European Investment Bank

The EU bank

Short-lived Climate Pollutants (SLCPs)

An analysis of the EIB's policies, procedures, impact of activties and options for scaling up mitigation efforts

November 2016

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LIST OF ABBREVIATIONS AND ACRONYMS

AD	Anaerobic Digestion
AR5	IPCC fifth assessment report
BAT	Best Available Technologies
BC	Black Carbon
CCAC	Climate and Clean Air Coalition
CH_4	Methane
CLTRAP	Convention on Long Range Transboundary Air Pollution
CO_2	Carbon dioxide
CO_2-eq.	Carbon dioxide equivalent
DPF	Diesel Particle Filter
EC	European Commission
EEA	European Environment Agency
EIB	European Investment Bank
EPS	Emissions Performance Standard
EU	European Union
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HDV	Heavy duty vehicle
HFCs	Hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JRC	EU Joint Research Centre
LLGHG	Long-lived greenhouse gases
MARPOL	The International Convention for the Prevention of Marine Pollution from Ships
MBT	Mechanical and Biological Treatment
MDB	Multilateral Development Banks
MP	Montreal protocol
MSW	Municipal solid waste
NEC	EU National Emissions Ceilings
NMVOC	Non-Methane Volatile Organic Compounds
NOx	Nitrogen oxides
O_3	Tropospheric or ground-level ozone
OC	Organic carbon
ODS	Ozone depleting substances
PE	Polyethylene
PM	Particulate matter
SLCPs	Short-lived climate pollutants
SO_2	Sulphur dioxide
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	U.S. Environmental Protection Agency
WTE	Waste-to-energy

LIST OF TABLES AND FIGURES

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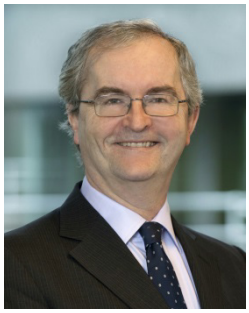
Message VP Taylor



In September 2015 the European Investment Bank issued its first comprehensive Climate Strategy, which guides the Bank's Climate Action with the aim of contributing to keeping global warming well below 2 degrees Celsius and adapting to climate change impacts.

Building on a strong track record in the area of climate action and being one of the largest climate financiers globally, we are eager to explore new avenues to understand how to increase the positive impact of our projects and of our financing operations.

When I heard about the potential of SLCPs to mitigate near-term climate change and simultaneously deliver immediate benefits to human health and the environment, I had no hesitation about the Bank joining the Climate and Clean Air Coalition. We are committed to exploring the impact of the EIB's projects on SLCP emissions and how we can address SLCPs in our financing operations, as well as raising awareness of this issue across the Bank.

I am very pleased to share with you this report, which presents an analysis of SLCPs in the EIB's project portfolio.

I wish you an interesting read.

Jonathan Taylor

EXECUTIVE SUMMARY

1. The European Investment Bank (EIB) is the European Union's bank and supports EU policy objectives through its financing activities, both inside and outside the EU. One of the EU's key policy objectives, and hence a key objective for the EIB, is addressing climate change. The EIB is one of the largest financiers of climate action globally with around EUR 110 billion of lending between 2010 and 2015. Building on its achievements in the field of climate action to date, the Bank published its first Climate Strategy in the autumn of 2015. The aim of the Climate Strategy is to further fine-tune the Bank's climate action activities, to explore new avenues to address climate change and increase the positive impact of its investments.

