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Clean Air for Life

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Clean Air for Life

More information:
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on Long-range Transboundary Air Pollution
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Air Pollution: Why should we care?

Air pollution harms human health, affects food security, hinders economic development, contributes to climate change and degrades the environment upon which our very livelihoods depend.

The monetary value placed on the health impact of air pollution – estimates of US $1.6 trillion for the European region of the World Health Organization (WHO) alone – serves to quantify a problem that goes well beyond financial matters. Children are particularly vulnerable to the devastating impacts of air pollution as their respiratory systems are still developing. But so are the elderly and frail, and it is increasingly understood that air pollution spares no one.

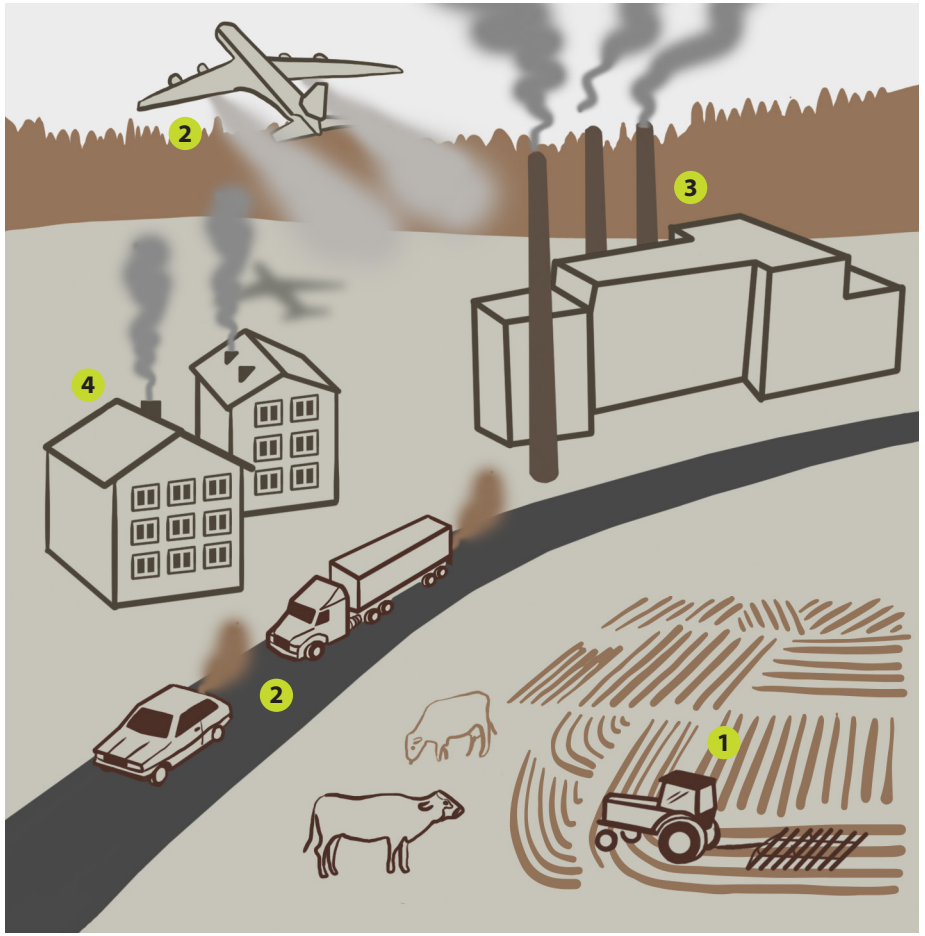
Activities in sectors such as transport, waste, energy and agriculture are responsible for releasing either primary air pollutants or chemical substances reacting with others and forming "secondary" pollutants in the atmosphere.

While numerous sectors are involved and the impacts are felt not only locally, but also globally, responses are all too often taken on a narrow sectoral basis, failing to consider the urgency of addressing air pollution as an international and pressing problem with multiple and far-reaching impacts.

The exponential rise of urbanized areas is also a significant factor in increased air pollution. Today the majority of our population lives in cities that on the one hand tend to be sources of air pollution, but on the other are also where the impacts of air pollution are most felt.

Air pollution knows no political boundaries: emissions from sources in one country can be transported and deposited in neighbouring countries, sometimes even thousands of kilometres away. In 2010, for example, experts estimated that only 36 per cent of the concentrations of fine particulate matter ($PM_{2.5}$) in Georgia and only 23 per cent of those in Kyrgyzstan came from national sources. In 1979, realizing the need for a common transboundary response to the problem, some 30 Governments and the European Community signed the Convention on Long-range Transboundary Air Pollution (Air Convention) within the framework of the United Nations Economic Commission for Europe (UNECE).

Figure 1: Sources of air pollutants



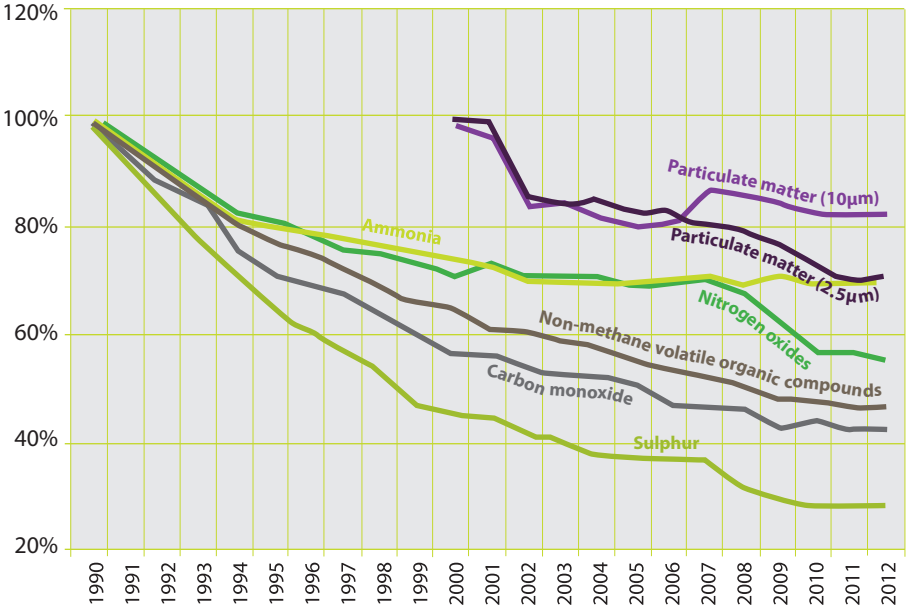
1. Around 90% of ammonia emissions and 80% of methane emissions come from **agricultural activities**.

