Egypt: Diesel Without Sulfur

For Cleaner Air and Better Health

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Introduction

Air pollution is dubbed a "silent killer" because the accumulation of pollutants in the air is responsible for a multitude of deadly ailments, especially in urban zones that are overcrowded with cars and other emission-producing vehicles. Air pollution in urban areas is primarily caused by the combustion of fossil fuels such as diesel, gasoline, and natural gas. In Egypt, the cost of impacts on health due to air pollution from fossil fuel burning is estimated to be more than EGP100 billion, the equivalent of 2.8% of GDP in 2018, according to a report published by Greenpeace last year.[1]

Although many countries around the world are gradually reducing their dependency on fossil fuels in the transport of goods, the elimination of fossil fuels to power transport fleets remains a distant prospect. This is because the rationale for environmental improvements in fuel production and trading is economic-driven instead of public health and climate motives. But even if we exclude highly ambitious goals from Egypt's energy and environmental policies, improving the quality of the most used fossil fuel locally – namely, diesel – is an easily achievable goal that would decrease health impacts and deaths that are linked to air pollution in our cities. It should therefore be a priority. Although the Egyptian government has adopted some goals that in theory lead to an improvement in fuel quality, and has updated the national plan for petrochemical production, it still has not updated the legislation on fuel quality standards that would require both government and private refineries to adhere to unified specifications. It is worth noting that governmental refineries produce fuel of lower quality than the private sector, whose products have improved in quality lately due to international financing conditions for increased local environmental protections. The quality of the more widely consumed, cheaper diesel fuel varies greatly depending on whether it is produced by the government or private sector, and most of what is available in the market is highly polluting and has been phased out of use in most countries of the world. Governmental practices designed to achieve existing fuel improvement goals still lack detailed legislation as well as monitoring and accounting mechanisms that would facilitate the achievement of said goals.

Even though the Egyptian government is currently seeking to become a regional hub for

1 Greenpeace, Toxic Air: The Price of Fossil Fuels, June 2020.

energy trading, it will nevertheless need to make changes to our daily consumption of fossil fuels, particularly the most polluting fuels like coal and diesel, as part of the global transition towards a model of more sustainable development that incorporates environmental aspects in its policies and building upon the declared principles and goals of the UN climate summit (COP26) in Glasgow and the need to transition to low-carbon energy sources that are less damaging to the environment and people's health. But observers of Egypt's policies and strategies will find that environmental considerations are only integrated for purely economic reasons. For example, converting cars to operate on natural gas, which is less polluting than diesel and gasoline, is a positive initiative that will have a concrete impact, but it is still motivated by economic conditions that are premised on Egypt achieving self-sufficiency in natural gas. On the other hand, no improvements to air quality and emission standards or an updating of diesel fuel standard specifications are on the legislative agenda. From the policymaker's perspective, there is no pressing economic need for such standards. In reality, however, the long-term health and environmental impacts of the status quo have indirect impacts that are far more costly than investments to improve the quality of diesel. The slow pace of transition to low-carbon fuels in general is also costing us missed economic opportunities to invest in renewable and low-carbon energy sources.

The concern of this report is one of the most important sources of air pollution in Egypt: high-sulfur diesel fuel, which is widely used in heavy transport vehicles such as trucks and bus fleets. It is the aim of this report to push for lower sulfur concentrations in diesel fuel, as it is the single largest contributor to emission pollution levels. To this end, the report spotlights the impact of this pollution on human health and the surrounding environment, and the subsequent economic costs, in comparison to the positive economic impact of rapid investments in lowering sulfur levels and improving fuel quality. The report also reviews Egyptian legislation regulating fuel quality and presents recommendations to develop these regulations in order to urgently and effectively improve the quality of fuel in general, while also lowering air pollutant levels with the aim of improving public health, preserving natural resources, and taking advantage of the economic opportunities available in today's world – a world where the transition to cleaner energy sources is increasingly a matter of life and death and not just as an economic choice.

1- Desulfurization of Diesel as a Top Priority

What is the impact of sulfur in diesel fuel on vehicle emissions?

The type and quality of fuel used in a vehicle greatly affects the resulting emissions, and high sulfur content in particular increases pollutant emissions. Desulfurization is highly effective in decreasing these emissions for two reasons:

1- Any increase in the percentage of sulfur in fuel leads to a direct increase in particulate matter that is 2.5 microns in width (PM2.5), which is the most important factor in calculating the health burden of air pollution.[2] When the concentration of sulfur in diesel is high, sulfur particles that are produced from combustion constitute a higher share of the total particulate matter emissions.