2. Addressing the emissions of short-lived climate pollutants (SLCPs) – methane (CH4), ground-level ozone (O3), black carbon (BC) and some hydrofluorocarbons (HFCs) – can contribute substantially to tackling near-term climate change. A joint report by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) published in 2011 found that tackling SLCPs could reduce near-term global warming by 0.4 to 0.5°C before 2050. Thus, mitigating SLCPs could contribute towards achieving the international community's objective of keeping the rise in global mean temperatures well below 2°C. To deliver the Paris Agreement will require substantial reductions in carbon dioxide (CO2) emissions and this must be a key focus for the EIB. Yet, delivering reductions in SLCPs can make a vital contribution to reducing near-term climate change. The Bank recognises that to address the significant challenges faced, all opportunities that contribute to reductions in greenhouse gas (GHG) emissions must be carefully considered. In addition, some SLCPs are also air pollutants with a negative impact on human health and ecosystems. The World Health Organization (WHO) estimates that 3.1 million people (WHO, 2009), mostly in developing countries, die prematurely each year from indoor and outdoor air pollution. Full implementation of all measures to mitigate SLCPs could prevent, each year, more than 2.4 million pre-mature deaths and the loss of 52 million tonnes of crops (1-4 percent of the global production of maize, rice, soybeans and wheat yearly (WMO/UNEP, 2001)). In Europe, air pollution is also an issue. A study by the consultancy Aphekom (2013) concluded that reducing annual average levels of fine particulate matter (PM2.5) to the WHO guideline levels (10ugm) would result in gains in average life expectancy ranging from: 22 months on average per person in Bucharest, 19 months in Budapest, to 2 months in Malaga.

3. In line with the EIB's ambition to fine tune its climate action and in view of the substantial potential to reduce global warming in the near-term, it was decided to raise awareness of the potential for addressing SLCPs internally, to gain a better understanding of the impacts of the Bank's lending activities on the emissions of SLCPs and to review whether considerations for SLCPs are consistently integrated into our lending criteria and standards. To explore these questions further, this report takes two approaches:

   a. The first looks at the Bank's standards, criteria and procedures in relation to SLCPs;

b. The second looks at projects and sectors that the Bank finances, the impacts they have on the emission of SLCPs and whether the Bank could scale up the financing of projects which mitigate emissions of SLCPs.

4. The report has looked at the Bank's procedures, criteria and standards with the aim of understanding whether SLCPs are appropriately taken into account. In an organization such as the EIB which mainly responds to financing requests from project developers, "procedures", "standards" and "criteria" are among the most powerful tools to influence the quality and the type of projects financed.

> The report found not only that most SLCPs are taken into account in the Bank's project appraisal and monitoring exercises, but that SLCPs are also considered in the decision making process on eligibility for financing, which means that projects where the CO_2-eq. of SLCP emissions is above a certain threshold do not receive the Bank's support.

The Bank's cost benefit analysis (CBA) puts a cost on a number of pollutants (e.g. nitrogen oxide, nitrous oxide, ammonia etc.) directly related to the projects under appraisal (upstream or downstream emissions are normally not included). The external costs caused by emissions of fine particulate matter ($PM_{2.5}$) are already included in the CBA for projects in the energy sector. An area where fine particulate matter ($PM_{2.5}$) and its component black carbon are, however, not yet integrated and priced into the project costs is in the transport sector. Transport is one of the sectors with the highest impact on $PM_{2.5}$ emissions and it is hence important that the costs caused by $PM_{2.5}$ emissions are internalised into the costs of transport projects.

> Therefore the Bank will work towards the inclusion of the external costs caused by PM2.5 into the CBA for transport projects, if considered of value.

5. The second approach is to explore projects financed by the Bank, the impact they have on SLCP emissions, and finally whether the Bank should and could finance more projects that have a positive impact on mitigating the emissions of SLCPs. To this end the report looked at several sectors which the joint UNEP/WMO report suggested were among those with the highest impact on SLCP emissions and where the highest savings could be achieved. The report includes analysis of the projects in the suggested sectors by looking at the available carbon footprint data of projects for six years between 2009 and 2014. The data from the carbon footprint exercise has, however, only a limited informative value for the emissions of SLCPs. The carbon footprint exercise provides data on significant[1] absolute (gross) and significant relative (net i.e. saved, reduced or avoided) CO_2-eq. emissions of a project. While the data usually provides precise information on the expected emissions of an SLCP, for example when a project only emits significant amounts of methane, for other projects the data can include methane as well as CO_2 and other GHGs, making the

[1] Emissions above 100,000 kt CO2-eq/year.

information on the specific SLCP emissions less clear. For some projects or sectors the available emissions data can only be considered a surrogate for SLCP emissions, e.g. in the transport sector where the data consists of CO_2 emissions and only allows for an approximate estimate of $PM_{2.5}$ and black carbon emissions. In addition, for some sectors, the carbon footprint exercise is a relatively new exercise and the availability and consistency of the data still requires refinement.

