Taking an integrated approach to air pollution and climate change

Opportunities and challenges from an African perspective

L'adoption d'une approche intégrée des questions de pollution atmosphérique et de changement climatique

Opportunités et enjeux du point de vue de l'Afrique

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1. Scope

Large sums of money are spent each year on the treatment of respiratory diseases caused by air pollution. Premature deaths caused by poor air quality take their toll on the affected countries' economies. According to the World Health Organisation (WHO), developing countries are particularly hard-hit: only malnutrition, unsafe sex and the lack of clean water and sanitation are greater health threats than indoor air pollution. Africa is no exception, and an increasing amount of evidence is revealing the impact of air pollution on ecosystems and communities in the continent. Similarly, it has been established by the Intergovernmental Panel on Climate Change (IPCC) that Africa is extremely vulnerable to climate change. There remains a great deal of controversy as to whether Africa should play a bigger role in stabilising and reversing the concentrations of greenhouse gases (GHG) in the atmosphere, given that the continent has contributed the least to their emission.

In developed countries – particularly the Annex 1 countries under the Kyoto Protocol – climate change mitigation is well entrenched as a legitimate policy priority. The same cannot be said of Africa where climate change is still widely perceived as a global – as opposed to local – issue for which the industrialised nations are held responsible. In addition, African decision makers are faced with a host of other pressing issues such as public health, food security, infrastructure, energy and education.

The overwhelming majority of studies on air pollution and climate change co-benefits have been carried out in developed countries. Most of them aim to investigate the ways in which ancillary air quality benefits can be obtained from GHG mitigation policies. The same rationale cannot be applied to Africa for at least two reasons. Firstly, air pollution and climate change co-benefits are policy-specific and location-specific. This means that extrapolating research results obtained in developed countries to Africa is unlikely to achieve the expected results. Secondly, there is a crippling dearth of data and information on air pollution in the continent. Although most African countries report on GHG emissions as part of their commitments under the UNFCCC, air pollution monitoring capacity remains rather feeble. In the absence of reliable data, it is very difficult to build models whereby the issue of air pollution and its interactions with climate change can be apprehended.

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Thus, any push for the adoption of an integrated air pollution and climate change approach in Africa should be adjusted to fit in with the continent's development priorities. The prospect of achieving ancillary public health benefits – as a result of air pollution reduction – from GHG mitigation is not appealing to African decision makers. Instead of allocating resources to the "low-priority" climate issue, they would rather invest directly into national programmes of air pollution abatement and/or public health.

In Africa, the synergy that could be derived from an integrated approach should be envisaged from the angle of air pollution, which would strike a cord with most African decision makers given that readily available data and anecdotal evidence confirm the adverse impacts of air pollution on human health and on the economies. The notion that addressing a relevant local issue – air pollution – helps tackle a global concern – climate change – makes sense and could easily gather public and political support in African countries. This is due to the fact that air pollution is a real, palpable issue with a clear public health, budgetary dimension, whereas climate change remains, to a large extent, a complex issue which belongs to the somewhat daunting world of models and scenarios.

With the purpose of identifying ancillary GHG mitigation benefits from improved air quality, a better understanding of the facts of air pollution in Africa is required. Many examples illustrate the complexity of the co-benefit concept in a policy making context. Indeed, decision makers seem to be faced with more trade-offs than co-benefits. Vehicle fuels are a case in point. Diesel engines are notorious for releasing significantly higher levels of Particulate Matter – a dangerous pollutant which can cause Acute Respiratory Infection (ARI) – than engines working on petrol. At first glance, transport-related air pollution may seem a relatively easy issue to tackle, at least from a purely conceptual point of view: switching to petrol and encouraging the use of end-of-pipe measures – to reduce emissions – should do the trick. However, such an approach would be overly simplistic, because diesel is a much more climate-friendly fuel than petrol. Moreover, end-of-pipe pollution reduction technologies are not widely available in Africa, and even if they were, it is not clear that they would have a real impact on pollutants' emissions given the state of the vehicles crowding the roads of African cities. The petrol-diesel dilemma in the transport sector illustrates the sheer complexity of the notion of air pollution and climate change co-benefits. "Quick fixes" do not exist partly because not all GHG mitigation policies necessarily improve air quality, nor do all air pollution abatement actions reduce GHG emissions. Hence the importance of identifying and implementing co-benefit measures.

