CONTROLLING SHORT-LIVED CLIMATE POLLUTANTS: An opportunity to improve air quality and mitigate climate change.

The case of Brazil, Chile and Mexico

Executive Summary[1]

Short-lived climate pollutants (SLCP) are gases and particulates that contribute to climate change and degrade air quality, affecting health and thus the enjoyment of human rights, especially among the most vulnerable populations. They are described as 'short-lived' because they have a relatively short lifespan, remaining in the atmosphere from a few days to a few decades, at most.

According to the Intergovernmental Panel on Climate Change, SLCPs are responsible for more than 30 percent of global warming,[2] and more recent studies calculate their contribution to be between 40 and 45 percent.[3] Due to their short lifespan, the mitigation and reduction of SLCPs presents a significant opportunity to make short-term progress in the battle against climate change.

The following contaminants are considered SLCPs: black carbon, methane (CH_4), tropospheric ozone (O_3) and hydrofluorocarbons (HFC). Black carbon is the only SLCP that is not a greenhouse gas (GHG). Rather, black carbon is an aerosol, generated by the incomplete combustion of fossil fuels and biomass, which is produced, for example, by diesel motors or the burning of firewood. Black carbon is also one of the main components of the particulate matter (PM) that contaminates our air—both PM_{10} and $PM_{2.5}$.[4] Black carbon is removed from the atmosphere after mere days. Tropospheric ozone is a reactive gas that lasts weeks in the atmosphere and is formed when sunlight interacts with other gases, including methane. Methane is generated primarily by agricultural activities (livestock rearing and rice production), fossil fuel production and distribution, as well as in landfills, wastewater management, and in the reservoirs of large tropical dams that submerge organic matter. It remains in the atmosphere for about 12 years. Finally, hydrofluorocarbons are man-made gases that entered the market as a replacement for chlorofluorocarbons (CFC) when the Montreal Protocol limited their commercial use.[5] HFCs are used in refrigeration and cooling equipment such as air conditioners, foam blowing agents, and aerosol sprays, among others. HFCs last an average of 15 years in the atmosphere.

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[1] The complete document, elaborated by the Interamerican Association for Environmental Defense (AIDA) in collaboration with the Institute for Energy and Environment (IEMA), can be downloaded here (in Spanish): http://www.aida-americas.org/es/contaminantes-climaticos-de-vida-corta-situacion-actual-y-oportunidades-para-su-disminucion-y-control
AIDA is a member of the Latin American Network on Short-Lived Climate Pollutants RedRacc http://redracc.org/

[2] AKBAR, Sameer, et al. *Integration of short-lived climate pollutants in World Bank activities: a report prepared at the request of the G8*. World Bank, 2013

[3] ZAELKE, Durwood. & BORGFOLD-PARNELL. Nathan. *Primer on Short-Lived Climate Pollutants: Slowing the rate of global warming over the near term by cutting short-lived climate pollutants to complement carbon dioxide reductions for the long term*: Institute for Governance and Sustainable Development, 2012

[4] Particulate matter is classified by the size of its particles: PM_{10} for particles with diameters smaller than 10 micrometers; $PM_{2.5}$ for those with diameters smaller than 2.5 micrometers. The latter are especially harmful to human health because, due to their smaller size, they penetrate deeper into the lungs.

[5] The Montreal Protocol, adopted in 1989 in the context of the Vienna Convention for the Protection of the Ozone Layer, was designed to reduce the production and consumption of substances that degrade the ozone layer.

Carbon dioxide (CO_2) continues to be the principal greenhouse gas, responsible for at least half of global warming. In contrast to SLCPs, carbon dioxide remains in the atmosphere for a very long time. In fact, in the first hundred years after being emitted, only half of the carbon dioxide is removed, leaving a significant portion in the atmosphere for millennia. Limiting carbon dioxide emissions is essential to maintaining the balance of the earth's climate in the long term; however, the reduction of carbon dioxide must be combined with the reduction of SLCPs to avoid significant temperature increases in the short term.