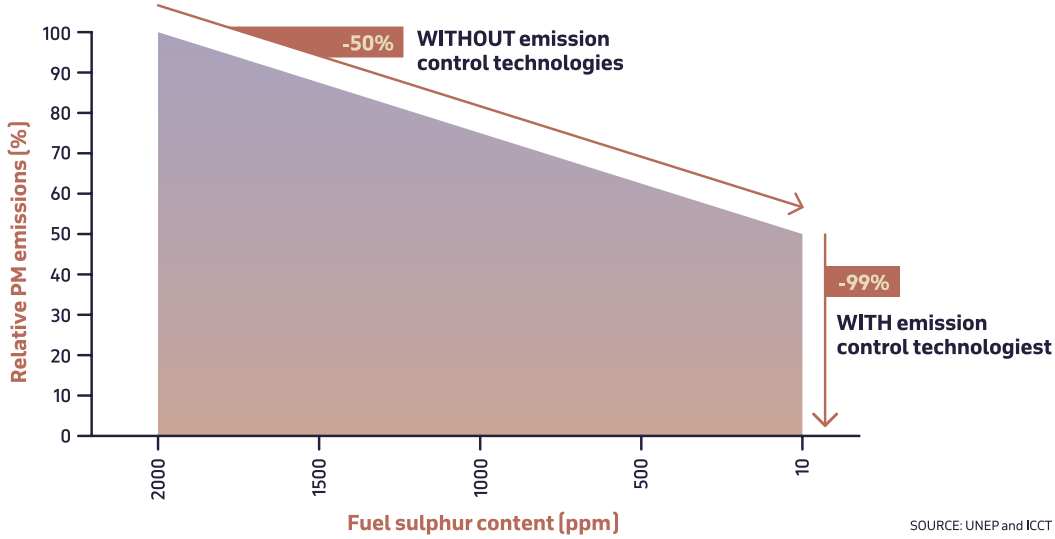
2- High sulfur percentages in fuel not only disrupt the correct functioning of emission control systems in internal combustion engines, which increases the pollutants produced by combustion, but it also lowers the performance of engines. Particulate filters, catalytic converters, or any other emission control system cannot be used unless fuel is low in sulfur content, and the lower the level of sulfur the higher the degree of emission control.

Using low-sulfur diesel (10 parts per million) alone reduces particulate matter emissions by 50% at least, even in retro vehicles. Current emission controls in new cars and trucks are capable of lowering particulate matter (PM) in exhaust emissions by 99%[3] if low sulfur fuel is used. The diagram below shows the correlation between sulfur content in fuel and PM emissions.

2 EIPR, Air Pollution: An Increasing Health Burden to Egyptians (PM 2.5 as an Indicator) (in Arabic), 2020.

3 Public Eye, Dirty Diesel: How Swiss Traders Flood Africa with Toxic Fuels, 2016, p. 24.

Emission control technologies become fully effective only at 10-15 ppm or less. This is why it is impossible to clean the air without first removing sulphur from fuels.



SOURCE: UNEP and ICCT

According to the International Council on Clean Transportation (ICCT), "It is impossible to clean the air, or in particular to reduce air pollution from the transportation sector, without getting sulfur out of fuels. Sulfur is a pollutant directly, but more importantly, sulfur prevents the adoption of all major pollution control technologies. No significant air pollution reduction strategy can work without reducing sulfur to near-zero levels."[4]

Vehicle emissions are one of the most important contributors to air pollution in urban areas of developing countries, where the number of vehicles is constantly increasing. Air pollution also has massive health implications, causing the deaths of 7 million people annually, according to the World Health Organization. Early death attributed to air pollution is mainly due to heart disease, stroke, chronic pulmonary embolism, acute lower respiratory inflammation, and lung cancer.