Another example, which is particularly relevant to the continent, is that of the household energy sources in sub-Saharan Africa. Many households are plagued by smoke released by cooking stoves. Biomass constitutes the single most widely used fuel for cooking in the region. Its poor combustion properties cause indoor pollution with serious health consequences on women and children who spend more time at home, and therefore are more exposed to smoke. Biomass includes two main types of solid fuels: unprocessed wood fuel and charcoal. While the use of charcoal produces less PM emissions than wood fuel – and thus saves lives – its production results in higher GHG emissions, not to mention potentially adverse impacts on local ecosystems – mainly deforestation and land degradation caused by overly intensive and unsustainable wood harvesting.

Should Africa's air quality, after all, come at the expense of the climate? Not quite, because measures which help tackle both issues do exist. In order to identify them, an in-depth look at the facts of air pollution and climate change in Africa is needed, particularly in the key sectors of household energy, transport, power generation and industry.

2. Exploring co-benefits in the transport sector

Urbanisation in sub-Saharan Africa is growing apace. As a result, the number of motor vehicles has increased. A large number of old cars and trucks, very often with dysfunctional catalysts, are crowding the roads of many African cities. Pollutants ejected into the air by vehicles' exhausts are responsible for dangerous concentrations of ground level ozone, particulate matter and sulphur. In 2006, the total lead phase out in sub-Saharan Africa marked a landmark achievement. By ridding Africa of the lethal dangers of lead poisoning, the phase out meant better health and longer lives for millions of Africans. However, the sheer importance of this remarkable success story should not overshadow the urgent need to tackle other pollutants, such as sulphur. In many African countries sulphur levels in diesel vehicle fuels reach staggering levels, up to a 1,000 times higher than acceptable levels in Europe (10 to 50 parts per million). For instance, Sudan reports a sulphur content in diesel of 11,000 parts per million whilst Ethiopia, Kenya, and Tunisia have sulphur content in diesel at 10,000 parts per million*. Sulphur emissions have been linked to health problems including heart attacks in the elderly and vulnerable groups. They can also damage trees and other biological systems as a result of the formation of sulphuric acid.

Air pollution abatement in the transport sector could be achieved through the introduction of more efficient and less polluting vehicles. The introduction of lead-free petrol and diesel with reduced sulphur

** Source: UNEP.*

content – which could be achieved through the upgrade of African refineries – can underpin the introduction of emission control technologies on vehicles including catalytic converters and particle traps. However, measures to improve vehicle efficiency could be overwhelmed by the growth in the sector. Moreover, such measures, in addition to being costly, do not necessarily reduce carbon dioxide and other GHG emissions.

An appealing co-benefit approach in the transport sector would consist of reducing the demand for cars without impeding economic development. This can be achieved through building or rehabilitating the public transport infrastructure in African cities. Less car use would mean less air pollution and less GHG emissions. The fact that the transport infrastructure in many African countries is still at the blueprint stage provides an opportunity to achieve co-benefits in the sector before irreversible policy choices and long term commitments are made. Ensuring that public transport is defined as a priority would achieve the co-benefits sought.

In addition, transport modal shifts from road to rail, adequate urban planning, and non-motorised transport within cities are all opportunities for climate change and air pollution co-benefits. Apart from gains in public health, quality of life improvement and climate change mitigation, such measures would help relieve pressure on ecosystems and protect farmland surrounding urban areas which, as the sulphuric acid contamination cases show, can suffer from urban air pollution with negative consequences on survival farming and cash crop yields. In this instance, reducing air pollution would also have ancillary benefits in poverty reduction.

