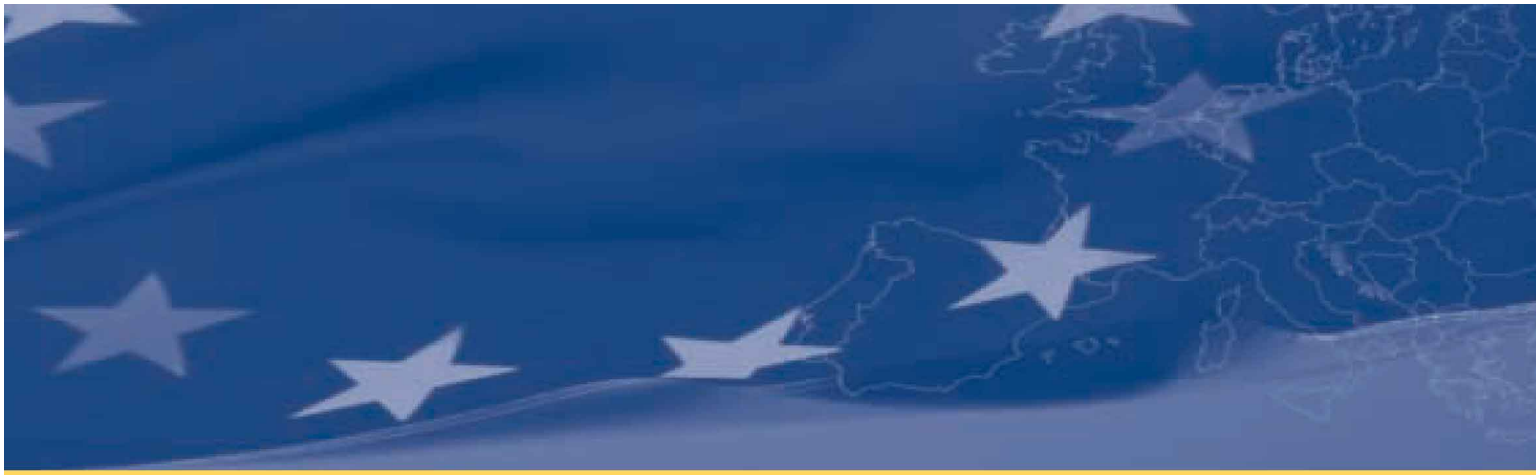

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Draft National Strategy for Air Quality Management in Lebanon

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Abbreviations

AQ	Air Quality
AQI	Air Quality Index
AQMN	National Air Quality Monitoring Network
AQMS	Air Quality Monitoring Stations
AQTF	Air Quality Task Force
ALI	Association for Lebanese Industrialists
AUB	American University of Beirut
AWFS	Autonomous Early Warning System for Forest Fires
BAU	Business As Usual
BAT	Best Available Technique
BOT	Build, Operate and Transfer
BP-IE-UoB	Biodiversity Program at the Institute of the Environment, University of Balamand
CAA	Clean Air Act
CAP	Compliance Action Plan
CDR	Council for Development and Reconstruction
CFC	Chlorofluorocarbon
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
EA	Environmental Assessment
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
ELV	Emission Limit Value
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
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
FWI	Fire Weather Index
GBA	Greater Beirut Area
Gg	Gigagram
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaftfür Internationale Zusammenarbeit
GoL	Government of Lebanon
GLFL	Grand Lycée Franco Libanais
HCFCs	Hydrofluorocarbons
IEE	Initial Environmental Examination
INDC	Intended Nationally Determined Contribution
INFOCA	Plan de Protección Civil y Atención de Emergencias por Incendios Forestales
IPCC	Intergovernmental Panel on Climate Change
ISF	Internal Security Forces

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 of2004 estimated that the impact of air pollution on human health in Lebanon is in the order$170 million per year (World Bank, 2004). A study between 2008 and 2010 at the American University of Beirut with the Université Saint-Joseph in collaboration with the National Centre for Scientific Research (CNRS) estimated the cost of air pollution in Beirut would cost around $10 million.

It can be expected that these costs are considerably higher nowadays due to an expected increase of emissions. In 2005, the Ministry of Environment (MoE) prepared the Draft Law on the Protection of Air Quality. Article 12-1 of this Draft Law stipulates the following:

"By a Council of Ministers 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 Healthand the Ministry of Agriculture, a National Strategy for Air Quality Management will be adopted...."

Accordingly, MoE has initiated the development of the Draft National Strategy for Air Quality Management 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).

Besides addressing air quality issues, this Strategy highlights the need for forecasting wildfire danger in Lebanon as a means to prevent large forest fires and avoid or mitigate the associated health and environmental impacts while taking full advantage of technical resources related to Air Quality Management (i.e. meteorological stations). 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 Council of Ministers' Decision No. 52 dated 13/5/2009).

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 $PM_{2.5}$, there is little evidence that suggests a threshold; 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 therespiratory 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 unequivocallyattributed to NO_2 only.

See summary of impact of various air pollutants on human health 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.

A 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[1] in detail in 2011 to 2013 in the light of new scientific findings on the impact of air pollution. The emission reduction cost of this policy package would amount to 4.5 billion EUR/year in 2030. However, the health benefits[2] are estimated to be about 44 billion EUR/year, i.e. ten times the costs. For the US, the Environmental Protection Agency (EPA) confirmed that the

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

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

benefits of implementing air quality measures under the Clean Air Act (CAA) exceeded the costs by a factor[3] of 30 (US EPA,2011).

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 (including 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[4].

1.3 Scope of the Draft National Strategy for Air Quality Management

The scope of the National Strategy for Air Quality Management in Lebanon was stipulated in Article 12-2 of the draft Law for the Protection of Air Quality. It includes several provisions which will be covered in the different sectors of this proposed strategy, more specifically these provisions call for the following:

- 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, scope and structure. Chapter 2 provides an overview of air quality management in Lebanon includingan assessment of the current state of air quality in Lebanon, the institutional and legal framework in relation to air quality and the wildfire risk management in the country. Chapter 3describes the long-term goals that should be achieved by 2030as well as the short-term action plan including the expected results and priority actions that should be achieved by 2020. Chapter 4 provides the modalities for how the strategy will be implemented, evaluated and itsprogress monitored.

[3]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.

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

2 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 National Ambient Air Quality Standards

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[5]. 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 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. Moreover, Emissions Limit Values (ELV) for point sources in Lebanon were issued by MoE Decision8/1 dated 01/03/2001. These values are currently being updated by MoE.

[5]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 Life 6.10^{-6}

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”.

2.1.3 Sources andEmissions 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 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, notablyCO, NO_x, SO_2, and Non-Methane Volatile Organic Compounds (NMVOC).

In 2012, a temporally-resolved and spatially-distributed emission inventory for the year 2010 was developed for Lebanon by Saint Joseph University. 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.

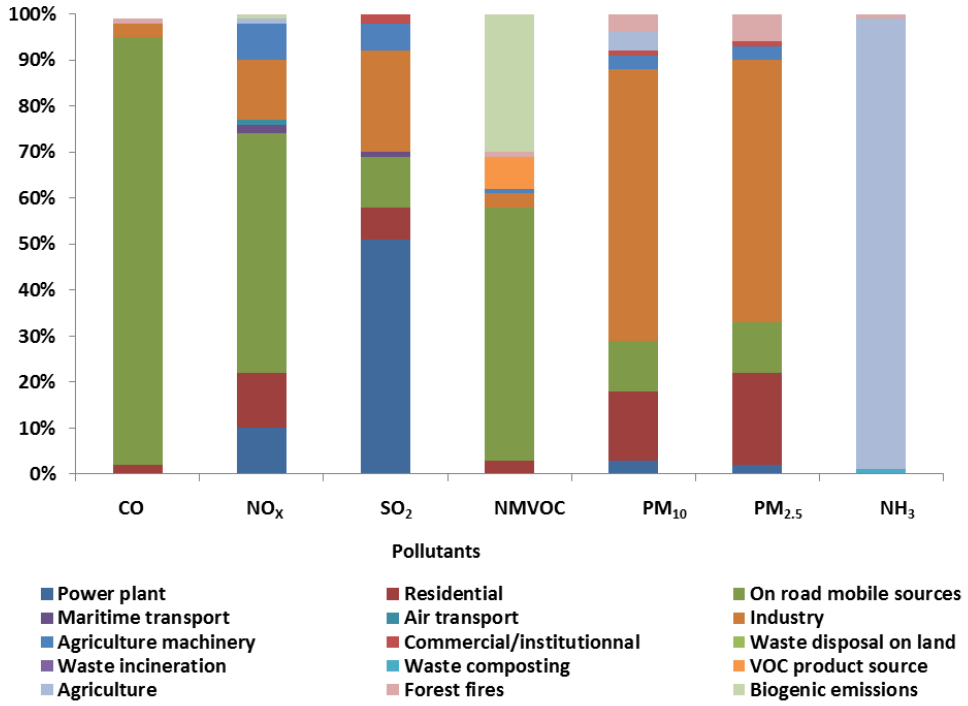

Figure 1: Emissions apportionment for the different pollutants for 2010 (Waked et al., 2012)

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 AmbientAir quality Standards stipulated in 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-termresearch projects on air pollution in Lebanon and started coordinating related activities. However, the research studies focused mainly on Beirut.

