draft Law on Integrated Solid Waste Management and Master Plan for Solid Waste Management (since 2005)

The draft law encompasses a comprehensive strategy on Solid Waste Management (SWM) which was updated in 2010. The Draft Law aims at the following improvements:

- Reducing the quantity of wastes to be disposed of;
- Assisting in the management of solid waste and the promotion of recycling and treatment facilities;
- Promoting waste minimization, source separation, recycling, energy recovery, effective waste treatment facilities;
- Setting up general policy for cost-recovery; and
- Specifying the institutional framework for SWM.

CoM consecutive decisions

In 2013, the CoM appointed a Ministerial Committee to prepare a draft National Solid Waste Management Plan for Lebanon and included Waste-to-Energy treatment technology as part of a future solution.

Since 2014, the CoM has issued several decisions related to solid waste management in Lebanon, which have allowed the adoption of temporary solution awaiting a long-term strategy which is currently being developed by concerned institutions.

2.2.7 Multilateral Environmental Agreements related to Air Quality Management

The Government of Lebanon (GoL) has acceded to and ratified several Multilateral Environmental Agreements (MEAs) to protect the atmosphere including air quality and combating climate change to reduce GHG emissions.

These conventions and protocols have implications on Lebanon and are listed in Table 5 with their main goals. A framework for assessing and reducing the impact of air pollution on ecosystem and human health was developed on western hemispheric scale within the Convention on Long-range Transboundary Air Pollution (LRTAP) under the United Nations Economic Commission for Europe (UNECE). Thus the GoL should firstly obtain an observer status for the LRTAP and later on sign the Convention and ratify its protocols. The possible advantages of signing the LRTAP Convention is the use of regional model results as boundary conditions for national modelling, assessment of impact of air pollutants on human health and environment, review of national emission inventories; cooperation with international scientific and policy orientated network.

Table 5. Multilateral Environmental Agreements related to Air Quality & Atmosphere

CONVENTIONS	MAIN GOALS	DATE	IMPLICATIONS ON LEBANON
Vienna Convention for the Protection of the Ozone Layer	Framework for the international efforts to protect the ozone layer damaged by ODS including CFCs, HCFCs, halons, methyl bromide	Adhesion by law number 253 (30/03/1993)	See implications under Montreal Protocol
Montreal Protocol on Substances that Deplete the Ozone Layer and its four amendments	Protocol to Vienna Convention- Phasing out the production and consumption of substances believed to be responsible for ozone depletion.	Adhesion by law number 253 (31/03/1993)	Phase out the consumption of ODS completely by the end of 2010. The National Ozone Unit (NOU) was established at MOE to assist industries in phasing-out ODS
United Nations Framework Convention on Climate Change (UNFCCC)	Framework for the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system	Ratification by law number 359 (11/08/1994)	1) No requirement to decrease national GHG emissions. Lebanon has voluntarily committed to increase Renewable Energy (RE) to 12 % by 2020 (Copenhagen 2009). 2) Submit national inventory of GHGs, assess Lebanon's vulnerability to Climate Change, and propose adaptation and mitigation strategies to reduce GHG emissions (although not an obligation under the UNFCCC)
Kyoto Protocol	Protocol to the UNFCCC Reduction of GHG (CO_2, CH_4, N_2O, SF_6) emissions to levels that would prevent interference with the Climate System.	Ratification by law number 738 (15/05/2006)	
Stockholm Convention on Persistent Organic Pollutants (POPs)	Framework for the Protection of human health and the environment from POPs, including (a) dioxins and furans (by-products of combustion activities) (b) pesticides (agriculture), and (c) PCBs (closed applications, such as transformer oil)	Signature: 22/5/2001 Accession by law number 432 (08/08/2002)	Eliminate production and import of POPs by 2025; set environmental guidelines and action plan for the use of POPs in the country and release prevention; develop educational and public awareness materials on the effects of POPs; and identify and quantify the main sources of POPs in the country.
WHO Framework Convention on Tobacco Control (WHO FCTC)	Framework for combating the tobacco epidemic and its industry marketing as well as protecting present and future generations from the devastating consequences of tobacco consumption and exposure to tobacco smoke	Ratification by law number 657 (04/02/2005)	A National Program for Tobacco Control (NPTC) was established in 2009 in Lebanon as a result of the GoL signing the FCTC. The NPTC came as a joint program between the MoPH and WHO. In 2013, the GoL enacted Law 174 which prohibits smoking in indoor/closed areas.

2.3 Wildfire risk reduction and warning

Besides the direct risk of wildfires to human health, fauna, flora and estates, wildfires can have a strong impact on air quality due to accompanying smoke, which can lead to high levels of PM and Polycyclic Aromatic Hydrocarbons (PAHs). Hence wildfire risk reduction and warning will be of benefit to air quality as well. However, to date, Lebanon lacks 1) appropriate measures for risk reduction, 2) fire prevention measures in response to fire danger forecasts, and 3) warning of fire emissions/smoke impacts.

An operational system of wildfire risk reduction and danger forecast in Lebanon is an important step towards improved resource allocation, mitigation, and recovery efforts. At the same time, a shift is needed towards more holistic, inter-sectoral and participatory approaches to fire risk management implementation and monitoring. This requires strengthening the capacity of the concerned authorities in order to address dynamic and comprehensive wildfire risk assessment and management.