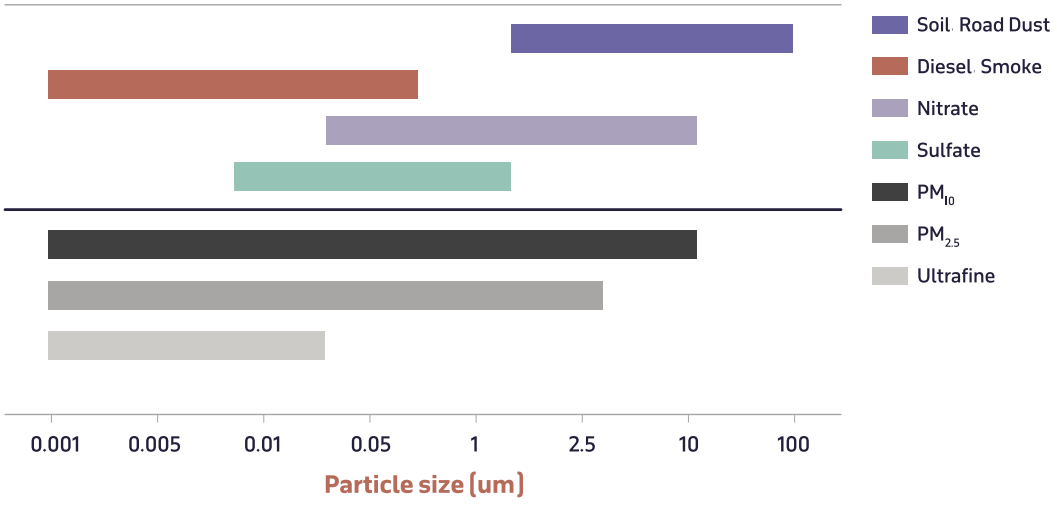
Diesel engine exhaust is linked in particular to lung cancer. In 2012, the WHO changed its classification of diesel exhaust from "probably carcinogenic to humans" (Group 2A) to "carcinogenic to humans" (Group 1).[5]

4 Low-Sulfur Gasoline & Diesel: The Key to Lower Vehicle Emissions, 2003, p. 2.

5 WHO and the International Agency for Research on Cancer, Diesel Engine Exhaust Carcinogenic, June 2012.

Diesel engine exhaust is responsible for the creation of particulate matter that is 2.5 microns in width (PM2.5), which can penetrate deep into the lungs due to its miniscule size. Chemically, it contains a mix of toxic pollutants such as ammonium sulfates, ammonium nitrates, nitrogen oxides, sulfur dioxides and other particulates. Sulfur content is thus the primary focus in measuring and studying the health burden of air pollution.[6]

Particulate Matter Size Resulting from Different Pollutants



Diesel engine emissions do not only cause air pollution and impact public health, but they also contribute to higher temperatures in the earth's atmosphere (global warming, or the increase in the average surface temperature of the earth). Such emissions are a source of short-lived climate pollutants (SLCPs) such as black carbon, a component of PM2.5 pollutants that can persist in the atmosphere for weeks while absorbing solar radiation and contributing to higher atmospheric temperatures. According to some estimates, black carbon is the second most dangerous air pollutant after carbon dioxide.[7] The Intergovernmental Panel on Climate Change (IPCC) concluded in its report that one kilogram of black carbon causes short-

6 Greenpeace, Toxic Air, p. 4.

7 What is the black carbon? Center of climate and energy solutions. (2010)

term negative climate impacts equivalent to 3,200 kilograms of carbon dioxide.[8] Global warming as a phenomenon is thus naturally inseparable from air pollution and its health impacts.

Diesel-powered vehicles in particular are a main target for policies aiming to reduce black carbon. Diesel exhaust emissions from vehicles, power generators, or machine equipment contribute approximately 86% of black carbon transport-related emissions, with the remaining 7% coming from diesel engines and marine shipping.[9]

In 2010, a World Bank study estimated the emissions percentages of gases and solid particles contributed by different sectors in Cairo. The study indicated that the transportation sector emitted 7.33% of (PM10) and 17.44% of (PM2.5). A higher level of contributed gas pollutants was reported, amounting to 22.14% of the total emissions of sulfur oxides and 79.14% of the total emissions of nitrogen oxides..[10]

Globally however, the transport sector alone was responsible for more than 55 million tons of greenhouse gas emissions, the equivalent of 17% of total emissions in 2017.[11] The transport sector was also the fastest growing source of climate emissions, contributing to 79% of emissions in 2005-2015.[12]

2. Sulfur Concentration in Diesel Fuel in Egypt

Egypt is one of the few countries that have not implemented strict measures to desulfurize diesel fuel, putting it among the 13 countries with the highest concentrations of sulfur in diesel.[13] Egyptian standard specifications permit the produc-

8 UNEP, Tightening Vehicle and Fuels Standards to Benefit Global Health and Climate, 2013.

9 Sims, R., V. Gorsevski and S. Anenberg, Black Carbon Mitigation and the Role of the Global Environment Facility: A STAP Advisory Document, 2015, Global Environment Facility, Washington, D.C., p. 43.