> Bearing these restrictions of methodology in mind, the analysis suggests that, among SLCP-relevant projects financed by the Bank between 2009 and 2014, replacing old gas pipelines, and thus reducing methane leakages, is the sector where the highest direct savings in SLCP emissions (methane) were demonstrated.

In addition to the caveats mentioned above, the results of the carbon footprint exercise indicating potential SLCP reductions need to be considered together with the financing volumes of projects in the respective sectors. In particular, due to their large financing volumes, gas network refurbishment projects, and transport projects, show overall a much larger saving of SLCPs than that of projects in sectors which might have been expected, for example the solid waste sector.

6. However, looking only at the carbon footprint of projects fails to provide a comprehensive picture of the impact of SLCP-relevant projects. Therefore, the report also describes SLCP-relevant projects from a more qualitative angle.

> The findings of this analysis pointed to the fact that waste and waste-water projects for example not only contribute consistently to emission savings, but also have positive impacts on the environment (e.g. water and soil quality), on the health of the local population, as well as on the economy by increasing resource efficiency. Finally, waste and waste-water projects seem to be an area where the EIB can particularly add value.

7. With respect to scaling up the financing of projects that contribute to mitigating SLCPs, the Bank is prepared to finance more projects in all of the sectors in which it is currently active and which have been identified as contributing to reducing SLCPs. However, demand for investments in projects in these sectors largely depends on factors which are outside of the Bank's sphere of influence, i.e. the regulatory framework and general market demand.

> The Bank will continue to explore whether specific funding for SLCP-relevant projects could support the objectives of the Bank's climate strategy during its implementation phase.

8. In comparison to other EIB-financed projects that contribute to the mitigation of greenhouse gases (GHGs), the climate-mitigation effect of SLCP-relevant projects is currently moderate. Yet, addressing SLCPs is an excellent way to complement other mitigation efforts made by the Bank, and simultaneously contributes towards improving local air quality, and thus positively impacts on the health of local populations and ecosystems.

9. Exploring the relationship between SLCPs and the EIB's activities has contributed to raising awareness internally about emissions of SLCPs, as well as the benefits of mitigating these substances. The analysis has shed light on additional opportunities to contribute to mitigating climate change which the Bank has not explored to date.

> Integrating the findings of this report will contribute to the objectives set out in the Climate Strategy, further refine the Bank's approach to climate action and support continued focus on reducing air pollution.

1. Introduction

1.1 Why this report? - Objectives

1. Addressing short-lived climate pollutants (SLCPs) has important potential to mitigate both air pollution and near-term climate change. A joint report by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) (UNEP/WMO, 2011[1]) found that by implementing a set of measures by 2030 mitigating SLCPs could reduce global warming by 0.5 °C by 2050 and thus support the international community's target of keeping global mean temperatures well below 2 °C. In contrast, even a fairly aggressive strategy to reduce carbon dioxide (CO_2) emissions under the (CO_2) measures scenario will do little to mitigate near-term climate change by 2050. Slowing down near-term climate change reduces the risk of triggering "knock-on effects", changes in weather patterns and allows more time to adapt to the impacts of climate change.

2. Two SLCPs – black carbon (BC) and tropospheric ozone (O_3) – are not only climate forcers, but also air pollutants with detrimental impacts on human heath, ecosystems and vegetation, in particular global crop production. The World Health Organization (WHO) estimates that 3.1 million people (WHO, 2009) die prematurely each year from indoor and outdoor air pollution caused by BC, O_3 and other air pollutants. More recently, a report by the World Health Organization (WHO, 2014)[2] estimates that 7 million premature deaths were linked to air pollution in 2012 – these findings more than double previous estimates. In addition, the UNEP/WMO report (2011) suggests that implementing a set of measures by 2030 would avoid annual losses from four major crops of approximately 32 million tonnes (range of 21-57 million tonnes) each year after 2030 when all measures have been implemented.