Lebanon's National Strategy for Forest Fire Management (Council of Minister's Decision No.52 dated 13/05//2009) highlighted the need to develop an efficient early warning system by providing links to the European Forest Fires Information System (EFFIS).The National Strategy for forest fire management aimed at reducing the risk of intense and frequent forest fires whilst al-lowing for fire regimes that are socially, economically and ecologically sustainable.

Other related strategies and policies of relevance to wildfire risk management include the recently developed National Forestry Program (NFP) and the ongoing revision efforts of the forest laws and regulations. The NFP aimed at "the continued management of forests by implementing modern resource assessment procedures and reinforcing related scientific research" (MoA, 2008), while updated laws and regulations can help in reducing fire risk and preventing large wildfires.

2.3.1 Institutional Set Up for wildfire risk management

In 2008, Lebanon's National strategy for forest fire management emphasized the need for a shift towards an enhanced capacity of stakeholders in Lebanon for better wildfire risk reduction and improved preparedness and response. As identified by the strategy and in reference to current efforts and contributions in wildfire risk management in Lebanon, the main stakeholders involved in managing wildfire risk include the following entities:

- Ministry of Interior and Municipalities (MoIM) (Directorate General of Civil Defense, Directorate General of municipalities, and the Internal Security Forces);
- Ministry of Agriculture (MoA);
- Ministry of National Defence;
- Ministry of Environment;
- Lebanese Agriculture Research Institute (LARI);
- Research centres (e.g. National Council for Scientific Research), and universities (e.g. University of Balamand);
- Lebanese Meteorological Service ;
- National Disaster Risk Management Unit;
- Other relevant national agencies (e.g. Council for Development and Reconstruction, Higher Relief Council, etc.);
- Natural Reserve committees;
- Local CSOs.

Currently, the National Disaster Risk Reduction and Management Unit at the Prime Minister's Office is working on developing response plans for each relevant ministry. This can facilitate the integration of developed fire danger systems into a National structure for a wildfire danger analysis and efficient communication of information.

2.3.2 Current situation related to wildfire risk and danger forecast

The assessment of the "Status of Wildfire Warning Systems in Lebanon" (MoE/EU, 2014) identified the current situation of existing wildfire risk warning systems and infrastructure in Lebanon for generating daily fire danger indices, and evaluated potential systems for a sustained and improved fire danger warning system. The assessment indicated that Lebanon lacks a dynamic and comprehensive wildfire risk assessment and management; number of initiatives and projects aiming at predicting wildfire risk have been implemented. Such initiatives and projects included:

1. The RISICO system in Lebanon (a system that is hosted outside Lebanon and it hasn't accounted for, until present, all necessary fire risk factors such as Lebanon's fire risk map including fire vulnerability);
2. The American University of Beirut's algorithm for forest fire occurrence prediction (connected only to two weather stations with a limited functionality);
3. Lebanon's Air Quality Index (AQI) developed within the MoE's ERML Project (ongoing initiative at the Ministry of Environment) which can contribute to fire risk forecasting;
4. The Fire Weather Index (FWI) as provided by European Forest Fire Information System (EFFIS), and as being investigated by the University of Balamand;
5. The fire risk map (Mitri et al., 2015) and its associated tools have been developed by the Land and Natural Resources Program at the Institute of the Environment, University of Balamand (UoB) comprising detailed monthly and annual fire risk static maps and a web application tool called FireLab for extracting fire risk information and data at the Municipality level. Most, recently, a fire danger forecast module (with national forecast estimates over 9 days) has been integrated into FireLab.

In summary, a review of existing systems in relation to wildfire risk management showed the following observations:

- Existing systems for fire danger forecast (e.g., RISICO, AUB fire algorithms) need to undergo further improvement by taking into account existing wildfire risk including vulnerability assessment;
- Local meteorological observations (e.g., the use of MoE's Air Quality and weather stations and the use of LARI's weather stations) are not sufficiently employed by existing fire danger systems;
- There is a potential of combine local data (e.g. local FWI, wildfire risk map produced by UoB) with other forecasted data (e.g. EFFIS) and produce an advanced national fire danger forecasting system and warning of fire emissions/smoke impacts.

2.3.3 Key Gaps for Efficient Wildfire Risk Reduction and Warning System

The main key gaps and needs identified to fulfil future achievements include:

- Lack of practical measures in wildfire risk reduction and preparedness;
- Lack of an operational system of meteorological data collection from the different existing/planned networks;
- Lack of knowledge at the stakeholders' level about performance of existing wildfire danger warning systems;
- Need for technical resources (e.g. necessary software, automation, etc.) to produce a national Fire Weather Index from local networks/stations;
- Lack of linkages, analysis, and interpretation between emissions from forest fires and air quality records from the AQMN;
- Need for a functional warning system of fire emissions/smoke impacts;
- Overall lack of linkages between the different national agencies (e.g. ministries) to communicate, disseminate and interpret wildfire risks and danger forecasts.