10 World Bank, For Better or for Worse: Air Pollution in Greater Cairo, Sector Note, 2013.

11 Climate Watch, Global Historical Emissions.

12 Crippa, M., G. Oreggioni and D. Guizzardi D et al., Fossil CO2 and GHG Emissions of All World Countries, 2019, Publications Office of the European Union, Brussels.

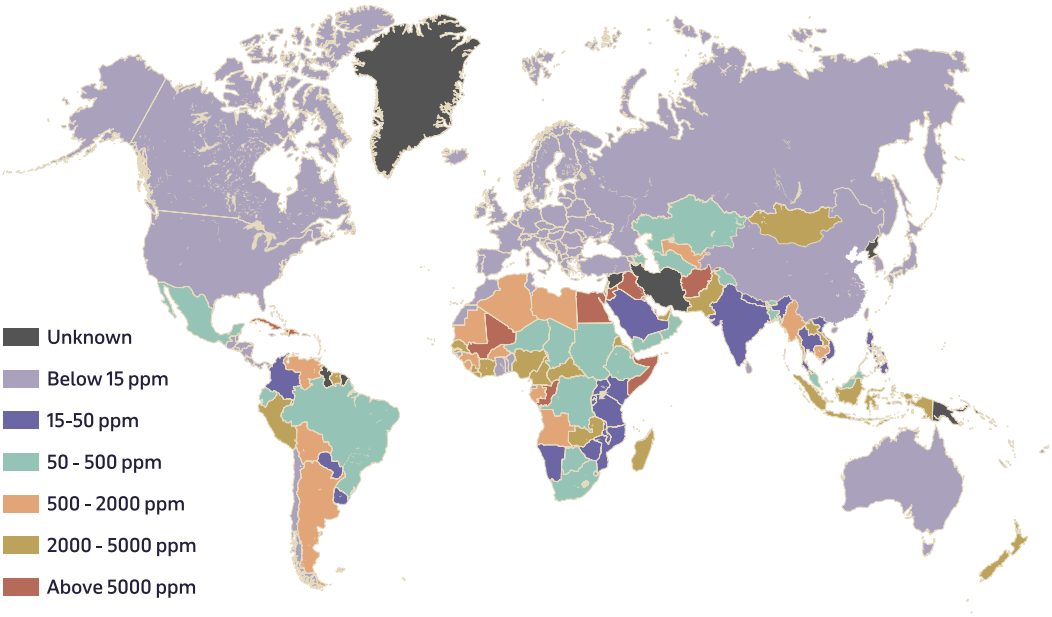
13 Egyptian Organization for Standards and Quality, Diesel Engine Specification, Decree Number 423 (in Arabic).

tion and importation of high-sulfur diesel with concentrations up to 10,000 ppm, the highest level legally permitted in any country in the world.[14] Steps needed to improve air quality do not require radical changes or a huge financial outlays, but Egypt lags behind a majority of the world in this respect.

The actual concentration of sulfur in locally-produced diesel fuel is more than 5,000 ppm (Figure 3) according to the United Nations Environment Program in 2020,[15] which is approximately 500 times higher than the highest permitted levels set by the EU, at only 10 ppm.

When imported diesel and locally-refined fuel are mixed, the actual concentration is determined to be around 2,600 ppm, which is 260 times higher than EU standards,[16] making it impossible for any vehicle emission controls to function correctly.

Sulfur Concentrations in Diesel Fuel Worldwide



14 CCAC, Cleaning up the Global On-Road Diesel Fleet, August 2016, p. 35.

15 UNEP, Sulfur Levels in Diesel Map, 2020.

16 CEDARE, Cleaner Fuels for Cleaner Air: Towards Cleaner, Low-Sulfur Diesel Fuel, policy brief, 2019, Sustainable Growth Program, p. 24.

Egypt is among the 13 countries with the highest sulfur concentrations in diesel fuel, and Egyptian standards permit the production and importation of high-sulfur diesel with concentrations up to 10,000 ppm, the highest level legally permitted in any country.