In 2013, the MoE under the Environmental Resources Monitoring in Lebanon (ERML) project with the support of the United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP) launched real time air quality monitoring in five sites in Lebanon of which two are also equipped with meteorological stations. These stations use online analysers connected to a supervisory control and Data Acquisition System (DAS) located at MoE.

The current network includes five urban background Air Quality Monitoring Stations (AQMS). This step constituted Phase 1 of the two-phase plan "Establishment of an AQMN in Lebanon" to implement a national Air Quality Monitoring Network (AQMN).

Phase 2 is currently implemented and covers the installation of ten additional AQMS including meteorological stations with the support of the EU/StREG programme. Moreover, eight additional standalone meteorological stations are being added within Phase 2 to expand the meteorological network. Those will be directly connected to the DAS at MoE. In North Lebanon, the Urban Community of Al-Fayhaa (UCF) is currently installing three AQMS in Tripoli (including an MS), Mina, and Beddawi under the European Union's Gouv'AIRnance project.

UCF's AQMS will be connected to a DAS within its premises. UCF's AQMS data will be communicated to the MoE's DAS to centralize all air quality parameters from the nationwide AQMS at MoE. All installedanalysers within the AQMS are based on reference methods meeting the requirements of the EU Air Quality Directive 2008/50/EC.

Figure 2: Distribution of some of the Air Quality Monitoring Stations (AQMS) in Lebanon

As shown in **Figure 2**, the AQMS are located based on the EU directive's technical requirements as well as a pre-assessment of the existing situation (previous research, pollution sources and modelling results) where potential degraded airsheds[6] were identified.

It is worth noting that some of the universities, local authorities, and companies have few instruments for the measurements of the airborne pollutants (ex. Saint Joseph University - USJ, American University of Beirut - AUB, University of Balamand - UOB, etc.).

[6]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.

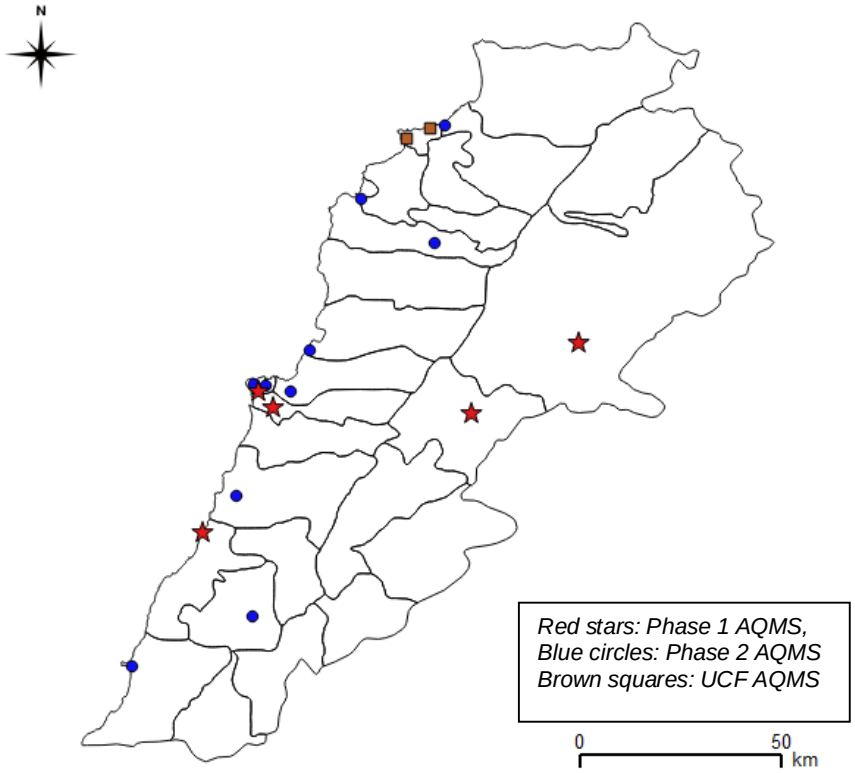

Figure 2: Distribution of some of the Air Quality Monitoring Stations (AQMS) in Lebanon

2.1.5 Air Quality Monitoring and Modelling Results

The air quality situation in Lebanon can be summarized as follows:

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[7] 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 AQMS which started in September 2013 show few exceedances. 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 µg.m^{-3}. For 2014, when considering WHO recommended values, values higher than 40 µg.m^{-3} were recorded in Zahle, Hadath, and Beirut of 59 µg.m^{-3}, 50 µg.m^{-3}, and 49 µg.m^{-3}, respectively but were all compliant with Lebanese national ambient air quality standards for NO_2 of 100µg.m^{-3}(MoE Decision 52/1).

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

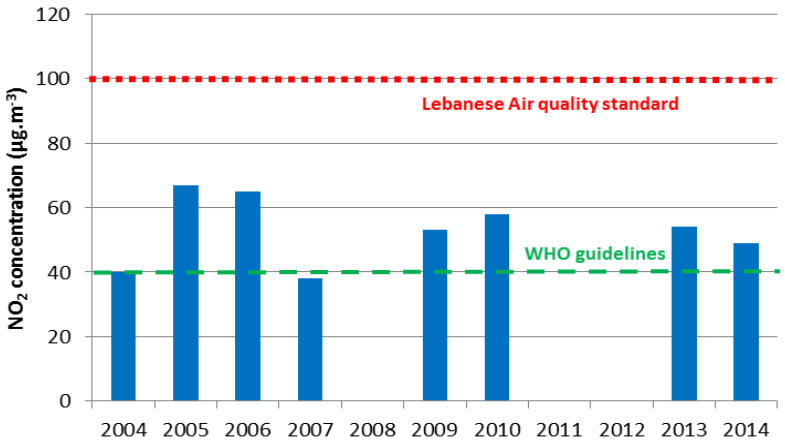

Figure 3: NO_2 annual values over Greater Beirut area[8].

- 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).

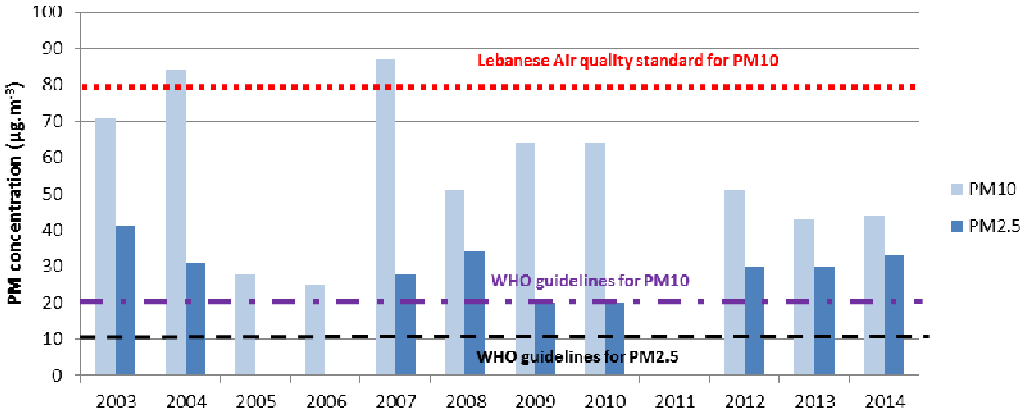

Figure 4: PM annual values over Greater Beirut area[9].

[8] 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).

[9] 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,

- 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.