The *Status Report of Wildfire Warning Systems on Lebanon* (MoE/EU, 2014) recommended the development of an efficient wildfire danger forecast system through establishing links with the European Forest Fires Information System (EFFIS) in line with Lebanon's National strategy for forest fire management. Although, a 9-day wildfire danger forecast system has been finalized and made operational and available to the public, the integration of local observations from existing infrastructure and resources in relation to the Ministry of Environment's AQMN and its associated weather stations is recommended. This could further improve fire danger forecast by combining the national FWI to the existing wildfire danger forecasts, especially in areas sensitive to wildfires.

In parallel, evaluating the performance of existing warning systems (i.e., RISICO and FireLab) is also of interest. Such evaluation can involve the comparison of the real fire situation on the ground (e.g. fire occurrence and spread) to the fire danger forecasts. One option for evaluation can comprise of the use of the results of the annual fire report as generated by MoE and UoB within the framework of a memorandum of understanding. This would allow comparison of real wildfire events against their corresponding wildfire danger forecasts. This could also help in identifying future options for the adoption of most appropriate national fire danger systems in Lebanon.

Another essential element in wildfire risk management is the development of an early warning system f of fire emissions/smoke impacts mainly on public health taking into account vulnerability (e.g., demographic vulnerability), hazard (e.g. density and combustibility of fuel), and observations from existing networks/stations especially during fire seasons. This can help in pooling the limited firefighting resources into crucial fire risk areas and warning vulnerable individuals in affected populations about possible wildfire emissions/smoke impacts.

3 Elements of the National Strategy for Air quality Management in Lebanon for 2030

3.1 Vision of the Strategy

In accordance with the Draft Law for the Protection of Air Quality, the **vision of the strategy is that "every citizen has the right to enjoy clean air".**

Through this strategy, the GoL is committing itself to enhance and protect ambient air quality through the adoption of long-term goals (including related outputs and priority activities) identified in this strategy, in order to reach the vision set forth in the strategy by 2030. This involves the assessment of carbon monoxide, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide which constitute the majority of the criteria pollutants.

The strategy will also aim at assessing – in addition to the already assessed tropospheric ozone – other short-lived pollutants (Black carbon, fluorinated gases, methane) as well as greenhouse gas emissions and will address where possible other important aspects such as indoor air quality, at residential as well as public areas (including aspecteds related to smoking) which also constitute an occupational hazard in the country, in addition, it will address aspects related to noise pollution.

Worth noting is that the term "territory" as used in this Strategy includes Lebanese territorial land as well as waters *per se*. As such, emissions from offshore activities, notably in the Oil and Gas sector and ports, are also accounted for in this Strategy.

As per Article 12-3 of the Draft Law for the protection of air quality, the goals identified in the strategy will ensure meeting the following provisions of the draft law for the protection of air quality:

- Article 12-3-1. Target limit values that must be achieved in a specific period of time;
- Article 12-3-2. Recommendations for the prevention, control and management of sources contributing to the ambient air pollution;
- Article 12-3-3. Procedures that must be implemented within specific deadlines to reduce emissions, such as using economic incentives, comprehensive management strategies for developmental sectors and collective activities and environmental awareness and education;
- Article 12-3-4. Recommendations for establishing local plans for the ambient air quality management in the areas where it is difficult to reach the limit values related to the ambient air quality, as provided in article 13 of this law".

At a broader policy level, this strategy will allow Lebanon to align itself with three Sustainable Development Goals (SDGs) and their targets and will allow the measurement and monitoring of two key indicators under the SDGs as presented in Table 6 below.

Table 6. Linkages of the National Strategy for AQM to the SDG targets and indicators

SDG	Targets	Indicators
SDG 3: Ensure healthy lives and promote well-being for all at all ages	Target 3.9: by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination	Indicator 3.9.1: Mortality rate attributed to household and ambient air pollution
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable	Target 11.6: by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management	Indicator 11.6.2: Annual mean levels of fine particulate matter (i.e. PM2.5 and PM10) in cities (population weighted)

3.2 Long-term goals of the Strategy (2017-2030)

The strategy is composed of 6 strategic goals and allows the GoL to identify the needed outputs and activities to meet the vision set forth in the strategy by 2030 at the level of each goal.

As such, the strategic goals together with their outputs and activities provide a framework for action at short-, medium and long-term level and allow the concerned stakeholders to use the strategy as a basis for identification of needed interventions.

The goals identified in the strategy are the following:

- **Goal 1: Strengthening the Legal & Institutional Framework**
- **Goal 2: Improving AQ Assessment Throughout the Territory**
- **Goal 3: Solving AQ Problems Due to Stationary Sources in Degraded Airsheds**
- **Goal 4: Solving AQ Problems from Mobile Sources**
- **Goal 5: Mainstreaming AQ Management in Priority Sectors**
- **Goal 6: Communication & Outreach on AQ**

At the level of each strategic goal, impact indicators are identified to support the monitoring and evaluation system needed as part of the implementation process of the strategy.

The strategic goals provide also an indication of the different stakeholders who should be involved in the implementation of the activities and outputs at the level of each goal in order to achieve the set strategy for air quality management in the country.

As such, the strategy will be used as a basis for developing a short-term action plan for MoE covering the period of 2016-2020 in line with the goals of the strategy and which complements the long-term goals of the strategy as presented in Figure 6 below.