2. More than 40% of emissions of nitrogen oxides come from **road transport**. Almost 40% of primary $PM_{2.5}$ emissions come from transport.

3. Some 60% of sulphur oxides come from **energy production and distribution**.

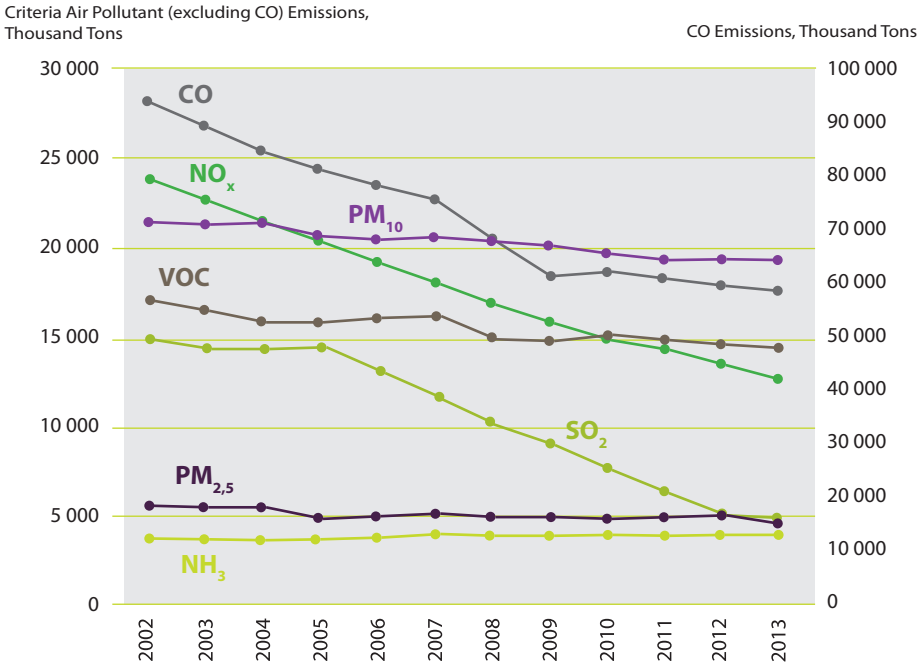
4. **Fuel combustion** is a key contributor to air pollution – from road transport, households to energy use and production. **Businesses, public buildings and households** contribute to around half of the PM2.5 and carbon monoxide emissions.

Figure 2: Emission trends in the UNECE region (excluding Canada and the United States)



Source: Centre on Emission Inventories and Projections

Figure 3: US emission trends for the main air pollutants



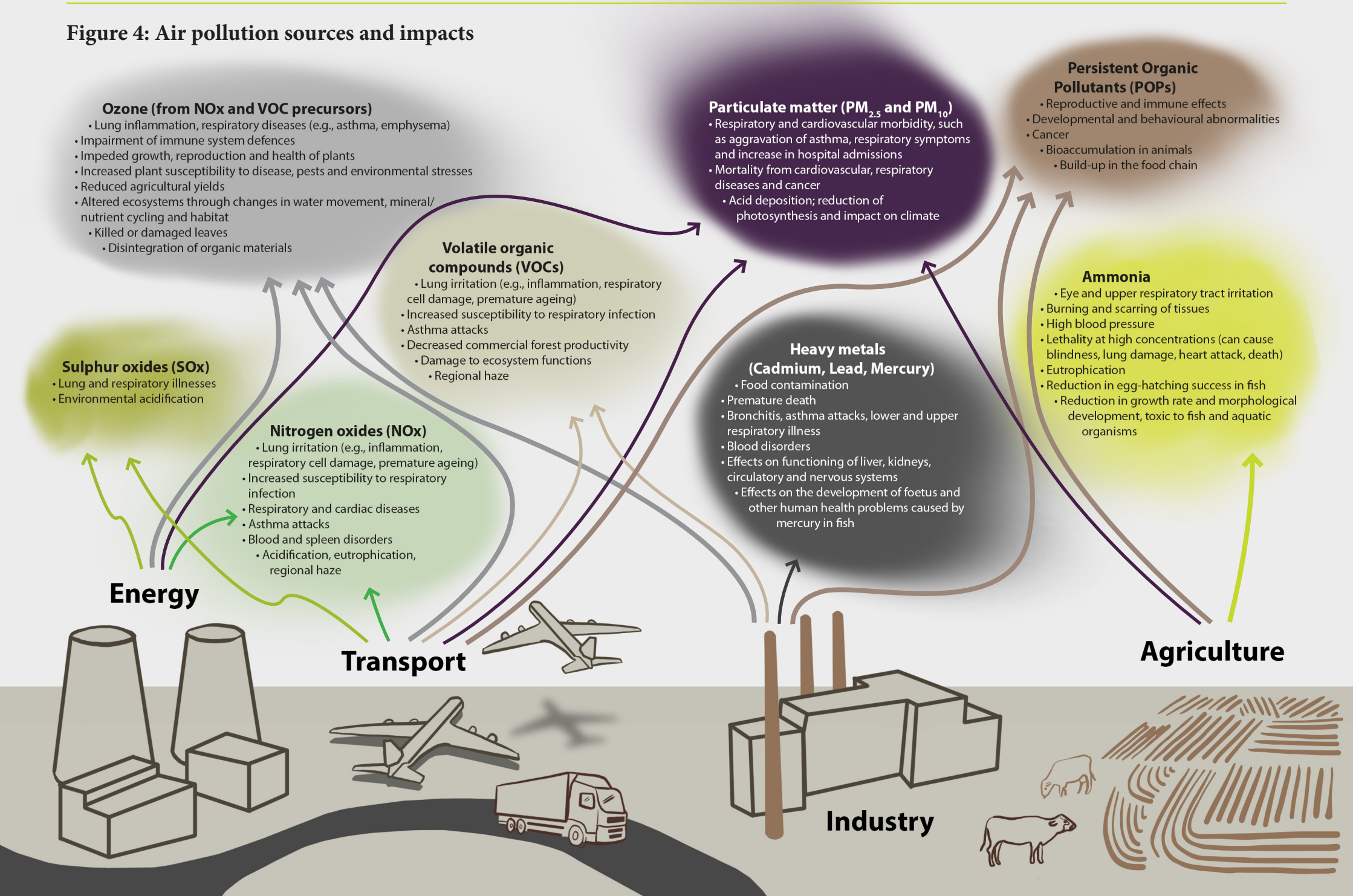
Source: US Environmental Protection Agency website