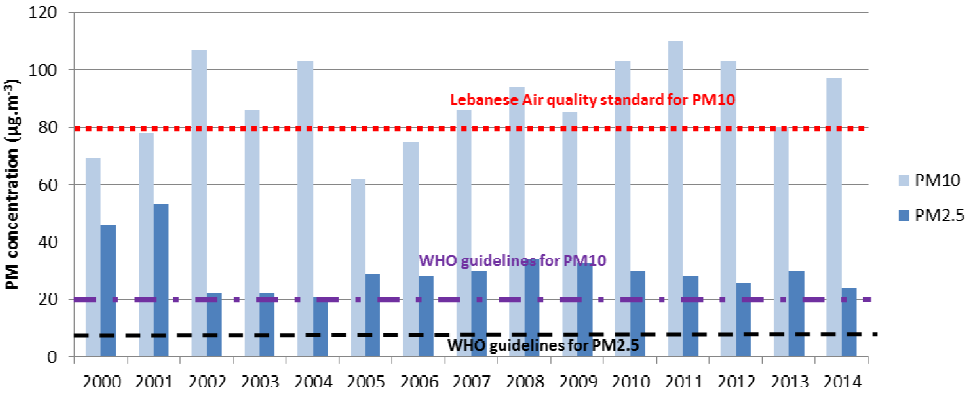

Figure 5. PM annual values over Tripoli (UCF, 2015)

- 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 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

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 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)

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).

While waiting for the AQMN to be fully implemented 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.

On the other hand the Syrian crisis causing displacement of refugees to Lebanon was estimated to precipitate in an increase of up to 20 % the emissions of air pollutants in Lebanon leading to a degradation of air quality (MoE/UNDP/EU, 2014).The spatial distribution showed that GBA will suffer from an increase in air pollutants concentrations of up to 20 % (based on the conservative approach followed in this assessment). It was also expected that other main cities such as Zahle, Baalbeck, Tripoli and Saida will also witness a significant degradation in air quality (MoE/UNDP/EU, 2014).

The exploration and exploitation of offshore oil and gas resources in Lebanon are still underway as environmental impact assessment interventions and seismic surveys are carried out. The sector is foreseen to release petroleum associated air emissions such as methane, VOC, polycyclic aromatic hydrocarbons (PAH), CO, SO_2, and NO_xthatwould be dangerous to the environment and human health. As such, the Ministry of Energy and Water created the Petroleum Authority (PA) which is responsible for monitoring and enforcing the quality, safety, health and environment issues emanating from the oil and gas sector.

2.2 Institutional, Policyand 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 realize more than even 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 Air Quality 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.

The AQ Department is currently under-staffed and under-resourced. Some support and technical assistance for air quality related issues is provided through the MoE/UNDP Project for Environmental Resources Monitoring in Lebanon.

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.

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 a BOT basis (Build, Operate and Transfer), 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[10]. As for the ministry of Public Works and Transport, it is

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

responsible for setting strategies and policies in the transport sector (including road transport) – see section 2.2.4.

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. MoE Decision 8/1-2001 stipulated Emissions Limit Values (ELVs) for power plants > 100 MW - < 300 MW(and other industrial sectors). To date, there are no emission standards for large power plants (> 300 MW).

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. The StREG programme is currently working on strengthening the role of MoE in enforcement and inspection, including updating the ELVs.

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-SectoralPolicy and Legal Framework

This draft strategy constitutes the GoL's strategy to protect air quality in Lebanon.

It will complement other national and sectoral policies and strategies related to air quality management in Lebanon and will be integrated within coming up national plans and policies including the National Sustainable Development strategy.

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. The NSDS comprises seven Strategic Objectives and forty-one Initiatives[11]; and although it does not dedicate a stand-alone Initiative to air quality management, it rather tackles air quality within various Initiatives including Sustainable Cities, Energy, and Transport. The existing situation related to air quality management as well as recommendations to improve air quality in Lebanon are extensively mentioned in the Sustainable Cities (SC) and Transport Initiatives. This will ensure continuous data streams to city planners and the public. 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 controlled gaseous emissions (NO_x, SO_2, and PM).

At the legal level, there are many legal texts that were developed and relate to reducing air pollution from several sectors (see Section 2.2.4). Since 1996, the MoE has been issuing legislation to protect air quality in the country.

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

MoE Decision 52/1 (12/09/1996) and MoE Decision 8/1 (01/03/2001) (definition of NAAQS, ELV)

In 1996, the MoE issued Decision 52/1 dated 12/09/1996 which defined the NAAQS -- see Section2.1.2 - that are legally binding and must not be exceeded. However, and as mentioned previously, those are exceeded in several areas in the country. In 2001, MoE amended Decision 52/1 by Decision 8/1 on 12/09/2001 which defined Emission Limit Values for stack emissions and effluent discharge from new and existing industrial establishments. 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.

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. It has defined 11 environmental principles including:

1. Precaution (cleaner production techniques)
2. Prevention (best available technologies)
3. Polluter-Pays-Principle (polluters pay for pollution prevention and control)
4. Biodiversity conservation (in all economic activities)
5. Prevention of the degradation of natural resources
6. Public participation (free access to information and disclosure)
7. Cooperation between central government, local authorities, and citizens
8. Recognition of local mores and customs in rural areas
9. Environmental monitoring (pollution sources and pollution abatement systems)
10. Economic incentives to encourage compliance and pollution control
11. EIA process to control and mitigate environmental degradation

Of importance is Section V of Law 444 dated 29/07/2002 on the protection of environmental resources, Chapter One of Section V relates to the Protection of Air Quality and Control of Unpleasant odors. 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.

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. It 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. As previously stated, the Strategy for Air Quality Management in Lebanon (*this document*) 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

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 (DGLMT) 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

Presently, the EU-SISSAF[12] Project implemented at the MoPWT is developing a 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.

In its current draft version, the Strategy does not include short- and long-term goals taking into consideration the protection of air quality.

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 (<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

[12] Support Programme for Infrastructure Sector Strategies and Alternative Financing

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. 82432003 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

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 (RE) 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 MoEWdeveloped the Policy Paper for the Electricity Sector (PPES) which seeks to redress the country’s ailing electricity sector by 2015 and achieve the 12% RE contribution. The PPES was unanimously approved by COM the electricity sector in Lebanonand effectively overhaul Law 462/2002 – see below. 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-term2015 and beyond).

The National Energy Efficiency Action Plan (NEEAP)

As a follow up the PPES, the COM adopted the National Energy Efficiency Action Plan in 2011 (NEEAP; 2011-2015). The plan describes 14 initiatives including:

1. Towards banning the import of incandescent lamps to Lebanon,
2. Adoption of the energy conservation law and institutionalization of the Lebanese Centre for Energy Conservation (LCEC),
3. Promotion of decentralized PV and wind applications in the residential and commercial sectors,
4. Solar Water Heaters for buildings and institutions,
5. Design and implementation of a national strategy for efficient and economic public street lighting,
6. Electricity generation from wind power,
7. Electricity generation from solar energy,
8. Hydropower for electricity generation,
9. Geothermal, waste to energy and other technologies,
10. Building code for Lebanon,
11. Financing mechanisms and incentives,
12. Awareness and capacity building,
13. Paving the way for Energy audit and Energy Service Companies (ESCO) business, and
14. Promotion of Energy Efficient equipment.

The Plan promotes the use of RE which reduces emissions from the power sector.

The National Renewable Energy Strategy

The Ministry of Energy and Water (MOEW)/Lebanese Centre for Energy Conservation (LCEC) prepared Lebanon's National Renewable Energy Strategy (NRES). The NRES is based on the 12 % RE national target, the National Energy Efficiency Action Plan (NEEAP) and the potential RE implementation technologies in Lebanon. The country energy efficiency and Renewable Energy Demonstration Project 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). A Strategic Environmental Assessment (SEA) for the NRES has been prepared. However, it is unknown if reductions in GHG emissionsin the energy sector related to the implementation of NRES were calculated.

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*** combustion plants including:

Combustion plants	**Fuel-oil power station: boilers, steam generators, power generators (>1MW - < 50MW)**
	Fuel-oil power generators (>50MW)
	Fuel-oil power generators (>50MW – <100MW)
	Fuel-oil power generators (>100MW – <300MW)

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 Law 132/2010 (Article 7 Clause 2), all licensing for exploratory drilling is subject to EIA. Additionally, well development and production licensing obligates in depth environmental impact assessment studies (Articles 29 and 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).