The Strategy will also constitute a basis for developing future plans and projects for the implementation of needed measures.

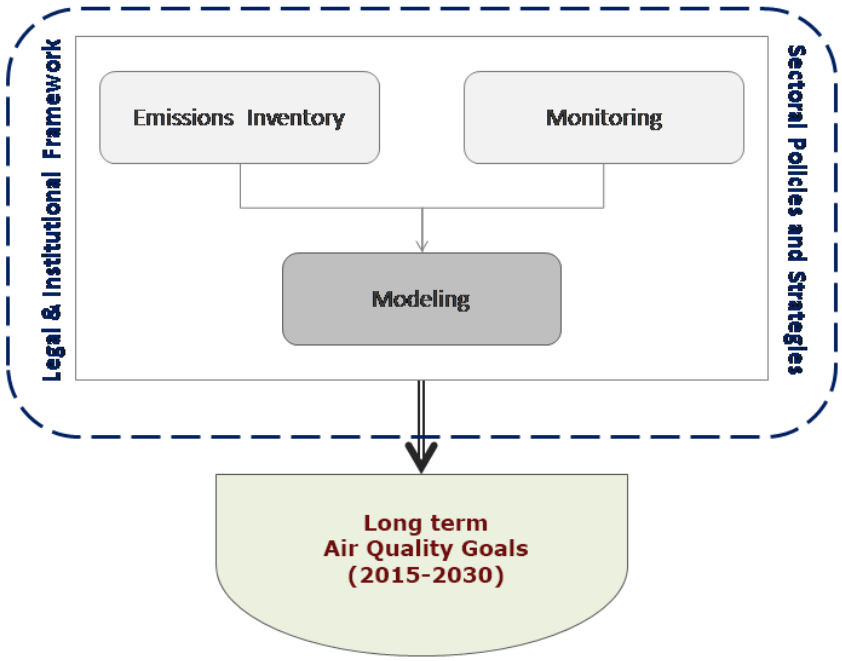


Figure 6. Overall scheme of the National Strategy for Air Quality Management

3.2.1 Goal 1: Strengthening the legal and institutional framework

Indicator 1.1: the priority application decrees required for the implementation of the strategy are issued by the CoM or Ministers' Decisions

Indicator 1.2: 100% of the AQ Service staff are provided with needed training in line with the training plan

Output 1.1 Adopting the Draft Law for the Protection of Air Quality

ACTIVITY	STAKEHOLDER
1.1.1. Approve the Draft Law for the Protection of Air Quality transferred by Decree 8075 (dated 05/05/2012) from CoM to Parliament	Parliament, MoE and other concerned partners
1.1.2. Update the gap analysis provided in Annex I	MoE
1.1.3. Based on the gap analysis conducted, draft or update all legal texts/application decrees related to the implementation of the short-term Action Plan as well as decisions of the Law for the Protection of Air Quality – see Annex I including the Decree related to the adoption of the National Strategy for Air Quality Management and the technical (template) and financial partnership frameworks between the public and private sectors for the management, operation and financing of the AQMN and the emissions inventory	MoE and other concerned partners
1.1.4. Adopt priority texts that are essential for the implementation of the Strategy	

Output 1.2 Updating the NAAQS based on the Assessment of AQ throughout the Territory

ACTIVITY	STAKEHOLDERS
1.2.1. Establish interim values (based on WHO approved methodologies)	MoE and other concerned partners
1.2.2. Develop a methodology for NAAQS	
1.2.3. Develop cost-benefit analysis for the improvement of air quality 1.2.4. Develop air pollution epidemiological studies and other health risk assessments 1.2.5. Develop cost of air quality degradation 1.2.6. Develop the cost of remediation of air pollution	MoE and other concerned partners
1.2.7. Issue an MoE Decision on National Ambient Air Quality Standards based on the methodology prepared Draft Law for the Protection of AQ	MoE

Output 1.3 Strengthening MoE AQ department and other concerned groups

ACTIVITY		STAKEHOLDERS
1.3.1.	Recruit a total of 7 employees at AQ Department based on decree 2275/2009	MoE and Civil Service Board
1.3.2.	Prepare and implement a training plan for the MoE AQ Department and other air quality monitoring bodies on AQ monitoring and management	MoE and other stake-holders

Output 1.4 Developing local air quality planning

ACTIVITY		STAKEHOLDERS
1.4.1.	Definition and assessment of degraded airsheds based on quality-controlled data	MoE and other stake-holders
1.4.2.	Develop guidance and templates for AQ planning for local authorities (e.g. based on the UK local air quality management guidances)	
1.4.3.	Source apportionment in two priority degraded airsheds (pollution sources, geographical boundary, etc.) in Lebanon based on data provided by the AQMN and updated modelling results	MoE and other stake-holders
1.4.4.	Prepare local action plans in degraded airsheds to improve air quality	MoE and other stake-holders
1.4.5.	Issue local action plans in MoE Decision (Article 13 of the Draft Law for the Protection of Air quality) to be coordinated with ELVs and application of BAT	MoE