Clean Development Mechanisms (CDM) can provide a suitable framework and the required resources to achieve co-benefits in the transport sector. The resources provided by Annex 1 countries would help reduce air pollution in African countries and ultimately reduce GHG emissions. CDM projects would also underpin development – by building or improving the transport infrastructure – in accordance with their development-oriented approach. There seems to be a large CDM potential in the transport sector. However, the project-based nature of the Clean Development Mechanisms is an obstacle to achieving sector-wide pollution abatement and GHG mitigation objectives. CDM projects are usually small and their large-scale impact is limited. Luckily, efforts to loosen the strict project-based configuration are already underway.

In any case, quick wins can be achieved by limiting the import of older, highly polluting vehicles. Regulations should progressively be put in place to enhance vehicle maintenance. Reducing traffic congestion and car use in cities should also be explored as a potential co-benefit measure.

The use of clean-burning biofuels cannot be regarded as a potential co-benefit measure so long as their low-carbon credentials have not been confirmed by rock-solid scientific evidence. In Africa, where many countries are severely hit by the unfolding food crisis, the use of biofuels is a highly controversial issue, not least because it competes with other land uses and causes food prices to soar.

3. Achieving co-benefits in African households

Outdoor air pollution seems to be the tip of the iceberg. Indoor air pollution resulting from residential solid fuel combustion is currently one of the leading causes of mortality worldwide. According to the World Health Organisation (WHO), exposure to high smoke concentration in households, resulting from solid fuel combustion is responsible for 1.5 to 2 million deaths per year almost entirely in developing countries. It is estimated that 2.5 billion people depend on traditional biomass (fuel wood and charcoal) as their primary fuel for the various household uses (cooking and heating) because it is a cheap source of fuel. Exposure to indoor pollution was estimated to have caused 1.3 million premature deaths in the world in 2002 (Stern/IEA). More than half of the victims are children who spend more time at home than adults. Their immune systems are ill-equipped to deal with exposure to particulate matter (PM), carbon monoxide and other pollutants emitted by biomass burning mainly for cooking. The danger of indoor pollution is not restricted to rural zones. Many city dwellers in Africa cling to rural habits and practices. The purchasing power issue is also a major obstacle to a wider use of clean fuels in the household.

Fuels derived from biomass usually dominate national energy supplies in sub-Saharan Africa. Even in fossil-fuel-rich countries such as Nigeria, Gabon or Angola, biomass accounts for the bulk of national energy consumption. Biomass is used in different forms: unprocessed fuel wood and charcoal are the most common sources of household energy. Use of animal dung and crop residues remain limited. Burning biomass causes bigger emissions of air pollutants than using fossil fuels such as kerosene or Liquefied Petroleum Gas (LPG). This is due to the poor combustion characteristics of most fuel woods.

The UN Millennium Project has set a target of reducing by 50% the number of households using traditional biomass as their primary fuel by 2015. Many obstacles have yet to be removed in order to attain this objective in Africa. In areas covered by the national electricity grid, prices are usually prohibitive. In fact, the average electricity consumption in sub-Saharan Africa does not exceed 23 percent of the total energy use. Liquid fuels (LPG and Kerosene) – which are considerably cleaner than solid fuels – are not viable options due to economic constraints faced by poor households and problems related to their supply and the required infrastructure for their transport and use.

Land degradation in large swathes of Africa is triggering migration flows from rural to urban areas.

Migration may be among the factors behind the fast-paced urbanisation in sub-Saharan Africa. Coupled with economic growth, urbanisation has spurred a change in the way energy is used. One of the most remarkable trends observed in recent years is the shift from fuel wood to charcoal. In addition to signalling an improvement in the average household income – charcoal is more expensive than unprocessed fuel wood – this shift comes as good news for health experts concerned with indoor air pollution. Charcoal is in fact a cleaner fuel which, in addition, is conveniently more affordable than liquid fuels. When it comes to choosing from various household energy alternatives, the price is a key criteria. Low income is one of the major obstacles impeding a massive shift to liquid fuels in sub-Saharan Africa.