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 > 0.25 MW). The circular specifies ELVs and monitoring requirements of air pollutants. Currently, the Circular is operational for one year and as a point of fact is out-of-date. Plans at the Service of the Urban Environment 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:

1. Expanding domestic market,
2. Increase industrial exports,
3. Increase competitiveness of the national industry,
4. Increase the investment and financing of the industrial sector,
5. Encourage Green Industry,
6. Encourage New knowledge industry, and
7. 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 including GIZ, EU and UNDP implemented many initiatives and projects, the on-going Lebanon Environmental Pollution Abatement Project (LEPAP) is jointly supported by MoE, WB, 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 is currently preparing a Road Map on strengthening the role of MoE in permitting, monitoring of ELVs, 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:

Industrial plants	**Cement**
	Glass
	Manufacturing of Batteries
	Electroplating
	Manufacturing of Aluminium
	Food
	Municipal Solid Waste Incinerators

In the framework of Component 1 of the StREG Project on Inspection and Enforcement of Industrial Establishments, the StREG Team developed updated ELVs for selected sectors including:

1. Cement production
2. Co-incineration
3. Power generation
4. Municipal solid waste incineration
5. Fertiliser production
6. Food, drink and milk production
7. Pulp and paper production
8. Tanneries
9. Vegetable oil production
10. Mobile generators

Those will be issued as MoE Decision, 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

The CoM approved, in 2012, Decree 8633 (dated 16/08/2012) on the "Fundamentals for Environmental Impact Assessment (EIA)". The EIA Decree defines environmental assessment procedures in Lebanon and specifies which projects require Environmental Assessment (EA) documentation including an EIA or an Initial Environmental Examination (IEE). 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

In line with articles 12 and 13 of Law 444/2002, the CoMapproved Decree 8471 (dated 19/07/2012) on "Environmental Compliance for Establishments". It applies 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). It provides a mechanism for obtaining an Environmental Compliance Certificate (ECC) from the MoE. 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 byCDR; list retrieved from MoE website) to determine their environmental performance (emissions of air pollutants, water consumption, waste and wastewater generation, etc.). The EA should include an Environmental Management Plan (EMP) / Compliance Action Plan (CAP) (template found in Annex 1 of the Decision) and should be reviewed/commented by the MoE. The ECC is issued by the MoE confirming that the audited establishment has implemented the EMP and complies with environmental standards. According to Article 8 of Decree 8471/2012, the MoE registers the industrial establishment in the ECC List. The validity of the certificate is forthree years, renewable upon the submission of a self-environmental audit (refer to Annex 3 of Decree 8471/2012). The Ministry then decides whether to keep the establishment on the ECC list or remove it. 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.

2.2.6 Policies and legal framework in the Municipal Solid WasteSector

Policies and Strategies

The GoL has developed several plans, decisions, and circulars, although these have not been fully implemented.In July 2015, a waste crisis was initiated 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 backyard burning activities.

Legal Instruments

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

In 2005, the MoE prepared a Draft Law onIntegrated Solid Waste Management(ISWM) in the context of the Regional Solid Waste Management Project (RSWMP) funded by the EU. This special program was implemented by the Mediterranean Environmental Technical Assistance Program (METAP) and managed by the World Bank (MoE/UNDP/Ecodit, 2011).

The law encompasses a comprehensive strategy on Solid Waste Management(SWM) which was updated in 2010.

The Draft Law aims at the following improvements (SWEEP-Net, 2014, p. 11):

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

The Draft Law was presented to and approved by the Council of Ministers in 2012. Currently, it still awaits Parliament approval. In 2013, the CoM appointed a Ministerial Committee to prepare a Draft National Solid Waste Management Plan for Lebanon and included waste to energy (WtE) treatment technology as part of a future solution. The Plan was followed by a Road Map for integrated solid waste management (ISWM) addressing short-term (2014 – 2018) and longer-term (2018 – 2040) priorities.

CoM consecutive decisions

Since 2010, the CoM has been issuing decisions related to solid waste management in Lebanon including: Decision 46 dated 30 October 2014 amended by Decision 1 of 12/1/2015. However, none of these decisions was implemented. The current SWM situation is at a critical stage especially in Beirut and Mount Lebanon area where the Naameh landfill was closed on 17 July 2015. The GoL has been endeavouring to find solutions to the solid waste management situation for the past decade. However, little progress has been made in improving the situation. Striving to find a pragmatic solution, the CoM issued Decision 1 of 09/09/2015 that stipulated building two new sanitary landfills, transfer all accumulated waste in Beirut and Mount Lebanon to Naameh for seven days, and expedite the distribution of outstanding payments to municipalities.

More recently, COM Decision 1 of 21/12/2015 allowed CDR to outsource the export of municipal wastes resulting from the governorate of Beirut and part of the governorate of Mount Lebanon outside the Lebanese territory and to dispose of them in accordance with the local laws, the international treaties that were concluded and enforced regarding the transport, treatment and disposal of wastes, in accordance with the provisions stipulated in this decision.

2.2.7 Policies and legal framework related 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 including Lebanon's emission inventory, impacts of climate change, GHG mitigation, vulnerability and adaptation measures. Lebanon submitted the 3rd National Communication to the UNFCCC in December 2015. Moreover, Lebanon will submit the National Appropriate Mitigation Actions (NAMAs) which aim to reduce GHG emissions in the waste and transport sectors.

In December 2015, at the Conference of Parties (COP 21), the GoL submitted also its Intended Nationally Determined Contribution (INDC) (Republic of Lebanon, 2015) which includes GHG reduction targets in the energy, industrial processes, agriculture, land-use, land-use change and forestry, and waste sectors.

Under the business-as-usual (BAU) scenario GHG emissions will approximately double from 2011 to 2030, the unconditional scenario will result in a 15 % reduction compared to BAU, the conditional scenario results in a reduction of 30 % compared to BAU.In general, climate change mitigation measures improve indirectly air quality.

2.2.8 Multilateral Environmental Agreementsrelated 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 3 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). Thusthe 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 3. 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 stabilization 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 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 prevention and warning will be of benefit to air quality as well. However, to date, Lebanon lacks an accurate and detailed system for wildfire risk warning.

Prediction of wildfire risk 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 provid-ing 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 re-cently developed National Forestry Program (NFP).The NFP aimed at "the continued manage-ment of forests by implementing modern resource assessment procedures and reinforcing re-lated scientific research" (MoA, 2008).

2.3.1 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. As identified by the strategy and in reference to current efforts and contributions in forest fire 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, Director-ate 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. Uni-versity 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 NGOs.

Currently, the National Disaster Management Unit at the Prime Minister's Office is working on developing response plans for each relevant ministry. This can facilitate the integration of de-veloped fire danger systems into a National structure for disseminating and interpreting risks.

2.3.2 Current situation related to Wildfire Risk Warning

The assessment of the "Status of Wildfire Warning Systems in Lebanon" (MoE/EU, 2014) identi-fied the current situation of existing fire risk warning systems and infrastructure in Lebanon for generating daily fire danger indices, and evaluated potential systems for a sustained and im-proved fire danger warning. The assessment indicated that Lebanon lacks a dynamic and com-prehensive wildfire risk assessment and management; there has been a number of initiatives and projects aiming at predicting wildfire risk. Such initiatives and projects included

1. The RISICO system in Lebanon (a system that is hosted outside Lebanon and it did not ac-count foruntil recentlythe necessary fire risk factors such as fire vulnerability and hazard);
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 initia-tive 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 Bio-diversity Program at the Institute of the Environment, University of Balamand (BP-IOE-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.

In summary, a review of existing systems in relation to fire risk management showed the follow-ing observations:

- Existing systems for fire danger forecast (e.g., RISICO, AUB fire algorithms) need to improve taking into account fire hazard and 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, fire risk map produced by UOB) with other forecasted data (e.g. EFFIS) and produce an advanced national fire danger sys-tem.

2.3.3 Key Gaps for Efficient Wildfire Risk Warning System

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

- Lack of an operational system of meteorological data collection from the different exist-ing/planned networks;
- Lack of knowledge at the stakeholders' level about performance of existing fire warning sys-tems and potential advanced systems;

- Need for technical resources (e.g. necessary software, automation, etc.) to develop the na-tional fire warning system and produce National Fire Weather Index (NFWI);
- Lack of linkages, analysis, and interpretation between emissions from forest fires and air quality records from the AQMS;
- Lack of linkages between the different national agencies (e.g. ministries) to communicate, disseminate, and interpret fire risks.

The "Status Report of Wildfire Warning Systems on Lebanon" (MoE/EU, 2014) recommended the development of an efficient national early warning system through providing links to the European Forest Fires Information System (EFFIS) in line with Lebanon's National strategy for forest fire management. The proposed national early warning system is expected to benefit from existing infrastructure and resources in relation to the Ministry of Environment's AQMS and its associated weather stations which could provide weather observations to generate the FWI at sensitive forest areas across Lebanon. Therefore, the integration of the warning system into the AQMS is a necessity.

The importance and uniqueness of the national warning system involve the ability to highlight risk taking into account vulnerability (e.g. the presence of a reserve) and hazard (e.g. density and combustibility of fuel). This can help in pooling the limited fire fighting resources into crucial fire risk areas.