SLCPs also degrade air quality, increasing the rate of premature deaths by causing respiratory and heart disease.[6] Furthermore, SLCPs significantly reduce crop yields, causing important economic losses and affecting the world's food supply.[7] For these many reasons, the development of strategies to identify the primary sources of SLCPs and actions that cut SLCP emissions should be a short-term priority for governments in the region.

The Climate and Clean Air Coalition is the first global initiative established with the objective of reducing SLCPs. It is made up of more than 60 member countries, and also has representatives from the private sector and civil society. The Coalition aims to raise awareness and improve scientific knowledge of the impacts of SLCPs, as well as to develop and strengthen national and regional efforts to address them.

To promote measures to mitigate SLCPs, AIDA, in collaboration with the Institute for Energy and Environment (IEMA) in Brazil, has written a report that analyzes the legislative and regulatory frameworks governing SLCPs in Brazil, Chile and Mexico. The review covers policies, laws, and air quality and climate change programs, as these relate to SLCPs. The three countries were chosen because they contribute an important amount of SLCPs regionally, and their governments have shown political will to reduce contaminants.

Mexico has already officially incorporated SLCPs into its climate change policies. Chile has indicated that it will do so soon and, in any case, has taken measures that aim to improve air quality and, subsequently, reduce SLCPs, although the climate benefits of these actions have not been recognized. In contrast, Brazil has displayed few signals that the government will adopt concrete measures to regulate SLCPs anytime soon, though it has shown political will to reduce GHG emissions as a whole. Cost effective measures to mitigate SLCPs exist and have already been applied in various countries with proven positive short-term impacts.

BRAZIL

Brazil is among the ten highest emitters of GHGs on the planet.[8] It is also one of the most urbanized countries in the world, and the contamination of its urban centers has become a serious public health problem. Although legislation, policies and programs exist to deal with air contamination and climate change, there is nothing that specifically addresses SLCPs.

[6] Integration of Short-Lived Climate Pollutants in World Bank Activities, *supra* note 2
[7] UNEP & WMO. *Integrated assessment of black carbon and tropospheric ozone*. 2011
[8] *CAIT Climate Data Explorer [web page]*. World Resources Institute

Historically, the main source of GHG emissions in Brazil has been deforestation related to agriculture and cattle farming, two of the country's primary economic activities. Impressively, Brazil has been able to reverse rates of deforestation in the last few decades, consequently reducing GHG emissions by 41 percent between 2005 and 2012. On the other hand, emissions associated with the burning of fossil fuels for energy production have increased in parallel with economic growth. Considering recent discoveries of new national oil reserves, it is possible that the burning of fossil fuels will soon become Brazil's main source of GHG emissions.[9]

With respect to SLCP emissions, Brazil stands among the five biggest emitters of methane in the world. Most of these emissions come from the country's large cattle herds.[10] Moreover, methane emitted from large dams in tropical regions has not yet been considered in the calculation of emissions, despite the fact that, in 2014, 65 percent of the county's energy came from hydroelectric dams,[11] many of which are located in the Amazon.[12]

Brazil is made up of many states with varied capacities for complying with national regulations. This inequality is evident when examining the national air quality control monitoring system, which is unreliable and suffers from a lack of territorial coverage. Because environmental authorities have not yet taken into account differences between states, many laws end in noncompliance. It is important that resources be allocated to improve capacity and monitoring, especially in the less developed states, to level air quality control efforts countrywide.

For example, there are Brazilian national standards that regulate PM_{10} and tropospheric ozone, but none that regulate $PM_{2.5}$. The states of São Paulo and Espiritu Santo have passed local regulations for $PM_{2.5}$, but São Paulo is the only state that has established maximum limits for the pollutant. Resolution 3/1990, which regulates national air quality standards, is currently being updated and is expected to include maximum limits for $PM_{2.5}$. However, there is no clarity as to when this update will occur.