Solutions to air pollution exist and major strides have already been taken. Parties to the Air Convention and its protocols can be proud of the successes in reducing air pollution to date. The Air Convention provides a platform for integrating science and policy to address air pollution via a whole range of approaches and sector-specific measures that Parties are implementing to cut their emissions and meet the targets set within the Convention's protocols.

Working to reduce air pollution in an integrated manner also helps Parties meet other commitments, notably those related to climate change and biodiversity conservation. And the other way around, the implementation of climate and energy policies in most cases brings benefits to air quality.

Yet much more remains to be done. Technical measures are available to further reduce emissions, in particular from combustion installations, transport and farms. Therefore, enhanced cooperation is essential between the sectors contributing to air pollution, and actions are required at the local, national and international levels. There is a need for greater involvement from all countries in the UNECE region, in particular those in Eastern Europe, the Caucasus and Central Asia.

Figure 4: Air pollution sources and impacts



Air Pollution and Health

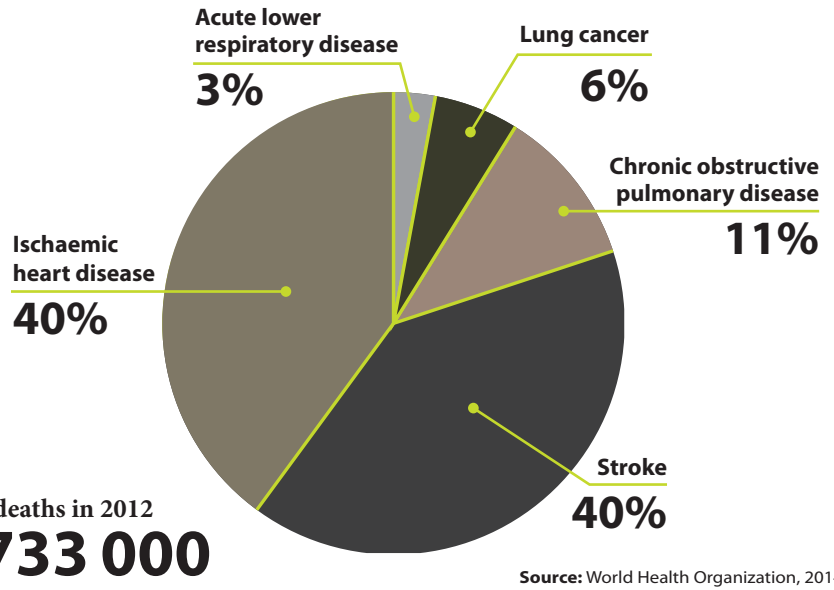
Around the world, every year 7 million people – equivalent to the entire population of Bulgaria – die prematurely because of combined indoor and outdoor air pollution (WHO, 2014). This represents more than the annual combined death rate of the "big" killer diseases – malaria, tuberculosis and AIDS.

The scientific evidence of disturbing links between air pollution and health continues to build. In accordance with recent WHO estimates, exposure to air pollution is a more important risk factor for major non-communicable diseases than previously thought. Air pollution is the largest contributor to the burden of disease from the environment. Air pollution causes and exacerbates a number of diseases, ranging from asthma to cancer, pulmonary illnesses and heart disease. The International Agency for Research on Cancer has classified outdoor air pollution and particulate matter, one of its major components, as carcinogenic to humans.

Individual studies on the health effects of air pollution for different countries estimate that mortality related to air pollution is even higher than what WHO finds. In France, the calculated number of deaths from ambient PM and ozone pollution in 2010 was over 17 000 (OECD, 2014). In the United Kingdom, in the city of London alone, air pollution (from $PM_{2.5}$ and NO_2) was estimated to cause nearly 9 500 early deaths in 2010 (Walton et al., 2015). In 2010, 94 500 premature deaths in the Russian Federation were caused by ambient particulate matter pollution (WHO, 2015). In Kazakhstan, the estimated mortality risk attributable to air pollution in general is 16 000 cases per year (Kenessariyev et al., 2013). The number of life years lost in South-Eastern Europe, Eastern Europe, the Caucasus and Central Asia due to outdoor air pollution is 20 per cent higher than in Western Europe (WHO and OECD, 2015).