In parallel, evaluating performance of existing warning systems (e.g. RISICO) is also of interest. Such evaluation can involve the comparison of the real fire situation on the ground (e.g. fire oc-currence and spread) to the produced indices. One option for evaluation can comprise of the use of the results of the annual fire report as generated by MoE and the University of Balamand within the framework of a memorandum of understanding or joint protocol. This would allow comparison of fire occurrence and distribution against its corresponding fire danger. Eventually, the evaluation of both, the proposed national early warning system in association with EFFIS and the fire risk map of Lebanon, the RISICO system is expected to help identifying future adoption of most appropriate national fire danger systems in Lebanon.

3 Goals of the Draft National Strategy for Air quality Management

3.1 Vision of the Strategy

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

Through this strategy, the GOL is committing itself to enhance and protect ambient air quality through the adoption of short and long-term goals (including related priority actions) identified in this strategy, in order to reach the vision set forth in the strategy.

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

"Article 12-3. The National Strategy for the Air Quality Management stipulates the following:

- 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".

As such, the strategy includes a set of long-term goals to be achieved by 2030 by MoE and other stakeholders to improve air quality in the country. The strategy includes also an action plan for the period of 2016-2020 composed of a set of short-term goals, results and actions and which complement the long-term goals of the strategy as presented in Figure 6 below.

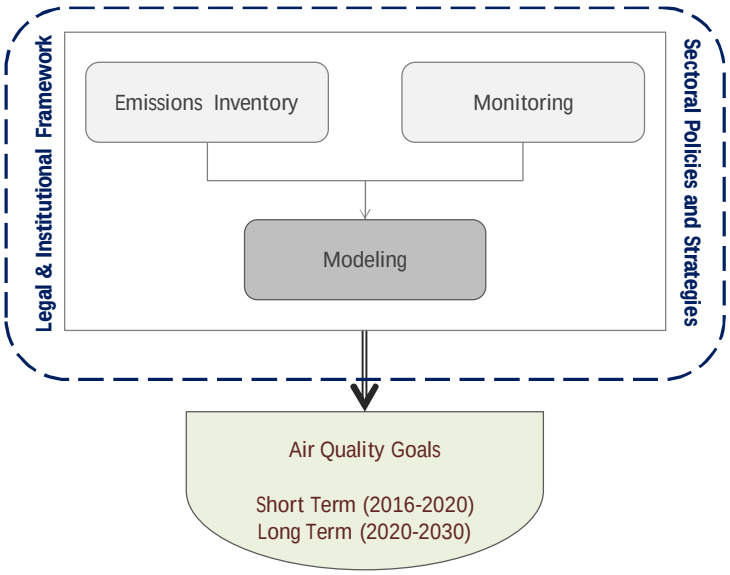

Figure 6. Overall scheme of the Strategy for Air Quality Management

3.2 Long-term goals (2020-2030)

The main Long-term AQ goal will be to reduce air pollutant concentrations to acceptable levels throughout the territory. Results to achieve these goals will be developed and implemented and include the following.

3.2.1 Long-term goal 1: Compliance with updated AQ standards

- Maintaining and improving the existing AQMN and the calibration laboratory; accrediting the laboratories;
- Implementing suitable air quality models for regulatory purposes, evaluate the performance and establish good practice guidance;
- Evaluating the performance of air quality models and adopt an Integrated Assessment Modelling system for the national air quality forecasting;
- Assessing the impact of each sector on air quality;
- Implementing strategies/policies/actions per sector to reduce the impact on air quality per region in order to comply with WHO recommended values;
- Developing and maintaining a programme for assessing the impact of air quality on health.

3.2.2 Long-term goal 2: Development and full implementation of the Draft Law for the Protection of Air Quality

- Developing the 27 decrees and decisions stipulated in the Draft Law for the Protection of air Quality;
- Implementing decrees and decisions related to the protection of air quality in coordination with public and private agencies;
- Strengthening the capacity of responsible government agencies (MoE, MoIM and MoJ) to enforce legislation related to air quality;
- Developing, implementing and monitoring local air quality planning for all degraded airshed in line with Draft Law for the Protection of Air quality.

3.2.3 Long-term goal 3: Development and evaluation of a national wild fire warning system

- Developing and implementing a new national fire warning system (combining EFFIS data with the fire risk map of Lebanon in addition to the meteorological data from the AQM stations and the automated weather stations of the MoE network);
- Evaluating the performance of existing fire warning systems in predicting fire risk (e.g. the new national fire warning system versus RISICO) and adopt one national fire warning system;
- Assessing the impact of forest fires (based on fire occurrence and burned areas as reported by MoE and BP-IoE-UoB) on air quality (e.g. CO, PM, etc.) and evaluate air quality data recorded by the AQM stations in association with occurred fires and burned fuel as part of the AQMS.

3.3 Short-term action plan (2016-2020)

The action plan set for 2020 will be used as a basis for improving air quality in the country, thereby reducing the impacts on health and the environment from air quality degradation. The main objective of the short-term action plan is to achieve compliance with the AQ Interim Standards throughout the territory and for all air pollutants. This requires a continuous assessment of pollutant levels in line with monitoring and modelling results as well as the implementation of priority actions in the main sectors. **Given the importance of proceeding with the implementation of the short-term action plan, a set of short-term goals, results and actions have been identified and are presented in Annex 2 of this strategy.** The action plan also identified the concerned national stakeholders to be involved in the implementation of the proposed actions. The action plan is composed of the following short-term goals and results.

3.3.1 Short-term goal 1: Strengthening the legal and institutional framework

- Adopting the Draft Law for the Protection of Air Quality;
- Updating the NAAQS based on the Assessment of AQ throughout the Territory;
- Strengthening MoE AQ department and Air Pollution Monitoring Bodies;
- Signing the UNECE LRTAP convention;
- Developing local air quality planning;
- Developing Measures/Plans in case of High Pollution levels.

3.3.2 Short-term goal 2: Improving air quality assessment throughout the territory

- Establishing, operating and maintaining (including the required QA/QC) the AQ monitoring infrastructure;
- Establishing a methodology for the analysis, assessment, and reporting of the AQ data;
- Updating, improving and reviewing regularly existing initial emission inventories;
- Developing and updating regularly a national integrated assessment and modelling system.

3.3.3 Short-term goal 3: Solving air quality problems due to stationary sources in degraded airsheds

- Adopting proposed Emission Limit Values (ELVs) for key industrial sectors in line with Best Available Techniques (BATs) levels;
- Developing procedures for enforcing regulations for self-monitoring, reporting and third-party verification in key sectors;
- Developing the Environmental Licensing Mechanism for Emissions of Air Pollutants.

3.3.4 Short-term goal 4: Developing a wild fire warning system

- Producing a local Fire Weather Index from existing weather monitoring stations;
- Designing and developing an advanced national wildfire danger warning system.

3.3.5 Short-term goal 5: Solving air quality problems from mobile sources

- Strengthening the inspection capabilities of mobile sources at national level;
- Implementing, monitoring and enforcing regulations for fuel quality.

3.3.6 Short-term goal 6: Mainstreaming air quality management in priority sectors

- Ensuring synergies with national climate change policies and plans;
- Developing an SEA for the Lebanese Land Transport Strategy;
- Improving AQ from Air and Maritime transport;
- Integrating Air Quality in the Energy Sector;
- Integrating Air Quality in the industrial sector;
- Integrating Air Quality in the Solid Waste Management Sector;
- Integrating Air Quality in other priority sectors.

3.3.7 Short-term goal 7: Communication and outreach on Air Quality

- Providing data and regular reports on air quality for all monitoring sites and modelling results to the public;
- Linking the on-going activities at the MoE and the universities.

4 Implementation, monitoring and evaluation

The success of this Air Quality Management Strategy depends on timely implementation of its priority activities. This can be achieved by allocating clear responsibilities for each activity and a timetable for the implementation. Regular monitoring supports the implementation process, whereas a timely evaluation allows for adjusting and aligning the activities in order to achieve the short-term and long-term goals.

4.1 Consultation Process for Validation

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

- National Council for the Environment;
- NGOs;
- Universities;
- Research centres;
- Environment observatories.

Consultations will provide an opportunity for stakeholders to review and comment on the draft document and deliver suggestions for improvement. In addition, the strategy document will be posted on the MoE website for public consultation and comments.

4.2 Implementation Process

This Strategy provides long-term goals as well as an action plan including with specific results and actions which should be implemented by different stakeholders. Therefore, the detailed action plan (specifying stakeholders) will be used by the MoE concerned departments (specifically the Department of Air Quality of the Service of Environmental Technology) in as a framework for the implementation of the strategy.