Brazil should consider regulating SLCPs by promoting the collaboration of state authorities with national and international agencies. The first step could be to enhance the compliance capacity of the less developed states, which should begin by improving monitoring networks. Considering the importance of Brazil's role in anthropogenic methane production, and its dependence on hydroelectric power stations, it is recommended that the emissions of methane generated by dams be considered, especially as new large hydropower projects continue to be planned in the Amazon.

Chile

Chile's contribution to global GHG emissions is relatively small; however, its emissions per capita are among the highest in the region. Although air quality has improved in recent years thanks to government decontamination strategies, atmospheric pollution in several cities continues to be a problem. GHG emissions in Chile are primarily generated by the energy and transportation

[9] Deep Decarbonization Pathways Project (DDPP). *Pathways to Deep Decarbonization in Brazil.* Sustainable Development Solutions Network (SDSN) & Institute for Sustainable Development and International Relations (IDDRI), 2015

[10] Brazil. G*lobal Methane Initiative(GMI) [web page]*

[11] Pathways to Deep Decarbonization in Brazil, *supra* note 9

[12] *Dams in the Amazon [web page]*. Fundación Proteger, International Rivers & ECOA

sectors.[13] Methane, which represents 21 percent of Chile's net GHG emissions, comes mainly from agriculture and landfills.[14] The main sources of $PM_{2.5}$ emissions are the use of firewood and fuel burning vehicles, especially those running on diesel.[15]

Chile has a long-standing history of air quality control, including national standards that regulate PM_{10}, $PM_{2.5}$ and tropospheric ozone. In addition, multiple regulations and programs have been put in place that indirectly cut SLCP emissions without this being the goal. Such measures are scattered throughout the territory in the absence of a central public policy framework. For now, they do not incorporate a climate change objective. The political will to improve air quality should be translated into public policy instruments that will remain as a legacy for future governments, and that will also consider the climate benefits.

Chile is a partner of the Climate and Clean Air Coalition and, in 2015, included the reduction of SLCPs within the Intended Nationally Determined Contributions (INDC).[16] To comply with the promised contributions, the next step for Chile should be to include SLCPs among the gases measured by the atmospheric monitoring system.

In 2014, the Ministry of the Environment merged the Department of Air Quality with the Climate Change Office to create the Division for Air Quality and Climate Change, which includes the reduction of SLCPs as one of its objectives.

As part of a 2014 tax reform, Chile introduced so called "green taxes." The first of these taxes covers emissions from boilers and turbines. The second taxes the purchase of new vehicles, based on emission levels, performance and price. Both of these taxes influence black carbon emissions and are excellent examples of the progress made in Chile with respect to the taxing of emissions.

With regard to climate regulation, no laws or budgetary proposals have been put in place to translate existing political will into action. In fact, the goals set under the country's INDCs are conditioned on economic growth and/or international financial assistance. Therefore, a next step to drastically reduce emissions, including SLCPs, must include regulations that secure the availability of economic resources, so that effective solutions can be implemented.

Mexico

Mexico is one of the top fifteen emitters of GHG emissions worldwide. The majority of these emissions come from transportation and electricity generation sectors.[17] The main sources of SLCPs are the transportation and industrial production sectors. In terms of air quality, Mexico City is one of the most densely populated metropolises in the world, and has a serious pollution problem that is also seen in other large Mexican cities.