The main air pollutants affecting health are nitrogen oxides (NOx), sulphur oxides (SOx), ozone and particulate matter with the latter – especially particulate matter below 2.5 microns – being of greatest concern, as these tiny particles penetrate deep into the lungs, affecting both the respiratory and vascular systems. Both the extent and duration of the exposure influence health outcomes.

Figure 5: Deaths attributable to ambient air pollution



Source: World Health Organization, 2014

Nearly every single individual in the European region is affected by air pollution with over 90 per cent of the residents being exposed to annual levels of outdoor fine particulate matter above WHO air quality guidelines. While the data for Eastern Europe, the Caucasus and Central Asia are less robust, there is cause for concern. In particular, trends in recent years indicate increasing emissions from a growing transport sector as a result of economic development and increasing purchasing power but also because of an ageing car fleet and poor quality fuel (WHO, 2004). Transport-related emissions may amount to more than 80 per cent of the air pollution in cities in Eastern Europe, Central Asia and the Caucasus (OECD, 2007).

In 2005, WHO published an update of its public health guidelines for different air pollutants, the first version of which was developed in 1987. To this day in the EU, however, concentrations of particulate matter and ozone are well above levels recommended by WHO, even though they have dropped in the last decade.

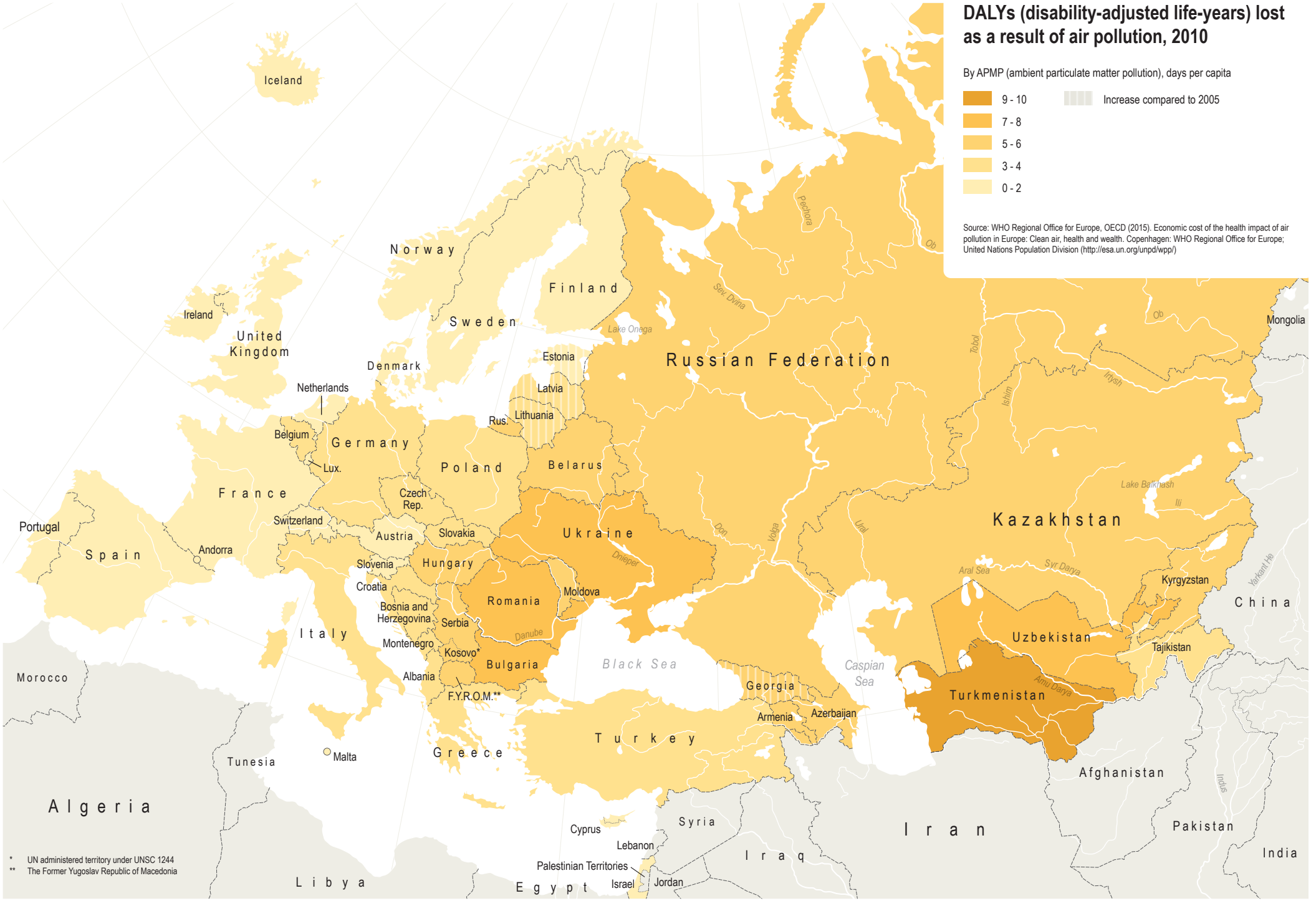
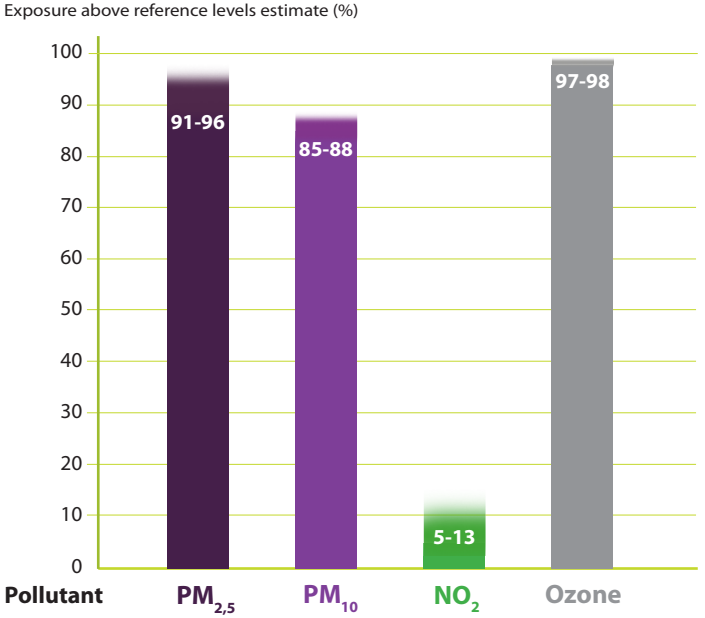