4.3 Monitoring, Evaluation and Reporting

4.3.1 Air quality

The MoE's Department of Air Quality within the Service of Environmental Technology will develop a set of indicators to track the progress of the proposed action plan on a yearly basis. The evaluation of the action plan 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 that the monitoring and evaluation of the strategy and action plan as well as its updating is conducted on regular basis and will inform the strategy for 2030.

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

4.3.2 Wildfire risk warning systems

There is a need to generate a fire database for use in the evaluation of the fire warning system. The fire database can be extracted from the annual reports of forest fires which are produced within a collaborative framework between the Department of Ecosystems at the Ministry of Environment and the Biodiversity Program at the Institute of the Environment, University of Balamand.

In 2013, a collaborative work was initiated between the Ministry of Environment (MoE) and the Institute of the Environment, University of Balamand (IoE-UoB), regarding the execution of the data analysis related to wildfires in Lebanon. The main goal of this collaboration is to produce a yearly report on wildfire occurrence and the extent of burned areas in Lebanon.

The analysis is done based on the data provided in the fire ID cards filled in by the Internal Security Forces (ISF) and copied to the Ministry of Environment, knowing that the fire ID cards format was issued through the notification of the Presidency of Council of Ministers number 256 dated on 1/3/2008. The report comes in line with the highlights of the technical requirements of Lebanon's National Strategy for Forest Fire Management (endorsed by Council of Ministers Decision No. 52 dated 13/5/2009) by working towards the unification of fire information and data as a means to empower efforts in understanding better the problem of wildfires in Lebanon.

Accordingly, the performance of existing fire warning systems in predicting fire risk (i.e., the new national fire warning system versus RISICO) will be monitored through conducting statistical analysis of fire occurrence data in combination with the daily output maps of the warning systems. This eventually will facilitate and promote the adoption of one National fire danger system in Lebanon.

References

Afif, C. (2008). PhDThesis: Etude de la chimie troposphérique en milieu urbain : rôle de l'acide nitreux. Paris 12 University - France, Saint Joseph University – Lebanon, 250 pp.

Afif, C., Chélala, C., Borbon, A., Abboud, M., Adjizian-Gérard, J., Farah, W., Jambert, C., Zaarour, R., BadaroSaliba, N., Perros, P.E.,Rizk, T.(2008). SO2 in Beirut: air quality implication and effects of local emissions and long range transport. Air Quality, Atmosphere and Health, 1, 167- 178.

Afif, C., Dutot, Jambert, C., A., Abboud, M., Adjizian-Gérard, J., Farah, W., Perros, P.E., Rizk, T. (2009).Statistical approach for the characterization of NO2 evolution in Beirut. Air Quality, Atmosphere and Health, 2, 57-67.

Air pollution hotspots in Lebanon progress report, Ministry of Environment, 2011

Badaro-Saliba, N., Adjizian-Gerard, J., Zaarour, R., Abboud, M., Farah, W., Saliba, N., Shihadeh, A. (2014).A geostatistical approach for assessing population exposure to NO2 in a complex urban area. Stochastic Environmental Research and Risk Assessment,28, 467-474.

EMEP – Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (2015): Transboundary particulate matter, photo-oxidants, acidifying and eutrophying components. EMEP Report 1/2015.

European Commission (2011): Commission Staff Working Paper establishing guidelines for demonstration and subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC on ambient air quality and cleaner air for Europe, 15.02.2011, SEC(2011) 208 final.

European Commission (2013): Commission Staff Working Document. Impact Assessment.Accompanying the documents: Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions -a Clean Air Programme for Europe.Proposal for a Directive of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from medium combustion plants.Proposal for a Directive of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC. Proposal for a Council Decision on the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone. SWD(2013)531.

EEA – European Environment Agency (2014): Air quality in Europe — 2014 report. EEA Report No 5/2014.

Greater London Authority (2006): The control of dust and emissions from construction and demolition. Best Practice Guidance. London.

Greater London Authority (2014): The control of dust and emissions from construction and demolition. Supplementary Planning Guidance. London.

ICP Vegetation – International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops, Programme Coordination Centre, Centre for Ecology and Hydrology (2011): Ozone Pollution: A hidden threat to food security. Report prepared by the ICP Vegetation. CEH, Bangor.

Kouyoumdjian, H.,Saliba, N. A.(2006).Mass concentration and ion composition of coarse and fine particles in an urban area in Beirut: effect of calcium carbonate on the absorption of nitric and sulfuric acids and the depletion of chloride, Atmos. Chem. Phys., 6, 1865-1877.

Lelieveld, J.; Beirle, S.; Hörmann, C.; Stenchikov, G. & Wagner, T. (2015): Abrupt recent trend changes in atmospheric nitrogen dioxide over the Middle East. Sci. Adv. 2015;1:e1500498.

Lim, S.S. et al. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet, 380(9859):2224–2260.

Massoud, R.,Shihadeh, A., Roumié, M., Youness, M.,Gerard, J., Saliba, N., Zaarour, R.,Abboud, M.,Farah, W.,Saliba N.A. (2011). Intraurban variability of PM10 and PM2.5 in an Eastern Mediterranean city.Atmos. Res., 101, 893–901

MoA – Ministry of Agriculture (2008).National Forestry Program.

MOE/ARDP/EU – Ministry of Agriculture / Agricultural and Rural Development Program / European Union (2014): Ministry of Agriculture Strategy 2015-2019, Beirut.http://www.agriculture.gov.lb/Arabic/AboutUs/Strategy_2015_2019/Pages/default.aspx

MoE – Ministry of Environment (2015). Joint exercise ENEA-USJ on Air quality modeling over Lebanon for the year 2011.

Mitri, G., Jazi, M., McWethy, D. (2015): Assessment of wildfire risk in Lebanon using Geographic Object-based image analysis. Photogrammetric Engineering & Remote Sensing. Vol. 81, No. 6, June 2015, pp. 499–506.

MoE/EU (2014): Status of Wildfire Warning Systems in Lebanon

MOE/EU/UNDP– Ministry of Environment / European Union / United Nations Development Program(2014): Lebanon Environmental Assessment of the Syrian Conflict & Priority Interventions. September 2014. Beirut.

MOE/UNDP/UOB –Ministry of Environment / United Nations Development Program / University of Balamand(2013): National Greenhouse Gas Inventory Report and Mitigation Analysis for the LULUCF sector in Lebanon (Final report).

MoE/UNDP – Ministry of Environment / United Nations Development Program(2015). Optimal Renewable Energy Mix of the Power Sector by 2020: Investment Cost Implications for Lebanon. Beirut, Lebanon.

MoE/UNDP/GEF (1999). Lebanon's Initial National Communication to the UNFCCC. Beirut, Lebanon.

MoE/UNDP/GEF (2011). Lebanon's Second National Communication to the UNFCCC. Beirut, Lebanon.

MoE/UNDP/GEF (2016). Lebanon's Biennial Update Report. Beirut, Lebanon.

MoE/UNDP/GEF, 2015. National Greenhouse Gas Inventory and Mitigation Analysis for the energy Sector in Lebanon. Beirut, Lebanon.

MOE/UNDP/ECODIT – Ministry of Environment / United Nations Development Program / ECODIT (2011): State and Trends of the Lebanese Environment 2010. Lebanon.

MoE/GIZ (2013): Policy Paper for Industrial Wastewater Management

MoE/MoI/UNEP (2015): Sustainable Consumption and Production Action Plan for the Industrial Sector in Lebanon

MradNakhlé, M.; Farah, W.; Ziade, N.; Abboud, M.; Coussa-Koniski, M.-L.&Annesi-Maesano, I. (2015a): Beirut Air Pollution and Health Effects – BAPHE study protocol and objectives. Multidisciplinary Respiratory Medicine (2015) 10:21.

MradNakhlé, M.; Farah, W.; Ziade, N.; Abboud, M.; Salameh, D. &Annesi-Maesano, I. (2015b): Short-term relationships between emergency hospital admissions for respiratory and cardiovascular diseases and fine particulate air pollution in Beirut, Lebanon. Environ Monit Assess (2015) 187: 196. DOI 10.1007/s10661-015-4409-6.

Republic of Lebanon (2015): Lebanon's Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change. September 2015.

Safieddine, S.; Boynard, A.; Coheur, P.-F.; Hurtmans, D.; Pfister, G.; Quennehen, B.; Thomas, J.L.; Raut, J.-C.; Law, K.S.; Klimont, Z.; Hadji-Lazaro, J.; George, M.; Clerbaux, C. (2014): Summertime tropospheric ozone assessment over the Mediterranean region using the thermal infrared IASI/MetOp sounder and the WRF-Chem model. Atmos. Chem. Phys., 14, 10119–10131, 2014.