3 - An Overview of Egyptian Policies for Improving Fuel Quality

Efforts to improve fuel quality started in the late 90s, and in 1999, Egypt switched to unleaded gasoline. These steps were built upon at the start of the new millennium when the state declared its plan to reduce sulfur levels in diesel.[17] But two full decades have since passed and successive governments still have not been able to bring sulfur concentrations in diesel fuel down to "acceptable levels" that could enable the utilization of emission controls in vehicles and the reduction of toxic diesel fumes.

Looking at annual reports of the Ministry of Environment to track Egypt's efforts and policies to improve fuel quality,[18] we have found in the first available official report (2004) that in 2002 the Ministry of Petroleum lowered sulfur concentrations in diesel from 6,500 ppm to 4,100 ppm.

In 2007 the Ministry of Environment announced in its report that the top goal for improving air quality was improving the quality of fuel and switching to less polluting alternative fuels through its five-year plan (2007-2012). The ministry did not, however, set a specific target for reduced sulfur concentration in diesel and did not create and lead a collaborative project with the Ministry of Petroleum and the Ministry of Trade and Industry to develop fuel standards. In 2009 the Ministry of Environment declared it was aiming to develop diesel fuel standards for sulfur concentrations of 2,000 ppm; the target was lowered in 2013 to comply with the European diesel fuel standard, known as "Euro-5," which does not permit more than 10 ppm of sulfur content in diesel - an ambitious plan, but one that went unimplemented.

17 Egyptian Environmental Affairs Agency, State of the Environment Report, 2004, Air Quality Chapter (in Arabic).

18 Ministry of Environment, Annual State of the Environment in Egypt Reports (in Arabic).

A 2014 Ministry of Environment report mentioned that the achievement of such a goal would rely on building new refineries, retrofitting existing refineries, and importing high quality fuel (as the report states, the price difference between different diesel sources is negligible).

To provide more clarity, it may be useful to compare standards in other countries that have surpassed us in reducing sulfur concentrations in diesel. EU diesel fuel standards in 1992 mandated that sulfur content would not exceed 2,000 ppm; this limit dropped to 500 ppm in 1996 and then 350 ppm in 2020 (Euro 3). The Euro 4 standard was adopted in 2005 and it mandated a sulfur content of 50 ppm, and in 2009 the standard was reduced to 10 ppm.[19]

Sulfur concentrations in diesel fuel are regulated in Egypt through standards set by the Egyptian Organization for Standards and Quality, which permit sulfur content up to 10,000 ppm.[20] This is actually higher than the sulfur concentrations in diesel fuel currently available in the market, whether local or imported. The EOSQ issued the standard specifications in 2013, which coincided with the Ministry of Environment's announcement that it aimed to lower sulfur content in diesel fuel to 2,000 ppm. In 2014 the Ministry of Environment further updated its target to the Euro-5 standard, which would entail bringing sulfur concentrations down to 10 ppm. The mismatch between the Environment Ministry's declared target and the standard specifications issued by the EOSQ is indicative of the poor coordination between government bodies and the lack of serious commitment to these declared goals.

The limited efficacy of the process of "upgrading" standard specifications for petroleum products is reflected in the decision by some global car manufacturers to ban the export of diesel-powered vehicles to Egypt due to the lack of diesel that is of sufficient quality to allow engines to operate efficiently and without malfunction.[21]

19 ICCT, Diesel Sulfur Content Impacts on Euro VI Soot-Free Vehicles, April 2020, p. 3.

20 Egyptian Organization for Standards and Quality: Diesel Fuel Standard Specification, Decree Number 423 (in Arabic).

21 Egypt Today, Fuel Furor, 5 November 2014.

The Egyptian government's growing efforts to upgrade the petrochemical industry are reflected in a new strategy to develop the sector between 2020 and 2035 "to achieve self-sufficiency, raise the quality of petroleum derivatives and encourage local manufacturing" through 2040.[22] But the new strategy still does not prioritize the reduction of sulfur concentrations in diesel to meet global standards. The Center for Environment and Development for the Arab Region and Europe (CEDARE) published a study in cooperation with the Egyptian Ministry of Environment confirming that the national strategy will have a limited impact on the overall quality of diesel fuel. The main purpose of the strategy is to increase local production and decrease imports, not the improvement of local low-quality diesel products, especially those produced by old refineries.[23]

Even in instances where the quality of fuel was improved, action was motivated by economic goals, whether to benefit the governmental petroleum sector (the state-owned MIDOR and ANOPC, under the Ministry of Petroleum) or to meet conditions for financing from international institutions. As an example of the latter case, the Egyptian Refining Company (ERC) produces diesel that meets Euro-5 standards in order to access development funds that are conditional on local environmental improvements.[24]