The mainly informal sector of charcoal production accounts for an annual turnover of several millions of US dollars in many African countries*. In Kenya – a country with large cities such as Nairobi or Mombasa – a study has revealed that GHG emissions from charcoal production and use are equivalent to those from transport and industry. As Kenya's example shows, the importance of the household energy sector in the context of air pollution and climate change mitigation is not to be underestimated. In sub-Saharan Africa, the majority of GHG emissions seem to originate in households as a result of energy consumption and land-use activities.

Despite its virtues in the field of indoor air pollution reduction, charcoal has setbacks in terms of GHG emissions. A study of wood fuel production and use in sub-Saharan Africa** found that each meal cooked with charcoal has 2-10 times the global warming effect of cooking the same meal with firewood and 5-16 times the effect of cooking the same meal with LPG or Kerosene. Apart from the GHG emissions caused by charcoal production and use, the deforestation and land degradation caused by the overexploitation of certain species may increase charcoal-related emissions even further. In sub-Saharan Africa, an estimated 20 percent of the wood harvested for energy generation purposes is transformed into charcoal. In some countries this figure could be as high as 50 percent. In view of the growing use of charcoal, there are mounting concerns that a combination of adverse climate change impacts, increasing demand from a growing and relatively better off population, and inadequate wood harvesting practices may lead to deforestation and land degradation. Existing and planned greenbelts surrounding some African cities may be at risk in the absence of regulations and proper forest management practices. The preferred species for the production of dense, slow-burning charcoal are characterised by slow growth, which further exposes them to overexploitation.

A massive shift to LPG or kerosene – which would require the large-scale provision of new stoves and canisters – would be an expensive option, and definitely not a cost-effective one given that the resulting reduction in GHG would be too small. By contrast, generalising the use of charcoal in the few pockets where unprocessed wood fuels are still being used would be much easier and more affordable. Such a measure would have immediate health benefits because concentrations of PM in homes will diminish considerably. It is essential that a wider use of charcoal be promoted along with behavioural changes such as keeping children away from stoves. Thus, damage from other pollutants released by charcoal – notably carbon monoxide – can be kept to a minimum. Other accompanying measures should also be aimed at curbing GHG emissions from charcoal's production and use. These would include sustainable forest and woodland management practices, promoting low-carbon charcoal production techniques, encouraging charcoal production from sawmill residues, and introducing regulations so as to promote low-carbon varieties of charcoal.

Taking this two-pronged approach to indoor air pollution and GHG emissions mitigation would also have positive impacts on social welfare, economic development and on local ecosystems. As a matter of fact, a state-regulated "charcoal sector" would provide jobs for rural communities and prevent forced migration to urban areas. Given its weight in many African countries, a healthy and thriving low-carbon charcoal sector would provide a sustainable source of household energy with minimum impacts on the natural environment. Arguments against a wider use of charcoal include the fact that even if all the CO_2 emitted in the production process were removed from the atmosphere thanks to effective forestry and woodland management practices, charcoal use in households would still result in bigger emissions of other gases falling under the Kyoto Protocol – mainly CH_4 and N_2O.

The resources required for the implementation of the mitigation measures needed for climate- friendly charcoal production and use could come from CDM. Possible projects could include investment in sustainable woodland management to compensate for the wood harvested and offset part of the emissions through tree planting. The introduction of low-carbon charcoal production techniques and of more charcoal-efficient stoves in households could also be envisaged.

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*** "Impacts of Greenhouse Gas and Particulate Emissions from Woodfuel Production and End-use in Sub-Saharan Africa", Robert Bailis, David Pennise, Majid Ezzati, Daniel M. Kammen, Evans Kituyi, 2004.*

4. The building and the energy sectors

In the current context of rapid urbanisation, energy-efficient buildings would help improve indoor and outdoor air quality, reduce GHG emissions, and improve social welfare. Access to technology and the lack of resources are among the main obstacles facing the adoption of an integrated air pollution and climate mitigation approach to the building sector in Africa.