Output 1.5 Developing measures/plans in case of High Pollution levels

ACTIVITY		STAKEHOLDERS
1.5.1.	Develop an internal procedure in the MoE AQ department on how to react (scenarios) in case of high pollution levels	MoE – AQ Depart-ment
1.5.2.	Establish an inter-ministerial committee to respond in case of high pollution levels (headed by MoE) – link to Disaster Risk Management	MoE, MoPH, MoPWT, MoIM, MoI, MoEW
1.5.3.	Prepare an action plan by the inter-ministerial committee in case of high pollution levels based on the scenarios proposed by the MoE AQ Depart-ment (see Article 31 of the Draft Law)	MoE, MoPH, MoPWT, MoIM, MoI, MoEW
1.5.4.	Implement the action plan	MoE, MoPH, MoPWT, MoIM, MoI, MoEW and Governorates
1.5.5.	Monitor the implementation of action plans	MoE and Gover-norates

3.2.2 Goal 2: Improving air quality assessment throughout the territory

Indicator 2.1: by 2018, a database is established based on treated information from measurements collected by the entire AQ monitoring network

Indicator 2.2: by 2019, an updated national emission inventory is in place

Output 2.1 Establishing, operating and maintaining (including the required QA/QC) the AQ monitoring infrastructure

ACTIVITY		STAKEHOLDERS
2.1.1.	Establish the AQMN	MoE and other local authorities
2.1.2.	Establish air quality monitoring systems around Beirut airport and ports	MoE, MoPWT
2.1.3.	Develop the general technical guidelines for the calibration of the air quality analysers and continuous emissions monitoring systems	MoE, IRI, APAV
2.1.4.	Adopt uniform calibration guidelines by all national monitoring systems	
2.1.5.	Identify sources of financing for the operation and maintenance of the AQMN	MoE
2.1.6.	Ensure continuous calibration, operation and maintenance of the AQMN, preparation of accreditation (ISO 17025)	MoE, IRI

Output 2.2 Establishing a methodology for the analysis, assessment and reporting of the ambient AQ data for MoE and affiliated monitoring systems

ACTIVITY		STAKEHOLDERS
2.2.1.	Develop guidance on data transfer, data control, database and IT based solutions	MoE
2.2.2.	Develop a methodology for the assessment of AQ Data	MoE
2.2.3.	Develop a template for annual national AQ reporting (based on article 7 of the Draft Law for the Protection of AQ) with special focus on identified degraded airsheds	MoE

Output 2.3 Updating, improving and reviewing regularly existing initial emission inventories conducted by MoE and other stakeholders

ACTIVITY		STAKEHOLDERS
2.3.1.	Establish technical guidelines for monitoring emissions from stationary sources	MoE
2.3.2.	Develop activity data and emissions template report for stationary sources in co-ordination with the MoE Climate Change Unit	MoE
2.3.3.	Develop a methodology for the regular update of the emission inventory	MoE, universities, research centres
2.3.4.	Update annually the emission inventory	MOE

Output 2.4 Developing and updating regularly a national integrated assessment and modelling system

ACTIVITY	STAKEHOLDERS
2.4.1. Acquire and update the meteorological database on an annual basis	MoE, universities, research centres
2.4.2. Update and improve AQ modelling results	MoE, universities, research centres
2.4.3. Develop guidelines for AQ modelling reports	MoE
2.4.4. Identify and assess pollution abatement measures (that will impact most under least costs)	MoE, universities, research centres

Output 2.5 Producing and disseminating the national Fire Weather Index (FWI) with the use of local networks/stations and start evaluating the performance of existing wildfire danger warning systems.

ACTIVITY	STAKEHOLDER
2.5.1. Acquire meteorological observations in a centralised platform for processing	LARI, Meteorological Service Department in Lebanon, MoE
2.5.2. Model the automated calculation of the FWI	MoE – AQ Department
2.5.3. Generate the FWI and communicate fire danger forecasts informaiton to national and local users	MoE, MoIM, MoA, MoD Union of Municipalities, Municipalities, Natural reserves, Universities , National Disaster Risk Reduction and Management Unit
2.5.4. Generate a national fire database (including fire danger forecasts, fire occurence, burned areas) for use in the evaluation of existing wildfire danger forecast systems.	MoE, CNRS, National Disaster Risk Reduction and Management Unit, Universities/research centers

3.2.3 Goal 3: Solving air quality problems due to stationary sources in degraded airsheds

Indicator 3.1: by 2018, the AQ sampling methodology is issued through an MoE decision

Indicator 3.2: starting 2018, all enviornmnetal audits and self-monitoring reports are adopting the AQ sampling methodology of the MoE

Indicator 3.3: The mitigation measures requested in the issuance of compliance certificates related to AQ are approved by the AQ department

Output 3.1 Adopting proposed Emission Standards for key stationary sources in line with Best Available Techniques (BATs) levels

ACTIVITY		STAKEHOLDERS
3.1.1.	Define criteria for the identification of degraded airsheds	MoE, MoPH
3.1.2.	Discuss proposed Emission Standards with stakeholders at the national level	MoE, MoI, MoEW, ALI, Chambers of Commerce
3.1.3.	Draft and Issue the update of MOE Decision 8/1-2001	MoE

Output 3.2 Developing procedures for enforcing regulations for self-monitoring, reporting and third-party verification in key sectors