Salameh T, Sauvage S, Afif C, Borbon A, Léonardis T, Brioude J, Waked A, Locoge N. (2015). Exploring the seasonal NMHC distribution in an urban area of the Middle East during ECOCEM campaigns: very high loadings dominated by local emissions and dynamics. Environmental Chemistry, DOI 10.1071/EN14154

Salameh, T., Sauvage, S., Afif, C., Borbon, A., and Locoge, N. (2016). Source apportionment vs. emission inventories of non-methane hydrocarbons (NMHC) in an urban area of the Middle East: local and global perspectives, Atmos. Chem. Phys., 16, 3595-3607, doi:10.5194/acp-16-3595-2016.

Saliba, N.A., Moussa, S., Salame, H., El-Fadel, M. (2006). Variation of selected air quality indicators over the city of Beirut, Lebanon: Assessment of emission sources. Atmos. Environ., 40, 3263-3268.

Saliba, N. A., Kouyoumdjian, H., Roumie, M. (2007).Effect of local and long-range transport emissions on the elemental composition of PM10–2.5 and PM2.5 in Beirut.Atmos. Environ., 41, 6497–6509.

Saliba, N.A., El Jam, F., El Tayyar, G., Obeid, W., Roumie, M. (2010). Origin and variability of particulate matter (PM10 and PM2.5) mass concentrations over an Eastern Mediterranean city. Atmospheric Research 97, 106–114.

SELDAS – Strengthening the Environmental Legislation Development and Application System in Lebanon (2005): Rapid Cost-Benefit Analysis for the Draft Law on Protection of Air Quality in Lebanon.

SWEEP-Net (2014). Country report on Solid Waste Management in Lebanon.

Urban Community al-Fayhaa – UCF (2015), private communication.

UNDP – United Nations Development Program (2014): Provision of Professional Services for the Preparation of the Strategic Environmental Assessment of Lebanon's Renewable Energy Sector. SEA Scoping Report. Contract Ref: 13/111.

UNEP – United Nations Environment Programme (2011): Near-term Climate Protection and Clean Air Benefits: Actions for Controlling Short-Lived Climate Forcers, United Nations Environment Programme (UNEP), Nairobi, Kenya, 78pp.

UNEP-ROWA – United Nations Environment Programme - Regional Office for West Asia (2013): Air Quality Monitoring in Lebanon: A step towards improved assessment and mitigation of Air Pollution. Environmental Resources Monitoring in Lebanon Project.

United Nations (2004): Clearing the Air. 25 years of the Convention on Long-range Transboundary Air Pollution. United Nations, New York and Geneva.

US EPA – United States Environmental Protection Agency (2011): The Benefits and Costs of the Clean Air Act from 1990 to 2020. Final Report – Rev. A.

US EPA – United States Environmental Protection Agency (2012): Report to Congress on Black Carbon. EPA-450/R-12-001

Van Dingenen, R., et al.(2009), The global impact of ozone on agricultural crop yields under current and future air quality legislation, Atmospheric Environment, 43(3): 604-618.

Waked, A., Afif, C., Brioude, J., Formenti, P., Chevaillier, S., El Haddad, I., Doussin, J-F., Borbon, A., Seigneur, C. (2013a). Composition and Source Apportionment of Organic Aerosol in Beirut, Lebanon, During Winter 2012, Aer. Sc. Tech., 47, 1258-1266.

Waked, A., Seigneur, C., Couvidat, F., Kim, Y., Sartelet, K., Afif, C., Borbon, A., Formenti, P., Sauvage, S. (2013b). Modeling air pollution in Lebanon: evaluation at a suburban site in Beirut during summer, Atmos. Chem. Phys., 13, 1-14.

Waked, A., Afif C., Seigneur C. (2012).An atmospheric emission inventory of anthropogenic and biogenic sources for Lebanon, Atmos. Environ., 50, 88-96.

Waked, A., Afif, C. (2012). Emissions of air pollutants from road transport in Lebanon and other countries in the Middle East region, Atmos. Environ., 61, 446-452.

Waked, A., C. Afif, P. Formenti, S. Chevaillier, I. El-Haddad, J.-F.Doussin, A. Borbon and C. Seigneur (2014). "Characterization of organic tracer compounds in PM2.5 at a semi-urban site in Beirut, Lebanon." Atmospheric Research 143(0): 85-94.

Waked, A., Afif C., Seigneur C. (2015).Assessment of source contributions to air pollution in Beirut, Lebanon: a comparison of source-based and tracer-based modeling approaches. Air Quality, Atmosphere and Health, 8, 495-505.

WHO - World Health Organization (2000): Air Quality Guidelines for Europe – Second edition. WHO Regional Publications, European Series, No. 91

WHO – World Health Organization (2006): Air Quality Guidelines. Global update 2005.Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.WHO Regional Office for Europe, Copenhagen.

WHO – World Health Organization (2013a): Review of evidence on health aspects of air pollution – REVIHAAP Project. Technical Report.WHO Regional Office for Europe, Copenhagen.

WHO – World Health Organization (2013b): Regional strategy on health and the environment. Regional Committee for the Eastern Mediterranean.Sixtieth session. Provisional agenda item 4(a). EM/RC60/Tech. Disc.1 Rev.1. September 2013.

WHO – World Health Organization (2015): Health and the Environment: Addressing the health impact of air pollution. Draft resolution proposed by the delegations of Albania, Chile, Colombia, France, Germany, Monaco, Norway, Panama, Sweden, Switzerland, Ukraine, United States of America, Uruguay and Zambia. Sixty-eighth World Health Assembly. Agenda item 14.6. A68/A/CONF./2 Rev.1. 26 May 2015.

World Bank (2004): Sarraf, M.; Larsen, B.; Owaygen, M.: Cost of Environmental Degradation, the case of Lebanon and Tunisia.Environmental Economics Series. Paper No. 97. The World Bank, Washington.

ANNEXES

Annex 1: Priority legal texts/implementation decrees and decisionsof 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	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	-

Annex 2: Action Plan including Short-term goals, results and actions for 2016-2020

1. Short-term goal 1: Strengthening the legal and institutional framework

- Adopting the Draft Law for the Protection of Air Quality

ACTION	STAKEHOLDER
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
Develop and adopt priority legal texts/application decrees and decisions of the Law for the Protection of Air Quality – see Annex 1 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 AQMS and the emissions inventory	MoE and other concerned partners

- Updating the NAAQS based on the Assessment of AQ throughout the Territory

ACTION	STAKEHOLDERS
Develop a methodology for NAAQS and establish interim value (based on WHO approved methodologies)	MoE and other concerned partners
Issue an MoE Decision on National Ambient Air Quality Standards based on the Draft Law for the Protection of AQ	MoE
Develop cost-benefit analysis for the improvement of air quality based on: Develop air pollution epidemiological studies Develop cost of air quality degradation Develop the cost of remediation of air pollution	MoE and other concerned partners

- Strengthening MoE AQ department and Air Pollution Monitoring Bodies

ACTION	STAKEHOLDERS
Recruit a total of 7 employees at AQ Department based on decree 2275/2009	MoE and Civil Service Board
Train MoE AQ Department and other air quality monitoring bodies on the operation and maintenance of AQMS	MoE and other stakeholders
Train MoE AQ Department and other air pollution monitoring bodieson stack emissions monitoring	MoE and other stakeholders
Prepare and implement a training plan for MoE AQ Department and other air quality monitoring bodieson the assessment of Ambient AQ analyses including data validation provided by the private a/o public sector	MoE and other stakeholders consultancy
Prepare and implement a training plan forMoE AQ Department and other air pollution monitoring bodies on the assessment of stack emissions monitoring data and analyses provided by the private a/o public sector (including breaches, etc.)	MoE and other stakeholders
Prepare and implement a training plan for MoE AQ Department on the calculation and assessment of emissions inventory data	MoE

- Signing the UNECE LRTAP convention

ACTION	STAKEHOLDERS
Join the UNECE LRTAP as an observer, sign the UNECE LRTAP	GOL
Implement the UNECE LRTAP	MoE

- Developing local air quality planning

ACTION	STAKEHOLDERS
Definition and assessment of degraded airsheds based on quality-controlled data	MoE and other stakeholders
Develop guidance and templates for AQ planning for local authorities (e.g. based on the UK local air quality management guidances)	
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 stakeholders
Prepare local action plans in degraded airsheds to improve air quality	MoE and other stakeholders
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