3. This means mitigating this group of substances referred to as short-lived climate pollutants (SLCPs) not only offers benefits for the climate, but also to human health, and vegetation and thus global food security. In view of this important potential a number of governments, international organizations and non-governmental organizations created a voluntary international coalition in 2012, the Climate and Clean Air Coalition (CCAC) in order to address SLCPs. In 2013 the EIB joined the coalition, which is led by the United Nations Environment Programme (UNEP), and committed to supporting the coalition's objectives.

4. To gain a better understanding of how the EIB can support and contribute to mitigating SLCP emissions, achieving the CCAC's objectives and creating a basis from which to work, the Bank decided to prepare this report. The report has the following key objectives:

   - *To raise awareness inside the Bank about the benefits and the potential of mitigating SLCPs,*
   - *To assess whether the Bank's standards and criteria appropriately consider SLCPs,*

- *To develop an improved understanding of the impacts of the EIB's activities with respect to emissions of SLCPs,*
- *To identify potential opportunities for the EIB to address and mitigate SLCPs,*
- *To communicate to the Bank's counterparts what EIB can offer to more effectively match the interests of the Bank and potential project developers willing to address SLCPs.*

5. More generally, the EIB is keen to understand where and how it can employ its financial and technical in-house expertise to contribute to mitigating air- and climate polluting SLCPs.

1.2 Limitations

6. In supporting the mitigation of SLCPs the European Investment Bank is subject to the following limitations:
   - The European Investment Bank is not a policy-setting institution, but a bank which largely responds to demands for financing economically viable projects [2]. As the EU's bank and a not-for profit bank the EIB is, however, distinct from commercial banks and offers a range of benefits. These include providing in-house technical expertise and assistance during project preparation and implementation, and providing concessional loans or blending grants and loans.
   - Developing countries offer the highest potential for mitigating SLCPs, especially countries in Africa and Asia. As the EU's investment bank, 90 percent of EIB's lending goes to projects inside the EU and 10 percent to projects outside the EU. At first, this could lead to the assumption that the Bank's impact outside the EU is marginal. However, due to the large total lending volumes of the Bank, investments outside the EU can still be considered important: in 2013 the Bank lent a total of EUR 7.6 billion to projects outside the EU 28, of which more than 30 percent, or EUR 2.3 billion, was invested in climate action projects.

1.3 Structure

7. The report is structured as follows. Chapters two and three provide background information on SLCPs, their impacts on the climate, human health and ecosystems, and the benefits of mitigation. Chapter four discusses the four main SLCPs in more depth. Building on this information, chapter five looks at the policy framework at the international and EU level, as well as the international actors active in addressing SLCPs. Chapter six explores the impacts of the EIB's activities on the emissions of SLCPs in different sectors and the potential for mitigating action in these sectors. It identifies those areas and sectors where the Bank has the highest impact on mitigating SLCPs and

[2] "Economically viable" as defined by the Bank

sectors with a potential for stepping up action. The outlook summarises the key findings and messages of this report.

1.4 Disclaimer

8. Descriptions of potential projects are provided to demonstrate to the interested audience (e.g. municipalities, cities, private developers, etc.) the type of services that the Bank can offer. Yet, a finance contract would be subject to the economic viability of the project, the compatibility with the Bank's standards and criteria.

2. What Are SLCPs?

9. Climate change is principally caused by the emission of greenhouse gases [3]. Carbon dioxide (CO_2) is the single most significant greenhouse gas and the most important cause of global warming. Carbon dioxide (CO_2) makes up for approximately 76 percent of anthropogenic greenhouse gas emissions globally, followed by methane (CH_4) responsible for approximately 16 percent and nitrous oxide (N_2O) responsible for approximately 6 percent of global greenhouse gas emissions (IPCC, 2014, in US EPA[3]). Another important property of carbon dioxide (CO_2) is that it remains in the atmosphere for a comparatively (in human terms) long time – between a hundred and a thousand years. (80 percent of CO_2 emissions will stay in the atmosphere for around 100 years, the remaining 20 percent for on average 800 years). This means that CO_2 emitted today will continue to impact the climate in many centuries to come and will be inherited by future generations. For this reason CO_2 is also referred to as a long-lived greenhouse gas (LLGHG) or climate pollutant.