ACTIVITY		STAKEHOLDERS
3.2.1.	Prepare key technical elements (including reporting ELV breaches) of the proposed self-monitoring decision	MoE
3.2.2.	Prepare an MOE decision for self-monitoring and external verification by the operators	MoE
3.2.3.	Disseminate self-monitoring provisions	MoE, MoI, ALI, Chambers of Commerce
3.2.4.	Establish and operate a third party review process for self-monitoring	MoE

Output 3.3 Developing the Environmental Licensing Mechanism for Emissions of Air Pollutants

ACTIVITY		STAKEHOLDERS
3.3.1.	Prepare the technical aspect for the environmental licensing mechanism	MoE
3.3.2.	Prepare the legal documents (decree and decision) for environmental licensing for emissions of air pollutants	MoE, MoF, CoM
3.3.3.	Adopt an air quality sampling methodology	MoE

3.2.4 Goal 4: Solving air quality problems from mobile sources

Indicator 4.1: by 2020, the Mécanique procedures include EU standards in the issuance of Mécanique certificates

Indicator 4.2: CoM decisions related to fuel quality standards are issued continuously based on LIBNOR recommendations

Indicator 4.3: By 2020, at least one mitigation measure is implemented in the BRHIA in line with source apportionment

Output 4.1 Strengthening the inspection capabilities of mobile sources at national level

ACTIVITY		STAKEHOLDERS
4.1.1.	Adopt international procedures in the technical inspection of vehicles ("Mécanique") to ensure compliance with emission standards (EU standards) through specs of operating companies of the Mécanique	MoE, MoIM
4.1.2.	Propose technical and legal measures for addressing air quality problems for on-road transport	MoE

Output 4.2 Implementing, monitoring and enforcing regulations for fuel quality

ACTIVITY		STAKEHOLDERS
4.2.2.	Update and issue in a COM Decision the fuel quality standard taking into account seasonal variation	MoE, MoEW, LIBNOR and other stakeholders
4.2.3.	Monitor fuel quality for entering ships at Lebanese ports	MoE, MoEW, Customs (MoF), MoET
4.2.4.	Monitor fuel quality at service stations	MoE, MoET

Output 4.3 Improving AQ from air and maritime transport

ACTIVITY		STAKEHOLDERS
4.3.1.	Strengthen reporting to the MARPOL Convention	MoPWT, MoE
4.3.2.	Develop standards for air emissions from airport activities and majort ports (Beirut, Tripoli, Saida, Jounieh)	MoE, MoEW, MoPWT, LIBNOR
4.3.3.	Prioritise mitigation measures for priority air emissions according to emission source apportionment at the Beirut - Rafic Hariri International Airport and majort ports	

3.2.5 Goal 5: Mainstreaming air quality management in priority sectors

Indicator 5.1: By 2020, at least two sectors have adopted the targets for air quality improvmenets in the implementation of their sectoral plans

Indicator 5.2: Air quality emissions and assessments are included in all climate change plans and projects starting 2018

Output 5.1 Ensuring synergies with national climate change policies and plans

ACTIVITY	STAKEHOLDERS
Include AQ emissions in plans and projects related to climate change mitigation and adaptation	MoE

Output 5.2 Developing an SEA for the Lebanese Land Transport Strategy

ACTIVITY	STAKEHOLDERS
5.2.1. Include targets for AQ improvements in the SEA of the Land Transport Strategy and Action Plan developed by MoPWT	MoPWT, MoE
5.2.2. Monitor the implementation of the SEA recommendations in terms of AQ improvement (policies for slow modes including bicycle, pedestrian traffic; incentivising clean vehicles, etc.)	MoE

Output 5.3 Integrating Air Quality in the Energy Sector

ACTIVITY	STAKEHOLDERS
5.3.1. Follow up with the MoEW the development of an SEA for any future Policy Paper for the Electricity Sector	MoEW and MoE
5.3.2. Co-operate with the MoEW to develop an SEA for the new National Energy Efficiency Action Plan (NEEAP)	MoEW and MoE
5.3.3. Include AQ improvements in the new National Energy Efficiency Action Plan (NEEAP)	MoEW and MoE
5.3.4. Review the SEA of the Petroleum Sector in such a way as to set targets for AQ improvements and monitor its implementation	LPA, MoEW, MoE

Output 5.4 Integrating Air Quality in the industrial sector

ACTIVITY	STAKEHOLDERS
Co-operate with the MoI to develop an SEA for the Integrated Vision for the Lebanese Industrial Sector 2025, including targets for AQ improvements	MoI and MoE

Output 5.5 Integrating Air Quality in the Solid Waste Management Sector

ACTIVITY	STAKEHOLDERS
Ensure that any new plan or project by GoL on the Solid Waste Management Sector will be covered by an SEA or EIA (as appropriate), including targets for AQ improvement	MoE, MoIM, CDR, OMSAR, MoF

Output 5.6 Integrating Air Quality in the agriculture/forestry sector

ACTIVITY	STAKEHOLDERS
Ensure that activities, plans, and projects undertaken by national authorities including the Ministry of Agriculture and the Ministry of Environment will comprise strict policy goals to 1) maintain functional and healthy terrestrial ecosystems and, 2) protect public health by mitigating smoke impacts from possible fires in agricultural lands and in the wild.	MoE, MoA