- Developing Measures/Plans in case of High Pollution levels

ACTION	STAKEHOLDERS
Develop an internal procedure in the MoE AQ department on how to react (scenarios) in case of high pollution levels	MoE – AQ Department
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
Prepare an action plan by the inter-ministerial committee in case of high pollution levels based on the scenarios proposed by the MoE AQ Department (see Article 31 of the Draft Law)	MoE, MoPH, MoPWT, MoIM, MoI, MoEW
Implement the action plan	MoE, MoPH, MoPWT, MoIM, MoI, MoEW and Governorates
Monitor the implementation of action plans	MoE and Governorates

2. Short-term goal 2: Improving air quality assessment throughout the territory

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

ACTION	STAKEHOLDERS
Establish the AQMN	MoE and other local authorities
Establish air quality monitoring systems around airports and ports	MoE, MoPWT
Develop the general technical guidelines for the calibration of the air quality analyzers and continuous emissions monitoring systems.	MoE
Identify sources of financing for the operation and maintenance of the AQMN	MoE
Ensure continuous calibration, operation and maintenance of the AQMN, preparation of accreditation	MoE

- Establishing a methodology for the analysis, assessment, and reporting of the AQ data

ACTION	STAKEHOLDERS
Develop Guidance on data transfer, data control, database and IT based solutions	MoE
Develop a methodology for the assessment of AQ Data	MoE
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

- Updating, improving and reviewing regularly existing initial emission inventories.

ACTION	STAKEHOLDERS
Establish the general technical guidelines for monitoring industrial emissions	MoE
Develop activity data and emissions template report for monitored stationary sources	MoE
Develop a methodology for the regular update of the emission inventory	MoE, universities, research centres
Update annually the emission inventory	MOE

- Developing and updating regularly a national integrated assessment and modelling system

ACTION	STAKEHOLDERS
Acquire and update the meteorological database on annual basis	MoE, universities, research centres
Develop and improve weather forecasts	MoE, MoPWT, universities, research centres

Update and improve AQ modelling results (diagnostic and forecasts)	MoE, universities, research centres
Develop relevant methodologies and assess the impact of natural sources (incl. dust storms) and of priority economic sectors on air quality	MoE and other stakeholders (universities, research centres, etc.)
Identify and assess pollution abatement measures (that will impact most under least costs)	MoE, universities, research centres

3. Short-term goal 3: Solving air quality problems due to stationary sources in degraded airsheds

- Adopting proposed Emission Limit Values (ELVs) for key industrial sectors in line with Best Available Techniques (BATs) levels

ACTION	STAKEHOLDERS
Define criteria for the identification of degraded airsheds	MoE, MoPH
Discuss proposed ELVs with stakeholders at the national level	MoE, MoI, MoEW, ALI, Chambers of Commerce
Draft and Issue the update of MOE Decision 8/1-2001	MoE

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

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

- Developing the Environmental Licensing Mechanism for Emissions of Air Pollutants

ACTION	STAKEHOLDERS
Prepare the technical aspect for the environmental licensing mechanism	MoE
Prepare the legal documents (Decree and decision) for environmental licensing for emissions of air pollutants	MoE, MoF, CoM

4. Short-term goal 4: Developing a wild fire warning system

- Producing a local Fire Weather Index from existing weather monitoring stations

ACTION	STAKEHOLDER
Acquire meteorological observations in a centralized platform for processing	LARI, Meteorological Service Department in Lebanon, MoE
Model the automated calculation of local FWIs	MoE – AQ Department
Calibrate, communicate, and disseminate the produced FWI to national and local users	MoE, MoIM, MoA, MoD Union of Municipalities, Municipalities, Natural reserves, Universities , National Disaster Risk Unit

- Designing and developing an advanced national wildfire danger warning system

ACTION	STAKEHOLDER
Design a new forecasted national fire danger warning index by employing Lebanon's' fire risk map and EFFIS data	University of Balamand
Develop a system for automated publishing of forecasted danger index (up to 3 days) in a report form including fire danger maps and tabular information for public access	University of Balamand
Present the system and communicate fire danger warning to end-users	MoE, MoIM, MoA, , MoD Union of Municipalities, municipalities, Natural reserves, National Disaster Risk Unit, University of Balamand
Generate a fire danger database for use in the evaluation of the fire warning system and for comparison with other danger rating systems.	MoE, CNRS, National Disaster Risk Unit, University of Balamand

5. Short-term goal 5: Solving air quality problems from mobile sources

- Strengthening the inspection capabilities of mobile sources at national level

ACTION	STAKEHOLDERS
Develop and implement a program (incl. provision of equipment and training program) for on-road inspection of vehicle emissions	MoE, MoIM,
Adopt international procedures in the technical inspection of vehicles (“Mécanique”) to ensure compliance with emission standards (EU standards)	MoE, MoIM
Develop and implement measures addressig air quality problems for off-road machinery	MoE

- Implementing, monitoring and enforcing regulations for fuel quality

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

6. Short-term goal 6: Mainstreaming air quality management in priority sectors

- Ensuring synergies with national climate change policies and plans

ACTION	STAKEHOLDERS
Establish a baseline and targets for AQ emissions within climate change projects (NAMAs, INDCs, etc.)	MoE

- Developing an SEA for the Lebanese Land Transport Strategy

ACTION	STAKEHOLDERS
Set targets for AQ improvements under the on-going Land Transport Strategy and Action Plan being developed by MoPWT	MoPWT, MoE
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

- Improving AQ from Air and Maritime transport

ACTION	STAKEHOLDERS
Strengthen reporting to the MARPOL Convention	MoPWT, MoE
Develop standards for energy sources in air and maritime transport systems in line with existing conventions	MoE, MoEW, MoPWT, LIBNOR

- Integrating Air Quality in the Energy Sector

ACTION	STAKEHOLDERS
Set targets for AQ improvements in the SEA of the Renewable Energy Strategy and monitor their implementation	MoEW, MoE
Assess AQ improvements in line with the implementation of the Policy Paper for the Electricity Sector	MoEW and MoE
Assess AQ improvements in line with the implementation of the National Energy Efficiency Action Plan (NEEAP)	MoEW and MoE
Set targets for AQ improvements in the SEA of the Petroleum Sector and monitor their implementation	LPA, MoEW, MoE

- Integrating Air Quality in the industrial sector

ACTION	STAKEHOLDERS
Set targets for AQ improvements in the Integrated Vision for the Lebanese Industrial Sector 2025 and monitor their implementation	MoI and MoE

- Integrating Air Quality in the Solid Waste Management Sector

ACTION	STAKEHOLDERS
Set targets for AQ improvements in the Solid Waste Management Sector and monitor their implementation	MoE, MoIM, CDR, OMSAR, MoF

- Integrating Air Quality in other priority sectors

ACTION	STAKEHOLDERS
Promote the use of renewable energy in the agricultural sector through elaborating and implementing a plan for the use of alternative energy in agriculture and ban agricultural waste burning.	MoA
Optimize the use of nitrogen-based fertilisers at the country-wide level to minimize ammonia and nitrous oxide emissions (refer to Gothenburg Protocol Annex IV, the Advisory Code of good Agricultural practice)	MoA and farmers
Develop and implement a best practice guide13 to avoid diffuse emissions from quarrying activities.	MoE

[13] see e.g. http://www.arb.ca.gov/pm/pmmeasures/pmmeasures.htm

7. Short-term goal 7: Communication and outreach on Air Quality

- Providing data and regular reports on air quality for all monitoring sites and modelling results to the public

ACTION	STAKEHOLDERS
Develop a website to be continuously updated with near real-time air quality data	MoE
Inform regularly the general public about the importance of good air quality (website, newspapers, smartphone applications, etc.)	MoE, MoPH
Publish AQ Index and forecast in newspapers and weather channel websites	MoE, private sector
Establish an open-data portal for near-real time data to allow for an independent use of the data (e.g. for smartphone app development)	MoE
Disseminate information on panels on the ambient air quality followed by awareness campaigns on the use of this information	MoE, Municipalities
Develop an early warning system to alert the public about dust and other pollution episodes	MoE, MoPH, Municipalities

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

ACTION	STAKEHOLDERS
Establish the partnership framework between both public and private sectors for the management, operating and financing of the AQMN	MoE, universities, MoIM, public sector
Establish the partnership framework between both public and private sectors related to the National Emissions Inventory	MoE, universities, MoIM, public sector
Establish the partnership framework between both public and private universities for the support on different studies/capacity building needed by MoE	MoE, universities
Establish the partnership framework between both public and private universities for the support on different research conducted by the universities	MoE, universities