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[13] Chile – Ministry of the Environment. *Segunda Comunicación Nacional de Chile ante la CMNUCC.* 2011
[14] Chile – Ministry of the Environment. *Primer Reporte del Estado del Medio Ambiente.* 2013
[15] Chile – Ministry of the Environment. "Capítulo 1: Contaminación del Aire" En: *Informe del Estado del Medio Ambiente.* 2011
[16] The INDC are official documents containing country commitments to reduce GHG emissions under the United Nations Framework Convention on Climate Change (UNFCCC).
[17] Instituto Nacional de Ecología y Cambio Climático De México (INECC). Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. *[web page]*

Mexico was one of the founders of the Climate and Clean Air Coalition. The 2012 Climate Change General Law establishes the legal framework to elaborate the National Strategy for Climate Change and the Special Program for Climate Change (ENCC and PECC, in Spanish), both of which address SLCPs through specific paths of action. Furthermore, national regulations control ozone, PM_{10} and $PM_{2.5}$ emissions. Recently Mexico included the reduction of SLCPs in the text of the INDCs, as an additional promise to reduce GHG emissions.

Considering the advances made in regulation of SLCPs, the current challenge is to operationalize this policy framework. In general, Mexico is known to have effective political and policy frameworks, but implementation, evaluation and sanctioning have proved insufficient. To this end, concrete action is required to enforce existing laws and regulations and to strengthen national capacity, including the improvement of air quality monitoring systems, which are currently ineffective or incomplete. For SLCPs specifically, Mexico must soon enact the delayed update of NOM 044, which is intended to improve the control of emissions from diesel vehicles.

Mexico must also better coordinate its national and international agendas. The new commitments taken on by the INDCs must be in line with the Climate Change Program and Strategy (ENCC and PECC), as all of them address SLCPs. This would facilitate future administrations' efforts to effectively comply with the various commitments made.

Another untapped opportunity lies in the energy reforms that Mexico began implementing in 2013 through constitutional reforms. On the one hand, temporary article 17 refers to the protection and conservation of the environment and encourages the effective reduction of GHG emissions and SLCPs. On the other, the same reform jeopardizes the achievement of climate change goals by facilitating the increased production of fossil fuels, which would increase GHG and SLCP emissions. The Mexican government should therefore strengthen internal coordination, ensuring integrity in its approach to the design and implementation of public policies.

Mexico´s situation is an interesting case study for assessing the effectiveness of measures implemented in policies and programs to reduce SLCPs.

Conclusions and recommendations

The following recommendations aim to mitigate SLCP emissions in Brazil, Chile and Mexico, capitalizing on the significant co-benefits for public health, the protection of human rights, ecosystems and economies, as well as for the global fight against climate change.

1. **Implement robust legal frameworks and public policies that address the reduction of SLCPs**: Appropriate legislation enables the establishment of institutional frameworks and integral views of the problems to solve, facilitating the implementation of public policies and programs, and even the allocation of resources to achieve goals. The adoption of specific climate change legislation in countries that still do not have such laws presents a good opportunity (though not the only one) to design a structured strategy to mitigate SLCPs. Mexico has set a good example by being the first country in the region (and second in the world) to have passed a specific climate change law; however, the challenge of proper implementation remains.

2. **Strengthen institutions and coordination among different areas of government**: To further the impact of SLCP reduction initiatives, internal capacities must be strengthened, recognizing that scientific knowledge is vital to monitoring emissions and implementing new technologies. Considering the relationship of SLCPs with different government sectors, effective internal coordination is crucial. In particular, communication between climate change and air quality departments must improve, as the actions taken by one impact the work of the other, and vice versa. (Actions to reduce SLCPs benefit both areas.) Chile has provided a good example by merging the Clean Air Division and the Climate Change Office, both within the Ministry of the Environment.

3. **Guarantee financial resources:** The availability of adequate and permanent financial resources to implement measures and technologies directed towards reducing SLCPs is essential. In the case of Mexico and Brazil, climate funds exist that can be used for the above purposes. Chile is less advanced in this regard, as it is yet to commit secured resources for climate change initiatives.

4. **Refine and enforce air quality standards:** Atmospheric pollution standards should be progressively updated to reflect World Health Organization (WHO) recommendations. At the same time, sanctioning and monitoring systems must be made effective so that standards will be meaningful and effective. The three countries studied possess maximum concentration standards for PM_{10} and ozone, however only Chile and Mexico effectively regulate $PM_{2.5}$. In any case, neither Mexico nor Chile match the WHO recommended levels and, moreover, the existing standards are generally not complied with or effectively enforced.