10. In contrast to carbon dioxide (CO_2) and other long-lived greenhouse gases (e.g. nitrous oxide (N_2O) life-time of approx. 120 years) there is a group of 'short-lived climate gases or pollutants' (SLGHGs or SLCPs). This report will refer to 'Short-Lived Climate Pollutants', because the report also explores the climate forcing impact of black carbon (BC) which is not a greenhouse gas, but particles which warm the atmosphere by changing the surface albedo. Short-lived climate pollutants remain in the atmosphere for between a couple of days and up to just over a decade. Even though SLCPs have a relatively short atmospheric lifetime, they have a significant warming potential which is often a multiple of that of carbon dioxide (CO_2) and are hence powerful warming agents (see table 1). Up until recently SLCPs have received little attention, despite the fact that they make up approximately 30 percent of climate pollutants emitted globally.

11. The main SLCPs include black carbon (BC), a substantial part of particulate matter ($PM_{2.5}$), methane (CH_4) and ground-level ozone (O_3). Other SLCPs include a number of hydrofluorocarbons (HFCs). While the share of HFCs in the mix of GHGs is currently very low (less than 1%), it is expected that

[3] Black carbon also causes warming, but is not a greenhouse gas. Warming mechanisms will be described further below.

their emissions may increase by as much as 19% of global GHGs emissions by 2020 (CCAC). All SLCPs have a potential to warm the atmosphere, also referred to as the 'global-warming potential (GWP)', more potent than that of CO_2. The potential to warm the atmosphere or the global-warming potential (GWP) of greenhouse gases or particulate matter is expressed as a factor of carbon dioxide (CO_2) whose GWP is standardised at 1. Methane, for example, has a GWP of 28 over a 100-year time horizon (Myhre et al, 2013[4]) which means its warming potential is 28 times more powerful than that of carbon dioxide (CO_2).

12. Single air pollutants and/or climate forcers have been policy issues for a long time and started to be addressed over thirty years ago. One of the first major and internationally binding agreements addressing air pollution was, for example, the Geneva Convention on 'Long-range, Transboundary Air Pollution' (CLRTAP) signed in 1979. A number of other initiatives and agreements addressing individual air pollutants, including some of the substances labelled as SLCPs today, followed. However, addressing the four substances: methane, black carbon, ozone and HFCs as a group and labelling them as "SLCPs" is relatively new and dates back to the publication of two seminal reports in 2011: 'The Integrated Assessment of Black Carbon and Tropospheric Ozone' published by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) and the publication of "Near-term Climate Protection and Clean Air Benefits: Actions for Controlling Short-Lived Climate Forcers" published by UNEP the following year. In 2012 the 'Climate and Clean Air Coalition' (CCAC) was founded and has since then taken the lead in addressing the group of substances labelled as SLCPs.

3. Impacts of SLCPs and benefits of mitigation

13. Deep and immediate carbon dioxide (CO_2) reductions are required to protect the long-term climate, as this cannot be achieved by addressing SLCPs alone. Measures to reduce SLCP emissions can complement CO_2 emissions reduction measures. Yet emission reduction measures targeting black carbon and ozone precursors would pay off in only a few years' time and have an immediate beneficial effect on health, climate, water and food security as well as ecosystems.

14. Near-term reduction of global warming is not only necessary to keep temperature increases within the 2°C target, but will also bring substantial benefits by slowing down the melting in the Arctic, the Himalayas and other glaciated and snow-covered regions which could trigger unforeseeable knock-on effects. Reducing exposure to air pollution will directly reduce negative impacts on human health. It also has to be recognized that carbon dioxide reduction strategies and strategies to abate SLCPs mostly target different sectors or areas which means that action in one area does not have to be traded against action in another area, but that efforts to mitigate carbon dioxide and SLCPs emissions can be complementary to each other.