DALYs (disability-adjusted life-years) lost as a result of air pollution, 2010
By APMP (ambient particulate matter pollution), days per capita
9 - 10
7 - 8
5 - 6
3 - 4
0 - 2
Increase compared to 2005
Source: WHO Regional Office for Europe, OECD (2015). Economic cost of the health impact of air pollution in Europe: Clean air, health and wealth. Copenhagen: WHO Regional Office for Europe; United Nations Population Division (http://esa.un.org/unpd/wpp/)
Iceland
Norway
Finland
Sweden
Ireland
United Kingdom
Denmark
Netherlands
Belgium
Lux.
Germany
France
Switzerland
Portugal
Spain
Andorra
Czech Rep.
Austria
Slovakia
Poland
Belarus
Ukraine
Slovenia
Hungary
Croatia
Bosnia and Herzegovina
Serbia
Montenegro
Kosovo*
Albania
F.Y.R.O.M.**
Romania
Moldova
Bulgaria
Italy
Malta
Greece
Turkey
Black Sea
Caspian Sea
Georgia
Armenia
Azerbaijan
Russian Federation
Estonia
Latvia
Lithuania
Rus.
Lake Onega
Pechora
Ob
Sev. Dvina
Tobol
Ishim
Irtysh
Mongolia
Kazakhstan
Lake Balkhash
Ili
Ural
Volga
Don
Dnieper
Danube
Aral Sea
Syr Darya
Kyrgyzstan
Tajikistan
Uzbekistan
Turkmenistan
Amu Darya
China
Yarkant He
Afghanistan
Indus
Pakistan
India
Iran
Iraq
Syria
Lebanon
Palestinian Territories
Israel
Jordan
Cyprus
Egypt
Libya
Algeria
Tunesia
Morocco
* UN administered territory under UNSC 1244
** The Former Yugoslav Republic of Macedonia

Figure 6: Percentage of the urban population in the EU exposed to air pollutant concentrations above WHO reference levels



The impact of air pollution on human health is of growing concern as research unravels more links between air pollution and serious medical problems among various age groups – diabetes, neuro-development disorders and preterm birth and low birth weight, among others (WHO, 2015).

Air pollution and the Environment

By 1984 almost half of the trees in Germany's majestic Black Forest were suffering from the impacts of acid rain. Thirty years later while in appearance the forest looks healthier, the damage is still there and the authorities continue to pour limestone over the forest to counteract acidity levels.

Air pollution, particularly sulphur and nitrogen emissions and ground-level ozone affect ecosystems' ability to function and grow. Emissions of both sulphur dioxide and nitrogen oxides deposit in water, on vegetation and on soils as acid rain, thereby increasing their acidity with adverse effects on flora and fauna. Ultimately, acidification affects the ability of ecosystems to provide such ecosystem services as nutrient cycling, carbon cycling and the provision of water, on which human life on the planet depends.

Increased ground-level ozone also causes damage to cell membranes on plants, inhibiting key processes required for growth and development. The loss of plant cover affects us all. Trees and other vegetation absorb pollutants such as excessive nitrogen dioxide, ozone and particulate matter, through their leaves and needles and thereby help improve air quality. Less plant cover thus means less filtering capacity to clean our air.

Eutrophication, the process of accumulation of nutrients, including nitrogen, in water bodies often results from air pollution. Nutrient overloads in aquatic ecosystems can cause algae blooms and ultimately a loss of oxygen, and of life: up to 30 per cent of the nitrogen causing eutrophication of Chesapeake Bay in the United States has been estimated to come from air pollution (Greaver et al., 2012).

While Europe is setting aside important biodiversity areas through the Habitats Directive and Natura 2000 – the largest ever network of protected areas – an estimated 73 per cent of Natura 2000 areas were being exposed to air pollution levels that exceeded 2010 eutrophication limits (EEA, 2015). In wetlands and coastal areas, excessive nutrients lead to hypoxia and so-called dead zones where the lack of oxygen kills off most living creatures. A total of over 400 such zones have been reported around the globe totalling over 245 000 km^2 (Diaz and Rosenberg, 2008).

Progress in reducing sulphur emissions has helped to decrease acidification levels, but eutrophication continues to pose a serious threat to our ecosystems (EEA, 2015). A key culprit is nitrogen emissions – mainly ammonia from agricultural activities and nitrogen oxides emitted from combustion processes – that have not decreased as significantly.

As ecosystems are impacted, ultimately so are human populations. Harmful concentrations of pollutants may directly enter our drinking water, notably through groundwater seepage. Equally, water quality may decline as air pollution negatively affects the vegetation that helps filter our natural water systems. Affected vegetation also has negative consequences on another important ecosystem service – capturing carbon and thereby reducing the impacts of climate change.

The links between air pollution and the environment are visible all around the globe. The two-way relationship – air pollution degrades our environment but natural resources also help to control air pollution – highlights the urgency of controlling air pollution.