5. **Adopt existing best technologies:** Many technologies have been successfully used in other countries to reduce SLCPs. Some can be easily implemented, such as the application of particle filters associated with the Euro 5 Standard,[18] already implemented in Brazil and Chile, which reduce almost all black carbon emitted from diesel vehicles. The risk of these kinds of measures is that, because they require installation of external accessories, their effectiveness depends on appropriate maintenance and inspection of vehicles, without which the benefits might become obsolete. Other technologies aimed at structural changes and long-term solutions are more costly, but also more effective. With respect to emissions from public transport, for example, it is better to aim at the progressive replacement of the bus fleet with electric vehicles that do not emit polluting gases, than the application of filters to old motors that could easily fail with time.

6. **Effective monitoring of air quality and access to information:** To reduce air pollution in cities, well-functioning monitoring systems with ample territorial coverage that address all pollutants to be controlled are essential. At the same time, air quality information, including the methods used to gather it, should be transparent and made available to the public. In Brazil and Mexico, monitoring systems are deficient and only capture information from a relatively small

[18] Euro Standard is the name by which European Emission Standards are known. They regulate the acceptable limits for exhaust emissions of new vehicles sold in the Member States of the European Union. These rules work through progressive implementation, listed numerically, increasing as they are become more restrictive.

portion of the national territory. This means that even if these countries have rigorous standards in place, they can only be implemented in a small number of cities. Measuring emissions from SLCPs and elaborating inventories on the matter is a good way to move forward with regulation and mitigation.

7. **Incorporate a focus on human rights:** Atmospheric pollution in various cities of the three countries has been associated with premature deaths and illnesses, especially affecting the most vulnerable populations. Additionally, SLCPs, particularly tropospheric ozone, affect crop performance, risking food security for entire populations. SLCPs are therefore a human rights issue. According to international human rights law, every State has the duty to protect, promote and respect human rights. In addition, all three countries recognize the constitutional right to a healthy environment. Therefore, to fulfill their human rights obligations, these States should promote effective measures to reduce SLCPs.

Comparative chart of environmental standards in relation to SLCPs

	BRAZIL			**CHILE**			**MEXICO**			**OMS**	**EU**	**US**
ntam.	Rule	Max. Level .(µg/ m³)	Prom. Anual Max. (µg/m³)	Rule	Max. Level (µg/ m³)	Prom. Annual Max. (µg/m³)	Rule	Max. Level (µg/m³)	Prom. Annual Max. (µg/m³)	Standard (µg/ m³)	Standard (µg/ m³)	Standard (µg/ m³)
zone (O_3)	Res. 3/1990 CONAMA	160 (1 hr)	N/A	DS 112/2002	120 (8 hrs)	N/A	NOM 020	186 (1 hr)** 137 (8 hrs)	N/A	100 (8 hrs)	147 (8 hrs)**	120 (8 hrs)
M_{10}	Res. 3/1990 CONAMA	150 (24 hrs)	50	DS 20/2013	150 (24 hrs)	50*	NOM 025	75 (24 hrs)	40	50 (24 hrs) 20 (annual)	150 (24 hrs)	50 (24 hrs 40 (annual)
$M_{2.5}$	N/A	N/A	N/A	DS 12/2011	50 (24 hrs)	20	NOM 025	45 (24 hrs)	12	25 (24 hrs) 10 (annual)	25 (24 hrs) 15 (annual)	25 (annual)

* Repealed standard that should soon return to rule.

** O_3 standards in Mexico and the US, which are reported in "parts per million (ppm)" have been converted into µg/m^3 according to the following formula: 1 ppm=1960 µg/m^3 a 1 atm y 25 °C.