3.1 Benefits to Climate

15. Since the start of industrialization the world has warmed by about 0.85 degrees C (AR5 IPCC, 2013) and the average global mean temperature is expected to rise by at least 2°C from pre-industrial levels by 2050. Temperatures in Europe have been rising even faster than the global average. Over the last 30 years the average mean temperature in Europe rose by 0.48°C whereas the average global temperature rose by 0.27°C (IPCC). Due to its long atmospheric lifetime and the amounts emitted, carbon dioxide (CO_2) is considered the most important greenhouse gas, for which emissions reductions must be prioritised in order to mitigate the rise of global temperature over the long term. However, some of the SLCPs, even though they remain in the atmosphere only a relatively short time, are extremely powerful GHGs with GWPs which can be up to a thousand times higher than that of CO_2 (IPCC, 2007). Mitigating SLCP emissions, is hence estimated to have the potential to limit near-term climate change and increase the chances of keeping temperatures well below 2 °C relative to pre-industrial levels as agreed in the framework of the UNFCCC. Two studies from UNEP/WMO estimate that implementing a number of suggested measures by 2030, would reduce global warming by between 0.4°C (UNEP 2011) and 0.5°C (UNEP/WMO, 2011). In contrast, even very ambitious measures to mitigate CO_2 would do little to mitigate warming over the next 20 -30 years (UNEP/WMO, 2011). The report 'Integrated Assessment of Black Carbon and Tropospheric Ozone' (UNEP/WMO, 2001a) suggests that measures agreed by the international community to mitigate carbon dioxide (CO_2) alone, will most likely not be sufficient to keeping the global temperatures increase to less than 2 °C.

16. In addition to keeping temperatures well below the 2°C target, mitigating near-term climate change could also avoid potentially dangerous "tipping points", i.e. thresholds of abrupt and irreversible change in important climatic systems (Molina et al., 2009). Such "tipping points" and abrupt transitions could be triggered through knock-on effects. The risk of abrupt or irreversible changes increases with the magnitude of warming increases (IPCC, 2013). For example, the release of further carbon from melting arctic ice and permafrost could lead to an accelerated melting and other knock-on effects. Finally, reducing near-term climate change could help reduce the extinction of species and loss of biodiversity.

17. Whilst reducing SLCPs offers an important opportunity to reduce the rate of warming in the coming decades, it has to be acknowledged that over the long term, mitigating SLCPs only makes a modest contribution to climate change mitigation.

Full implementation of all SLCP mitigation measures suggested by WMO/UNEP by 2030, is estimated to reduce global warming projected for 2050 by between 0.4°C (UNEP 2011) and 0.5°C (UNEP/WMO, 2011)

3.2 Benefits to Health & Ecosystems

18. In addition to being climate forcers, some of the SLCPs are also air pollutants with a negative impact on human health and ecosystems. The World Health Organization (WHO) estimates that 3.1 million people (WHO, 2009), mostly in developing countries, die prematurely each year from indoor and outdoor air pollution. The main air pollutants include sulphur dioxide (SO_2), nitrogen oxides (NOx) non-methane volatile organic compounds (NMVOCs), ammonia (NH3), carbon-monoxide (CO), lead, ground-level ozone (O_3), and particulate matter/black carbon (PM/BC), not all of which are SLCPs. Particulate matter (PM) and ground-level ozone (O_3) are associated with serious health risks in particular. Methane, though not an air pollutant in itself, is a precursor to ground-level ozone.

19. Exposure to ground-level ozone (O_3) can harm human health leading to impacts ranging from minor effects such as irritation of the eyes, nose, throat and respiratory symptoms, such as coughing and shortness of breath to more serious impacts such as a decrease in lung function and respiratory symptoms, aggravated asthma and eventually premature mortality (EEA, 2012)[5]. The EU's 'Thematic strategy on air pollution' estimates that there will be around 21,000 cases of premature mortality in 2020 in the EU because of elevated ozone levels.

20. Ground-level ozone (O_3) is equally toxic to plants and damages ecosystems. It harms vegetation by damaging leaves, reducing photosynthesis, impairing plant reproduction and growth, reducing plants' uptake of carbon dioxide (CO_2) and decreasing crop yields. In fact, ground-level ozone is the air pollutant most responsible for reducing crop yields, and thus affecting global food security. One study estimates, for example, that yields of wheat, soybeans and maize could be reduced by up to 26% globally in 2030 should O_3 emissions continue to increase (S. Avnery et al.[6]). The study "Integrated Assessment of Black Carbon and Tropospheric Ozone", suggests that by cutting ground-level ozone and its precursor gases 32 million tonnes (range of 21-57 million tonnes) of annual crop losses could be avoided (UNEP/WMO, 2011).