Air Pollution and Food Production

By 2050 our ability to produce food may be lowered by as much as 10 per cent due to rising air pollution (Bloom et al., 2014), and yet there will be as many as 50 per cent more mouths to feed on the planet.

In a world faced with much unrest and uncertainty, global food insecurity is an additional driver of turmoil. The reasons for this include an increase in demand and declines in production related to climate change, energy costs and air pollution. Ozone precursor emissions (nitrogen oxides and volatile organic compounds) are of particular concern for global food security as these compounds react to form ground-level ozone. This, in turn, penetrates the plant structure and impairs its ability to develop.

Agriculture is the single largest contributor of ammonia pollution, and emits other nitrogen compounds as well. These pollutants affect the very capacity of the soil to sustain plant and animal productivity. Furthermore, the growing trade in agriculture products in the last few decades has further increased the amount of pollution emitted from the intensification process in producer countries. This burden remains in the producer country, and creates an imbalance that shifts the pollution problem from the importing countries to the producer countries (Lassaletta et al., 2014).

Conversely, there is increasing evidence that air pollution threatens food production. According to recent estimates, ozone caused global crop losses of 6-16 per cent for soy, 7-12 per cent for wheat and 3-5 per cent for maize (Harmens et al., 2011). A study in 2000 on the impact of ozone on 23 crops in Europe found economic losses of €6.7 billion (Holland et al., 2006). While the EU Air Quality Directive includes an objective to protect vegetation from high ozone concentrations, in 2011, 88 per cent of Europe's agricultural area was exposed to levels above the target, with the highest values being in southern and central Europe (EEA, 2015).

The transboundary nature of air pollution also affects food. For example, a recent study found that anthropogenic air pollution from North America causes Europe to lose 1.2 million tonnes of wheat a year. On the other hand, a reduction in US-based nitrogen oxides emissions can enhance Europe's wheat production by up to 30 per cent more than through European emission cuts alone (Hollaway et al., 2012).

Some crops have been found to be more sensitive than others to ozone exposure: wheat and soybeans are particularly sensitive; potatoes, rice and maize are moderately sensitive; and barley has been found to be ozone resistant (Wilkinson et al., 2012). That these most sensitive crops are all staple foods for the majority of the world's population is a matter of concern.

Fisheries are also affected as nutrient run-off from land-based sources creates dead zones, degrading habitat for fish, coral, sea grasses and mangroves, and endangering fish species already vulnerable because of overfishing and climate change (Erisman et al., 2013). Globally, up to 20 per cent of human protein consumption comes from aquatic animals, and fisheries are a major source of income and jobs for many communities around the world.

Research on the impact of air pollution on food is relatively recent. Yet all indications suggest that reducing air pollution benefits food production and thereby global food security.

Air Pollution and Economic Development

The economic cost of premature death and disability from air pollution in Europe is close to US $1.6 trillion, or nearly the size of Canada's 2013 GDP (WHO and OECD, 2015).

While it is difficult to put a financial estimate on the cost to society of air pollution, the US $1.6 trillion figure calculated by WHO and OECD demonstrates what is at stake. A recent estimate by the European Environment Agency of the cost of pollution from the 10 000 largest polluting facilities in Europe totalled between €102 and €169 billion in 2009 (EEA, 2013). The countries paying the highest price for air pollution in 2009 were Germany (€22.5-33.8 billion), Poland (€10.8-19.0 billion) and the UK (€11.7-18.7 billion).

Air pollution takes its toll on the economy in several ways: it costs human lives, it reduces people's ability to work, it affects vital products like food, it reduces the ability of ecosystems to perform functions societies need, and it costs money in remediation or restoration. The economic cost of premature deaths due to air pollution specifically from particulate matter has increased in many countries in Eastern Europe, the Caucasus and Central Asia by as much as 50 per cent between 2005 and 2010 (WHO and OECD, 2015), in large part because of the increase in car traffic.

New technologies that contribute to emission reductions are constantly being developed. Emission limit values for air pollutants under the different Protocols of the Air Convention have proven to be effective in stimulating investment in clean technologies. Benefits of improved technology to reduce air pollution have been quantified in many cases. For example, in the US, a study found that by investing US $1 million in improving energy efficiency in buildings rather than spending the same amount in the oil and gas sector, up to four times as many jobs could be created (Pollin et al., 2009 in UNEP 2014). Economic models show that with the introduction of additional measures some sectors will lose jobs (e.g., the fossil fuel sector), but that other sectors will gain jobs (e.g., the building and equipment sectors). In the long run, environmental policy will favour the economy as it stimulates more efficient use of resources. The health benefits would increase GDP by up to 10 per cent (WHO, 2015). A larger market for clean technologies will reduce the costs of producing the required equipment and thus the abatement measures. Countries that move first expand their possibilities for a growing clean tech industry.

Major international development organizations and financial institutions argue in favour of improvements in our economic system towards one that can deliver economic growth and development while reducing impacts on our environment and climate. Their guidance also directly benefits air pollution control.

Furthermore, the current development context of the United Nations Sustainable Development Goals provides a solid framework for achieving multiple benefits in the areas of development, environmental conservation and climate and pollution mitigation.

Reducing emissions is a wise long-term investment that contributes to several development goals and that will ultimately yield substantial benefits.

Sustainable Development Goals (SDGs) and links to air pollution

In September 2015, countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years.

Abating nitrogen emissions and managing nitrogen more sustainably has direct impacts on soil quality.

Reducing air pollution helps to mitigate the risk factors for non-communicable diseases such as respiratory and cardiovascular diseases, including cancers.

Water pollution is notably linked to depositions from air pollution. Consequently, one way of reducing water pollutants is to reduce air pollution.

Given that a major source of air pollution is energy production, consumption and transport, increasing the share of renewable energies and improving energy efficiency under this SDG will serve to reduce air pollution. Investing in clean technologies in this sector, as called for under this SDG, will also achieve reductions in air pollution.