Current plans aim at improving the quality of diesel fuel by reducing sulfur content to meet the Euro-5 standard of 10 ppm in only three Egyptian oil refineries, the Middle East Oil Refinery (MIDOR), Assiut National Oil Processing Company (ANOPC) and the ERC. But these high-quality products satisfy no more than 45% of market needs. It is thus unlikely that this will lead to the general application of low-sulfur diesel standards by 2030 absent additional legislation. Sulfur concentrations in diesel are expected to drop to 1,900 ppm by 2030 according to the current strategy, which is 190 times the Euro-5 standard.[25]

As of the time of writing, no legislation has been introduced to modify fuel quality

22 Masrawy, El Malla: Finalizing the Update of the National Petrochemical Industry Plan until 2040 (in Arabic), 22 July 2021.

23 Cleaner Fuels for Cleaner Air, p. 23.

24 CCAC, Cleaning up the Global On-Road Diesel Fleet, p. 30.

25 CEDARE, Cleaner Fuels for Cleaner Air.

standards, indicating that there is no legal commitment to improved fuel quality. Nor have the fuel improvement targets published in the Ministry of Environment's annual reports been achieved. Indeed, we are not even close to partially achieving them.

4- The Cost of Air Pollution vs. Sulphur-Free Fuel

The cost of any project is not calculated solely on the basis of building and operational costs. There is an additional economic cost that is linked to the burden of environmental degradation and the harmful impacts on the health of people and their quality of life. Labelled ‹›externalities," these costs are not included in the economic assessment of a project because they are unpriced or unknown and vary from one place to another depending on the nature and type of project. Environmental and social assessment studies of economic activities require the calculation of any "direct" environmental impact such as the cost of mitigating emissions, sewage processing, land reclamation after use, or damages to injured parties. But these studies do not include indirect environmental and social costs such as natural resource depletion and pollution, or health impacts such as disease, the cost of living with and treating a health condition, missed days of school or work, or even premature death, all of which are long-term, compounded costs.

Experts point to the economic benefits of fuel quality improvement programs, considering cleaner vehicles a "winning investment" when it comes to public health relative to the actual cost. For example, every dollar of investment in regulations to clean up diesel fuel for US truck fleets will reap USD17 in benefits to the American public. In China, vehicle emission controls could bring USD150 billion in public health benefits at an even lower cost than programs in the United States.[26]

The cost of the desulfurization of diesel in Egypt to Euro-5 standards, through a specialized process known as hydrotreating, is estimated at USD508-660 million. The cost includes the addition of new processing units, modification processes and

26 UNEP, Tightening Vehicle and Fuels Standards to Benefit Global Health and Climate.

increasing the capacity of existing units, according to CEDARE.[27]

On the other hand, the cost of environmental degradation – including the impact of such degradation on human health, quality of life and natural resources – is one of the most important tools for changing public policy on sustainable investments and environmental protection policies, monitoring, and legislation.

The burden of air pollution entails health costs such as discomfort, pain, illness and premature death, as well as indirect costs such as the economic devaluation of natural resources due to air pollution. For example, a local population gets sick due to the accumulation of air pollutants; the pressure builds on respiratory hospitals; social and economic contributions such as worker productivity decrease due to sick leave; fewer students go to school; the place is less able to attract tourists, industries, or more skilled labor and therefore its economic value is eroded.

Air pollution leads to premature deaths and lowers the average lifespan due to pulmonary and heart diseases. According to the WHO, since 2016, Egypt has experienced 67,434 premature deaths due to air pollution, 58% caused by heart disease, 18% by stroke and 24% by respiratory disease and cancer.[28]

Every Egyptian citizen loses some two years of their life due to an illness or health-related disability caused by air pollution.[29] Cairo's population, which had surpassed 17 million inhabitants, experienced in 2017 the equivalent of two weeks of illness and health disability due to illnesses caused by ambient fine particulate matter (PM2.5).[30]

Air pollution was also responsible for more than 12% of total deaths in Egypt in 2017 according to the Institute for Health Metrics and Evaluation (IHME).[31]