Similarly, the energy sector in the continent constitutes an area where co-benefits could also be achieved. Upgrading ageing industrial facilities and coal-fired power plants may present opportunities for reducing air pollution and cutting GHG emissions. In many African countries, securing affordable energy to underpin economic development is a national priority. Power plants running on fossil fuels remain a convenient option especially for countries with substantial reserves of oil or coal. The technology allowing a cost-effective use of renewable energy remains expensive. Renewable energy options have so far been unable to compete with fossil fuels. However, the current context of soaring oil prices makes renewable energies more attractive to both governments and the private sector. Nonetheless, price volatility may act as a disincentive to investments. CDM provides a suitable framework for developing the renewable energy sector in Africa. A bigger share for renewable in the continent's energy consumption would result in major co-benefits in air quality and climate change mitigation. As the African energy sector grows to underpin the continent's development, end-use energy efficiency improvement measures should be considered in energy-hungry hotspots – capitals and large cities. Investment in efficiency improvement has ancillary effects in air pollution and GHG emissions.

5. Final observations and suggestions

Household energy production and use, in addition to being the major source of indoor air pollution in sub-Saharan Africa, is responsible for a significant part of the region's GHG emissions. Thus, the household energy sector presents significant opportunities for co-benefit measures in both rural and urban areas. The transport, building and energy sectors also present attractive entry points for the adoption of a cost-effective integrated approach to air pollution and climate change mitigation.

The Clean Development Mechanism (CDM) has the potential of providing a suitable framework for the implementation of co-benefit measures in Africa. From a conceptual point of view, instruments such the CDM are the ideal framework to harmonise global – climate change – and local – air pollution – issues, African and non-African interests – climate change mitigation and development – with a view to creating a win-win situation for all the stakeholders.

As illustrated by the failed attempts to switch to liquid fuels in some African countries, the sole consideration of technical aspects can lead to erroneous policy choices. The socio-economic characteristics – for instance the significant economic weight of the charcoal sector in some African countries – must be taken into account. The process of choosing from a range of available policy and technology options must be guided by the local socio-economic context in addition to scientific and technical considerations. The risk often associated with CDM projects is precisely the fact that they pay little heed to the local specificities. This should be addressed in order to prevent well-intentioned projects causing unemployment or other unwanted social problems.

Resource transfers from developed countries – through the Clean Development Mechanisms (CDM) or other resource transfers (e.g. grants by the Global Environment Facility) – combined with an improved awareness of the significance of ancillary benefits, could act as an incentive for African policymakers to explore mitigation options. A better quantification of ancillary benefits that Africa could reap from GHG mitigation could constitute the ultimate incentive for Africa to take part in a global endeavour to stabilise GHG concentrations in the Earth's atmosphere. After all, Africa's best interest lies in preventing the climate system from going through the turbulences described in the IPCC reports. Currently, the best estimates of ancillary benefits from climate change mitigation actions come from developed countries and rapidly industrialised countries and are not necessarily useful for assessing the co-benefits potential in Africa.

The lack of data on air pollution and its impacts on human health and ecosystems is a major obstacle to quantifying co-benefits and assessing the true impact of potential CDM projects. APINA is making progress towards addressing the need for accurate and comprehensive data. Capacity building is needed in order to enhance the monitoring and modelling capabilities, especially in sub-Saharan Africa. But even if data were available, devising and implementing coherent policies would be another challenge to meet given the wide range of possible co-benefits and the multitude of ministries, agencies and departments involved. All the national institutions must work in a collaborative manner if the co-benefit potential is to be achieved.

The leaded petrol phase out in Africa shows that effective partnerships can work and yield impressive results. Regional partnerships – facilitated and supported by developed countries through the appropriate resource transfer mechanisms – aimed at implementing an integrated approach to air pollution and climate change mitigation could be highly beneficial. The ancillary benefits from air pollution abatement would include less GHG emissions, substantial savings in the public health sector, and more protected ecosystems. There is also a case for exploring the potential co-benefits from taking a synergetic view to climate change adaptation and air pollution abatement in Africa, which remains thus far an unchartered territory for research.