A focus of the green economy is to improve and increase jobs while focusing on cleaner sectors and technologies that are sustainable which includes sectors that have a reduced impact on air pollution such as renewable energies or improved transport, as promoted under this SDG.

Old industries and technologies are a major source of air pollution, and upgrading and retrofitting many facilities, as called for under this SDG, will serve to significantly reduce air pollution. Investment in research and innovation will also provide options for achieving improvements in industrial production while reducing waste and air pollution.

Under SDG 11, there is an explicit target linked to improving air quality: *"by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management"*. Reducing air pollution at the national level also helps to improve air quality at the city level.

Improvements in life cycle management of chemicals and all wastes will contribute to reducing air and water pollution. Improving companies' practices with a focus on complying with international and national norms will also serve to reduce emissions of air pollutants.

As greenhouse gases and some key air pollution have the same sources, combating climate change will bring improvements to air quality. In turn, reducing air pollution will help in bringing about climate co-benefits.

Reducing air pollution, particularly nutrient (nitrogen) pollution will help reduce marine pollution from land-based activities.

Reducing air pollution helps mitigate effects on ecosystems and biodiversity.

Air Pollution and Climate Change

In March 2014, pollution reached a peak in Paris due to unseasonably mild weather. On 17 March 2014 – for the first time since 1997 – alarmed by the level of particulate matter emissions, authorities in Paris implemented emergency measures to reduce traffic in an effort to bring down emission levels.

In December 2015 the world's leaders met in Paris to agree on measures to combat climate change. The outcomes of this landmark event were anticipated with much trepidation as more and more extreme weather events are being attributed to climate change. Sectors that contribute to greenhouse gas emissions are also frequently culprits in terms of air pollution and there are certainly opportunities, political leverage and cost savings to be made by tackling both together.

Until recently the policy and scientific debates around air pollution and climate change tended to take place separately, but it is increasingly understood that the two are inextricably linked (WMO, 2012). For example, particulate matter is known to vary in the atmosphere depending on other, seasonal environmental factors such as temperature, forest fires, winds and storms (WHO and OECD, 2015). Scenarios for the United States (Mickley et al., 2004) suggest that by 2052 a warming climate could increase air pollutant concentrations by 5-10 per cent in the summer in the Northeast and Midwest regions of the United States.

Some sources of greenhouse gases are also sources of air pollution. The burning of fossil fuels, for example, is a major source of both air pollutants and greenhouse gases. Air pollution also has a short-term regional climate effect – pollutants such as black particles and ozone and its precursors contribute to warming and are thus recognized as short-lived climate pollutants. While the reduction of greenhouse gas emissions may have important co-benefits for decreasing air pollution, especially in the energy and industry sectors, some measures to mitigate climate change may have negative impacts on air quality. Examples in the transport and residential heating sectors include the use of biomass and biofuels.

There are gains to be made across both climate and air pollution policy, as in some cases technological improvements in the same target sector may serve both objectives. Thus, there are not only policy advantages but also economies of scale and co-benefits to be achieved by addressing air pollution and climate in an integrated manner that combines approaches (West et al., 2013). A study showed that EU efforts to reduce greenhouse gas emissions in the framework of its climate change commitments could also make a significant contribution to reducing air pollution while also reducing any costs related to air pollution by as much as €10 billion per year (EEA, 2007).

Policymakers can achieve substantial gains by approaching the challenges of air pollution and climate change conjointly.

The UNECE Convention on Long-range Transboundary Air Pollution

In 1967, the Swedish scientist Svante Odén brought to the world's attention the links between sulphur emissions from combustion of fuel – particularly coal at the time – and the level of acidity in rainfall. Twelve years later, in 1979, recognizing the transboundary nature of air pollution, countries mobilized to tackle the problem via the first international, legally binding instrument to deal with air pollution – the Convention on Long-range Transboundary Air Pollution (the Air Convention).

As the oldest multilateral environmental agreement, the Air Convention has served as a platform for promoting international cooperation to address air pollution, and has prompted action to control and reduce the impact of air pollution on humans and the environment. Today the air we breathe in Europe and North America is certainly cleaner than the air our forefathers breathed in the late nineteenth century and up to the middle of the twentieth century.

At the vanguard of science and policy related to air pollution today, the Air Convention has 51 Parties extending to the west to the United States and Canada and to the east as far as Kazakhstan. The Convention is underpinned by the scientific work of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), which includes an extensive network on emissions, dispersion modelling, coordination of air monitoring networks and integrated assessment modelling. The Convention can also rely on the work of international cooperation centres and task forces focused on monitoring of the effects of air pollution on health, vegetation, waters and materials, and on modelling and mapping. This scientific basis supports Parties to develop cost-effective pollution abatement strategies and policies, and to assess them accordingly.

The Convention has been extended by eight protocols. Key protocols are presented in the table below.

Table 1: Convention protocols

Protocol	Key obligations
The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) and its 2012 amended version	• Emission reduction commitments for 2020 and beyond for sulphur dioxide, nitrogen oxides, ammonia, Volatile Organic Compounds (VOCs), $PM_{2.5}$. • Application of emission limit values for sulphur, VOCs and NOx and specific ammonia control measures. Application of limit values for mobile sources and limit values for VOC content in products. • Application of best available techniques (BATs) for mobile and stationary sources in accordance with the respective guidance document • Reporting obligations
The 1998 Protocol on Heavy Metals and its 2012 amended version	• Reduction of emissions of mercury, lead and cadmium from the level of emissions in the reference year • Application of limit values and BATs for major stationary sources • Application of product control measures (unleaded petrol, mercury in batteries) • Reporting obligations
The 1998 Protocol on Persistent Organic Pollutants and its 2009 amended version	• Elimination of production or use of 21 pesticides, use restrictions for 2 industrial chemicals • Reduction of emissions of 4 polycyclic aromatic hydrocarbons, dioxins/furans, hexachlorobenzene and polychlorinated biphenyls and implementation of BATs for their major sources • Reporting obligations
The 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)	• Financing of EMEP programme by mandatory contributions from the Parties to the Protocol. The EMEP budget covers the coordination costs of the monitoring network, emission data collection, modelling concentrations and depositions and integrated assessment modelling.