Egypt is ranked 6th amongst the top 13 high-sulfur concentration nations and is

27 CEDARE, Cleaner Fuels for Cleaner Air.

28 Global Health Observatory data repository.

29 Ambient PM2.5 Reduces Global and Regional Life Expectancy.

30 Larsen, Bjorn, Egypt: Cost of Environmental Degradation: Air and Water Pollution, 2019, World Bank.

31 IHME, Outdoor Air Pollution, 2019.

the site of 88% of global health impacts of high-sulfur diesel. The transport sector alone is responsible for three-quarters (75.6%) of deaths linked to the burden of air pollution in Egypt, while diesel accounts for 33.6% of fuel consumption used for on-road vehicles.[32]

As mentioned above, most studies of the burden of air pollution do not include the full cost of it, as estimates of environmental degradation vary from one study to another due to variations in analysis and calculation methodologies. Nevertheless, the cost is quite significant even by the most conservative estimates. Summarized below is a number of studies examining the health burden of air pollution in Egypt.

1. In a 2002 World Bank study on the cost of environmental degradation in Egypt, the health cost of air pollution was estimated at 2.1% of GDP, the equivalent of EGP6,400 million. The study also shows that air pollution was the largest contributor to the average cost of environmental degradation, which reached 4.8%, or double the average in industrialized nations (see Table 1).[33]

Table 1: Average Annual Cost of Environmental Degradation in Egypt in 1999

Type of Degradation	Annual Cost in Million EGP	Percentage of GDP
Air	6400	2.1
Soil	3600	1.2
Water	2900	1
Coastal areas and historical heritage sites	1000	0.3
Waste	600	0.2
Total	14500	4.8

32 CCAC, Cleaning up the Global On-Road Diesel Fleet, p. 35.

33 World Bank, Arab Republic of Egypt Cost Assessment of Environmental Degradation, 2002.

2. The World Bank published a study in 2013 on the burden of air pollution in Greater Cairo in which it estimated the cost of air quality degradation to be 1.03% of GDP in 1999-2009. The study also found that the cost of degradation caused by air pollution had increased 2.5 times, from EGP4.1 billion in 1999 to 10.2 billion in 2009, with a compounded cost over the same duration that adds up to some EGP61 billion (see Table 2).[34]

Table 2: Annual Cost of Air Pollution in Greater Cairo 1999-2009

Indicator/ year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cost in billion EGP (2013 prices)	4.1	3.7	4.3	3.8	4.2	5.2	4.9	5.4	7.3	7.9	10.2
Percentage of GDP	1.3	1.1	1.2	1	1	1.1	0.9	0.9	1	0.9	1

3. In another report also published by the World Bank in 2016, the estimated cost of the burden of air pollution in Egypt was 3.58% of GDP in 2013, or the equivalent of USD31,545 million in 2011 prices (see Table 3).[35]

Table 3: Cost of the Health Burden of Air Pollution in Egypt in 2013

Indicator	Average annual concentration of fine particulates PM2.5 (µg/m3)		Total number of deaths caused by air pollution		Economic losses (cost in USD million in 2011 prices) (percentage of GDP)	
Year	1990	2013	1990	2013	1990	2013
Egypt	35.92	36.41	40881	39118	17802 (5.25%)	31545 (3.58%)

34 World Bank, The Arab Republic of Egypt for Better or for Worse: Air Pollution in Greater Cairo, 2013, p. 68.

35 World Bank and IHME, The Cost of Air Pollution: Strengthening the Economic Case for Action, 2016, p. 94.

In the latest World Bank report about the cost of air pollution and environmental degradation, published in 2019, the cost of illness and early deaths due to ambient air pollution (outside the household) with fine particulate matter PM2.5 in Greater Cairo alone was estimated to have reached EGP46 billion in 2016/2017, the equivalent of 1.35% of Egypt's GDP (see Table 4).[36]

Table 4: Cost of Health Effects of Ambient PM2.5 In Greater Cairo, 2016/17	
Economic losses caused by early deaths in billion EGP	38.3
Economic losses caused by illness	8.7
Total health burden	47
Percentage of total GDP in 2016/2017	1.35

Most recently, in 2020, Greenpeace published a report that estimated the annual cost of air pollution from fossil fuels in the Middle East and North Africa region in 2018. Egypt topped the list of countries with an average estimated cost of USD6,900 million or the equivalent of 2.8% of GDP.[37]

The health of its citizens should be a top policy priority for any country, and this also extends to future generations of citizens who will be directly impacted by our use of high-sulfur diesel today. The Egyptian constitution of 2014 stipulated in Article 46 that "every person has the right to a healthy environment; the protection of the environment is a national duty; the state is committed to undertaking the proper measures to preserve it and not to harm it, and to the sustainable use of natural resources that would guarantee sustainable development and the safeguarding of future generations' rights."