3.2.6 Goal 6: Communication and outreach on Air Quality

Indicator 6.1: By 2018, key communication tools for disseminating of the AQ index through a smatphone application, MoE's website and information panels are operational

Indicator 6.2: By end 2017, monthly and yearly reports are uploaded on the MoE website on continuous basis

Output 6.1 Providing data and regular reports on air quality from all monitoring sites and modelling results to the public

ACTIVITY		STAKEHOLDERS
6.1.1.	Provide on the MoE website updated data with near real-time air quality inde and monthly (including hourly) and yearly data (AQ & meteorological)	MoE
6.1.2.	Inform regularly the general public about the importance of air quality (website, newspapers, smartphone applications, etc.)	MoE
6.1.3.	Disseminate information on panels on the ambient air quality followed by awareness campaigns on the use of this information	MoE, Municipalities
6.1.4.	Develop an early warning system to alert the public about dust and other pollution episodes (with a clear methodology for short-term intervention)	MoE, MoPH, Municipalities

Output 6.2 Linking the on-going activities at the MoE and the universities

ACTIVITY		STAKEHOLDERS
6.2.1.	Establish the partnership framework with public and private sectors related to the National Emissions Inventory	MoE, universities, MoIM, public sector
6.2.2.	Strengthen the partnership framework between both public and private universities, research centers and other concerned institutions in the cooperation on different studies and capacity building programmes	MoE, universities, research centers, concerned institutions

4 Implementation, monitoring and reporting

The successful implementation of this National Strategy for Air Quality Management can be achieved by addressing the priority goals and their related ouputs and activites as well as by setting a timetable for their implementation. Through regular monitoring, it is important to agree on the implementation process, in addition a timely evaluation allows for adjusting and aligning the activities in order to achieve the Strategy's goals.

4.1 Consultation Process for Validation and Implementation

To validate and implement this Strategy, multi-stakeholders meetings will be continuously conducted. According to Article 12 of the Draft Law on Air Quality Protection, public entities which play a leading role in Air quality Management include the following:

- The Ministry of Industry;
- The Ministry of Energy and Water;
- The Ministry of Public Works and Transport;
- The Ministry of Public Health;
- The Ministry of Agriculture.

Other key stakeholders to be consulted include:

- Other Governmental institutions;
- Local authorities (especially those with Environment observatories);
- Research centres and Universities;
- NGOs;
- Private sector.

Continuous consultations will provide an opportunity for concerned stakeholders to be part of the implementation of the Strategy and provide suggestions for improvement. In addition, the strategy and its results will be posted on the MoE website for public consultation and engagement.

In order to ensure a broad-based consultation process and the involvement of all concerned stakeholders, an Air Quality Task Force (AQTF) has been established at the outset of the development process of the strategy and will be continuously involved in its implementation and follow up.

4.2 Implementation Process

This Strategy provides long-term goals as a basis for action including specific outputs and activities which should be implemented by different stakeholders. Therefore, a detailed plan of action to be adopted by the different stakeholders will be developed by the MoE concerned departments (specifically the Department of Air Quality of the Service of Environmental Technology) in consultation with all concerned stakeholders and will be used as a framework for the implementation of the strategy.

4.3 Monitoring of Air Quality Management in Lebanon

The MoE's Department of Air Quality within the Service of Environmental Technology will develop a baseline and target values for the indicators identified in the Strategy in order to monitor the progress of the implementation of the strategy. The evaluation of the Strategy as well as improvements on air quality will be presented to the National Council for the Environment as stipulated in the Decree 8157 of 2012 in overseeing and evaluating environmental actions in Lebanon.

MoE will also ensure that the monitoring and evaluation of the Strategy as well as its updating is conducted on regular basis and will inform the follow up and reporting on the implementation of the Strategy throughout 2030.

Moreover, the MoE will follow the monitoring and evaluation framework proposed at the level of the set goals of the Strategy and which are consolidated in Table 7 below.

Table 7. Proposed indicators at the level of the Goals of the Strategy

Short-Term Goals (STG)	Indicators
STG 1. Strengthening the legal and institutional framework	Indicator 1.1: the priority application decrees required for the application of the Action Plan is issued by the CoM or Ministers' Decisions Indicator 1.2: 100% of the AQ Service staff are provided with needed training in line with the training plan
STG 2. Improving air quality assessment throughout the territory	Indicator 2.1: by 2018, a database is established based on treated information from measurements collected by the entire AQ monitoring network Indicator 2.2: by 2019, an updated national emission inventory is in place
STG 3. Solving air quality problems due to stationary sources in degraded airsheds	Indicator 3.1: by 2018, the AQ sampling methodology is issued through an MoE decision Indicator 3.2: starting 2018, all enviornmnetal audits and self-monitoring reports are adopting the AQ sampling methodology of the MoE Indicator 3.3: The mitigation measures requested in the issuance of compliance certificates related to AQ are approved by the AQ department
STG 4. Solving air quality problems from mobile sources	Indicator 4.1: by 2020, the Mécanique procedures include EU standards in the issuance of Mécanique certificates Indicator 4.2: CoM decisions related to fuel quality standards are issued continuously based on LIBNOR recommendations Indicator 4.3: By 2020, at least one mitigation measure is implemented in the BRHIA in line with source apportionment
STG 5. Mainstreaming air quality management in priority sectors	Indicator 5.1: By 2020, at least two sectors have adopted the targets for air quality improvmenets in the implementation of their sectoral plans Indicator 5.2: Air quality emissions and assessments are included in all climate change plans and projects starting 2018
STG 6: Communication and outreach on Air Quality	Indicator 6.1: By 2018, key communication tools for disseminating of the AQ index through a smatphone application, MoE's website and information panels are operational Indicator 6.2: By end 2017, monthly and yearly reports are uploaded on the MoE website on continuous basis