Full implementation of all measures to mitigate SLCPs could prevent more than 2.4 million premature deaths and the loss of 52 million tonnes of crops, (1-4 percent of the global production of maize, rice, soybeans and wheat) each year (WMO/UNEP, 2001)

21. Particulate matter ($PM_{2.5}$) and its sooty component, black carbon are also responsible for causing asthma attacks, bronchitis, sinus infections and a reduction of general life expectancy. Whereas larger particles such as PM_{10} can be filtered in the nose and upper lungs, it is in particular the smallest particulate matter, $PM_{2.5}$ which is too small to be filtered. They enter not only through the respiratory system, but also through the human skin. Supported by the GAINS (Greenhouse gas-air pollution Interactions and Synergies) model it is estimated that in 2005 European average statistical life expectancy was shortened by 8.5 months due to the exposure to fine particulate matter (Amann

et al., 2014[7]). According to a study by Aphekom (Aphekom, 2013[8]) reducing annual average levels of $PM_{2.5}$ to the World Health Organization (WHO) guideline levels (10ugm) would result in possible gains in average life expectancy ranging from 22 months on average per person in Bucharest, and 19 months in Budapest, to 2 months in Malaga, and half a month in Dublin. At a global level it is estimated that reducing SLCPs by implementing the 16 measures suggested by UNEP/WMO (UNEP/WMO, 2011) targeting methane and black carbon could prevent more than 2 million premature deaths annually from outdoor and indoor air pollution by 2030.

EIB helps financing a tram in Morocco to move to low-carbon transport and reduce urban air pollution.

Reducing annual average levels of fine particulate matter (PM2.5) to the WHO guideline levels (10ugm) would result in possible gains in average life expectancy ranging from: 22 months on average per person in Bucharest, 19 months in Budapest to 2 months in Malaga (Aphekom, 2013)

22. While air pollution is a transboundary issue and pollutants emitted in one country or continent can be carried over long distances, addressing SLCPs is considered to have direct impacts on the improvement of local and regional air quality as well as local weather patterns.

4. The Four Main SLCPs

4.1 Methane

23. Methane (CH_4) is a hydrocarbon and the primary component of natural gas. Methane is also a potent greenhouse gas. Its GWP over a 100-year time span is 28 times higher than that of the greenhouse gas carbon dioxide. In contrast to CO_2, however, it has a comparatively short life time of only 12 years. Methane is the second most abundant GHG after CO_2 accounting for 16% of global emissions (US EPA). Methane emissions do not cause direct harm to human health, agriculture or ecosystems. Yet, methane is one of the most prominent precursor gases to ground-level ozone which has detrimental impacts, both on human health and in particular on crop yields (ecosystems, agriculture). Like other greenhouse gases, methane prevents infra-red radiation that enters the atmosphere from exiting the

CH_4

atmosphere and being released into space. Methane is emitted both, from natural sources, such as wetlands (or the decomposition of plant and animal waste) and man-made sources. Emissions from natural sources and processes account for approximately 40% and those from man-made sources for approximately 60% of total global methane emissions. At the global level, the main sources of methane emissions from human activities are the production and transportation of fossil fuels (gas), agriculture (enteric fermentation, livestock manure, rice cultivation), solid waste and wastewater treatment and coal mining.

24. Main measures to reduce methane emissions include recovering and flaring methane from oil and gas production, reducing fugitive emissions from gas networks, managing manure from livestock, changing farming techniques for rice and with respect to waste, diverting biodegradable waste away from landfill and using alternative disposal/treatment methods such as composting or incineration, collection and combustion of landfill gas, and improved oxidation of fugitive landfill emission in the landfill cap.