What can be done in light of this constitutional mandate? For starters, implement-

36 Larsen, Egypt: Cost of Environmental Degradation, p. 9.

37 Greenpeace, Toxic Air, p. 16.

ing protective measures through environmental standards that safeguard people's health, by updating current environmental legislation and especially air pollution standards that exceed international limits.[38]

Implementing environmental standards is the most effective and least costly scenario for the state to reduce the social, environmental and economic burden of air pollution. It moreover acts as a safeguard against the continuation and accumulation of this burden over the long run. This can be demonstrated by comparing the cost of upgrading refineries to reach the Euro-5 standard and with the estimated cost associated with the burden of air pollution on public health and the economy. According to a study published by the US Environmental Protection Agency that compares the economic return from the application of US standards to the cost of non-compliance, the economic returns from implementing legislation is 30 times that of non-implementation. From 1990 to 2020, the enactment of the Clean Air Act in the US was responsible for preventing the premature deaths of 230,000 people, which represents 85% of the total economic cost of the burden of air pollution.[39]

The Egyptian government has recently sought to upgrade the petrochemical industry sector through an estimated investment of USD19 million,[40] but the plan entails no regulatory changes to fuel standards or a legal commitment to reach internationally recommended standards, although some estimates put the cost of sulfur-free diesel at no more than USD660 million – a bargain when considering the health and economic benefits to be gained from diesel desulfurization. It would be a shame for this strategy to become yet another wasted opportunity to implement statutory changes that are absolutely necessary for citizens' health, a clean environment and a sustainable economy.

38 Egyptian Initiative for Personal Rights, A New Alarm Bell Over Air Quality: The World Health Organization Issues Stricter Standards for Pollutant Concentrations and EIPR Demands a Review of Very Low Egyptian Standards (in Arabic), September 2021.

39 EPA, Benefits and Costs of the Clean Air Act 1990-2020.

40 Al Ahram, Upgrading the National Petrochemical Plan…and a New Development Strategy (in Arabic), 25 May 2020.

5. Recommendations

1- Recommendations for the Desulfurization of Diesel

- Develop a standard specification for locally-produced diesel fuel that is compatible with European standards (Euro-5) to urgently limit polluting vehicle emissions.
- Invest in the development of older refineries to produce diesel that is up to the Euro-5 standard and require the private sector to develop oil refineries and infrastructure during a specified timeline.
- Immediately ban the importation of high-sulfur fuel in line with many countries that have successfully limited sulfur pollution.

2- Recommendations on Public Policy for the Protection of Public Health and Environment

- Integrate the environmental and social dimension into the development strategy of the petrochemical sector and energy strategies and plans in general, particularly as relates to oil refining.
- Conduct more studies to evaluate the health burden of air pollution and publish their results; integrate the cost associated with health and environmental degradation into the policymaking apparatus and all policy papers in the Ministries of Industry, Petroleum and Mineral Resources as well as the Ministry of Electricity.
- Support the transition to electric vehicles and make use of the surplus electricity that is currently available to create an infrastructure to support their spread and the rapid transition away from fossil-fueled cars.
- Encourage cleaner transportation options such as bicycles and provide more bike paths in cities; increase green spaces in cities and encourage tree planting, which maintains good air quality.

3- Recommendations Regarding Air Pollution

- Enact "clean air" legislation that is separate from other laws and pertains to all matters related to air quality in all sectors; its enforcement would be supervised by the Ministry of Environment as a protective measure and to eliminate any barrier to coordination between concerned ministries through the power of law.
- Improve Egyptian standards that are specific to air quality and permitted emission levels, which are currently two-three times higher than the maximum WHO permitted levels of pollutants.
- Improve environmental protection laws and regulations; build capacity and improve the efficiency of regulatory systems, environmental monitoring and legal implementation systems; and make this a top legislative priority of the current parliament.
- Expand the range of early warning systems and inform citizens of instances of high air pollution levels.
- Improve and update available air pollution data, making it easily accessible to the public and concerned environmentalists, and provide an online platform for live environmental monitoring that is updated every day, on the hour.
- Issue a decree that would prohibit any development funding for public or private refineries unless they are committed to produce Euro-5 diesel fuel.