4.4 Information sharing on Air Quality Management in Lebanon

As part of its mandate in advocacy and public participation in environmental management, information sharing of data on air quality management is considered as a priority within MoE's strategy in general and of the Department of Air Quality in specific.

The Strategy will therefore ensure the inherent right of every citizen to gain access to information about the environment and promoting access to scientific and sound information, all of these principlaes being in the existing legal framework which, namely the following:

- **Law 444/2002 on the Protection of the Environment, specifically Article 14 on Envrionmental Information Systems** which stipulates: "*Any natural or legal person, concerned about environment management and sustainable development has the right to gain access to the environment information system, according to the rules and regulations of the present law and its protocols. Every person has the right to get objective information about the environmental situation, except for the information pertaining to national security or professional secrecy. The information ought to be given within a month. Any refusal to grant them shall be sanctioned*".
- **Law 28 of 2017 on the Right to Access to Information** and which confirmed the right to any person, to access to information and documents available within the administration.

This is also in line with the trends in other countries, especially Europe and the US, which are signatory of the **Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters** and which was adopted on 25 June 1998. The Aarhus Convention commits all Parties to the Convention to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to the following: "*the right of everyone to receive environmental information that is held by public authorities (*"***access to environmental information***"*). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession*".

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Annex 1: Priority legal texts/implementation decrees and decision-sof the Draft Law for the Protection of Air Quality.

DECREE / DECISION	IMPLEMENTATION OF ARTICLE	CONTENT	RESPONSIBLE AUTHORITY	OTHER INVOLVED AUTHORITIES
Decree	Article 5-2	Setting the partnership framework between the public and private sectors for the management, operation and financing of the stations part of the national ambient air quality monitoring Network.	MOE	COM
Decree	Article 6-2	Setting the partnership framework between the public and private sectors for the development of a national inventory of emissions.	MOE	COM
MOE Decision	Article 8-1 and 8-2-1	Setting Limit Values, Threshold Limit Values and Information Threshold Limit Value for ambient air quality (NAAQS). Pollutants include: CO, NO2, O3, PM (PM10, PM2.5, PM1), SO2, VOCs and Lead (updated of MOE Decision 52/1-1996)	MOE	MOPH
MOE Decision	Article 8-3	Defining methodologies and techniques for the measurement of ambient air pollutants	MOE	LIBNOR
MOE Decision	Article 9-1	Establishing emission limit values from stationary sources (update of MOE Decision 8/1-2001)	MOE	MOI and MOEW
MOE Decision	Article 9-2	Establishing emission limit values for stationary sources in areas where pollution calls for such a measure (degraded airsheds)	MOE	Local administrations/ municipalities and councils or the pertinent general administrations
MOE Decision	Article 9-3	Defining methodologies and techniques for the measurement of stack emissions from stationary sources.	MOE	LIBNOR
MOE Decision	Article 10-1	Defining emission limit values for mobile sources for criteria pollutants	MOE	MOPWT and MOIM
MOE Decision	Article 10-2	Defining methodologies and techniques for the measurement of emissions from mobile sources	LIBNOR	MOE and MOIM
Decree	Article 11-1	Defining harmful substances in fuel through fuel composition and physical properties	LIBNOR	MOE, MOEW, MOI, MOPWT and MOIM
MOE Decision	Article 11-2	Setting methodologies for testing the conformity of imported fuels	LIBNOR	MOE, MOEW, MOF

DECREE / DECISION	IMPLEMENTATION OF ARTICLE	CONTENT	RESPONSIBLE AUTHORITY	OTHER INVOLVED AUTHORITIES
Decree	Article 12-1	Adopt the National Strategy for the Management of Ambient Air quality	MOE	MOI, MOEW, MOPWT, MOPH
Decision	Article 15-2	Defining stationary sources which require an environmental permit for emissions for their operation	MOE	-
Decree	Article 16-2	Establishing the mechanism of issuing environmental permits for emissions as well as the required tariffs and emission trading conditions	MOE and COM	MOF
MOE Decision	Article 16-4	Defining the air emissions reporting requirements and formats	MOE	-
MOE Decision	Article 18-1	Defining guidelines for inspection and monitoring of environmental compliance by MoE	MOE	-
MOE Decision	Article 25-2	Defining the general format of the air quality data and information made available by the national ambient air quality operated by the local authorities, councils and private sector institutions and meteorological stations	MOE	-
MOE Decision	Article 26-2	Defining the data and information transfer modality to MoE from the local authorities, councils and private sector	MOE	-

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