There are synergies and cooperation between the Air Convention and other international agreements and processes (e.g., the Stockholm Convention, the Minamata Convention, the Climate and Clean Air Coalition hosted by UNEP). Parties to the Air Convention can thus optimize their approaches and improve their knowledge, capacity and implementation under several international agreements. For example, the 2012 revised text of the Gothenburg Protocol represents the first binding agreement to include emission reduction commitments for fine particulate matter and specifically includes the short-lived climate pollutant black carbon (or soot) as a component of particulate matter.

The Convention and its protocols encourage the Parties to implement best available techniques and to introduce limit values for specific emission sources in order to keep emissions down. These measures can inspire the countries that are not Parties to introduce a similar approach; this would contribute to the modernization of industrial installations and a transition to cleaner and greener technologies. Each of the key protocols provides respective guidance and methodologies to support Parties. For example, major reductions in sulphur oxide emissions can be attributed notably to the following technologies: flue gas desulphurization, denitrification (selective catalytic, reduction) and precipitators (e.g., electrostatic precipitator), baghouses and catalytic/thermal oxidation (UNECE, 2004). The development and use of technology such as flue gas desulphurization in power generating plants has helped Bulgaria – where 93 per cent of sulphur dioxide emissions are from energy use and supply (EEA, 2014) – achieve a significant drop in sulphur dioxide emissions.

The transboundary and cross-sectoral nature of air pollution calls for regional responses. In recent years, the Air Convention has made a concerted effort to improve understanding about the benefits of ratifying the Convention and its protocols, targeting Parties from Eastern and South-Eastern Europe, the Caucasus and Central Asia. In particular, recent amendments to the Convention's key protocols offer flexibility to ease accession by new Parties. For example, a Party to the Convention joining the Gothenburg Protocol before the end of 2019 may postpone the application of emission limit values by up to 15 years after the entry into force of the amended Protocol.

In addition, a number of technical cooperation, advisory and capacity-building activities being implemented within various framework projects in the region are responding to the most urgent needs of countries with economies in transition in order to close the gap in air quality management across the region.

Parties to the Air Convention and its protocols have demonstrated that much can be achieved in tackling transboundary air pollution. This has been particularly challenging in the field that is constantly evolving and where new scientific developments continue to inform policy. While challenges remain, UNECE has successfully provided an arena for Parties to exchange best practices, lead key research, develop practical tools and learn from and motivate each other in tackling air pollution.

Looking Forward

What is starkly apparent is that there are intricate, frequently multidimensional, links between air pollution and ecosystems, food production, economic growth and human health and well-being.

Parties to the Air Convention can be proud of their achievements in reducing emissions of numerous air pollutants, but challenges remain: more than 90 per cent of the EU population are living in areas where the levels of $PM_{2.5}$ and ozone concentrations exceed WHO recommendations, for example. Latest figures reported by Parties in Eastern Europe, the Caucasus and Central Asia show that emissions of some of the main pollutants have increased.

As more data are published and popularized, the public is also beginning to understand the impact of air pollution and demanding stricter emissions controls and policies.

Priorities for the future include fostering intersectoral cooperation among industry, housing, transport and agriculture, and increasing the number of Parties to the Convention and its protocols. Political engagement and a supportive political framework are much needed, particularly in Eastern Europe, the Caucasus and Central Asia. Research is ongoing and more is needed on the impacts of air pollution, on the combined impacts of air pollution and other environmental factors such as climate change, and on the technological solutions to reduce emissions. Much investment is needed to ensure progress at a sufficient pace to reduce the long-term impacts of air pollution.

The time for international concerted action is now. The Air Convention builds on over 35 years of experience, on UNECE-wide expertise and on key partnerships to provide stepped-up support to current and new Parties to improve their environment, reduce air pollution-related deaths and diseases, mitigate climate change, improve food security and enhance economic development by tackling air pollution.

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Acronyms and Abbreviations

BAT	Best Available Technique
EEA	European Environment Agency
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EU	European Union
GDP	Gross Domestic Product
NOx	Nitrogen oxides
OECD	Organisation for Economic Co-operation and Development
PM	Particulate matter is an air pollutant consisting of a mixture of particles suspended in the air. PM10 – particles with an aerodynamic diameter equal to or less than microns (coarse particulate matter), including PM2.5 – particles with an aerodynamic diameter equal to or less 2.5 microns (fine particulate matter)
POPs	Persistent Organic Pollutants
SDG	Sustainable Development Goal
SOx	Sulphur oxides
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WHO	World Health Organization
WMO	World Meteorological Organization

Clean Air for Life

Air pollution harms human health, affects food security, hinders economic development, contributes to climate change and degrades the environment upon which our very livelihoods depend. Air pollutants know no political boundaries: emissions from sources in one country can be transported and deposited in neighbouring countries, sometimes even thousands of kilometres away. This is why in 1979, realizing the need for a common transboundary response to the problem, some 30 Governments and the European Community signed the Convention on Long-range Transboundary Air Pollution within the framework of the United Nations Economic Commission for Europe. The result of this collective effort has been a success: emissions of a series of harmful substances have been reduced by 40 to 80% since 1990 in Europe. Yet much more remains to be done. Enhanced cooperation is essential between the sectors contributing to air pollution, and actions are required at the local, national and international levels.

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