4.2 Tropospheric Ozone

25. Ozone (O_3) is a highly reactive gas. It is a reactive form of oxygen that primarily exists in two layers of the atmosphere: the troposphere, the lower layer of the atmosphere and the stratosphere, the upper layer of the atmosphere. In the stratosphere ozone protects life on Earth by absorbing strong ultraviolet (UV-B) solar radiation. In the troposphere, at ground-level, however, ozone is a potent greenhouse gas and harmful to human health and ecosystems. The ozone in the troposphere is also referred to as 'tropospheric or ground-level ozone'. This report looks at tropospheric or ground-level ozone. Ground-level ozone is the third most important contributor to the anthropogenic greenhouse effect after carbon dioxide and methane (Royal Society, 2008). Heightened levels of tropospheric ozone reduce the ability of plants to conduct photosynthesis, the plant's capacity to take up carbon dioxide, to reproduce and grow. As a result tropospheric ozone is one of the main reasons for globally reduced crop yields and slower forest growth. High ozone levels also contribute to the corrosion of materials and especially building substances (EEA Signals, 2013). In humans high ozone levels can cause inflammation of the lungs, asthma and allergies. In the EU alone, tropospheric ozone causes approximately 22 000 premature deaths every year (WHO, 2008).

26. Unlike carbon dioxide, methane and other air pollutants, tropospheric ozone is a secondary pollutant as it is not directly emitted. It is formed as a result of sun-light driven chemical reactions between carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), nitrogen oxides and methane. The latter can be considered as one of the main precursors of tropospheric ozone (50%). Like other GHGs, ozone warms the atmosphere by preventing infra-red radiation from exiting the atmosphere and reaching space. Tropospheric ozone is included in the group of SLCPs, because it remains in the atmosphere for between hours and a couple of days only.

27. The wide range of sources of ozone precursors, the natural and physical process of distribution and its complex chemistry means that controlling tropospheric ozone formation is not straightforward. The most effective strategy to mitigate ozone consists in reducing precursor gases and in particular methane and nitrogen oxide (N_2O).

4.3 Black carbon

28. In contrast to the climate forcers presented so far, black carbon (BC) is not a greenhouse gas. Black carbon (BC) is a major component of soot and exists in the atmosphere as particles or so called particulate matter (PM). Black carbon is a climate forcer harming human health. Black carbon causes warming of the atmosphere in a number of different ways. Firstly, due to their black colour, particles do not reflect incoming radiation, but absorb it and release the heat into the atmosphere. Secondly, when deposited on ice or snowfields, black carbon reduces the albedo of these surfaces and leads to accelerated melting rates and atmospheric warming. Finally, the particles also influence cloud formation thereby changing regional weather and in particular rainfall patterns. Black carbon is always emitted together with organic carbon which is a cooling agent. Yet, they are emitted in different proportions. Mitigation measures for black carbon need to take into account the changes in all emissions that influence warming. Black carbon mainly occurs in two different sizes, PM_{10} and $PM_{2.5}$. The negative health impacts increase with the decreasing size of the particles. Hence, it is especially the small-sized or 'fine' particulate matter defined as $PM_{2.5}$ (particles with a diameter of less than 2.5 micrometres) which has detrimental impacts on the cardiovascular and respiratory human system. According to the World Health Organization black carbon and organic carbon contribute a substantial part of the fine particulate matter in air pollution that is the major environmental cause of ill-health and premature deaths globally (WHO, 2009).

29. The global warming potential of black carbon over a 100 year time period exceeds that of carbon dioxide by a thousand times.

30. Black carbon results from the incomplete combustion of fossil fuels, wood and other biomass. The main sources of black carbon at the global level are transport, especially diesel engines; residential heating and cooking, especially the burning of coal, wood and other biomass cooking and heating stoves and diesel generators; open burning of agricultural waste; open burning of biomass from deforestation, forest fires and some industrial facilities.

31. At the global level the main mitigation solutions addressing black carbon include strengthening vehicle and fuel standards (ensuring diesel cars are equipped with particulate filters), introducing clean burning fuel stoves, improving wood-burning stoves and heating; replacing traditional brick and coke ovens; reducing open burning of agricultural and forestry waste; reducing forest fires.

4.4 Hydrofluorocarbons

32. Hydrofluorocarbons (HFCs) are a set of very potent greenhouse gases. An indication of their potency is their GWP which can range from 4 up to 12400 (IPCC, AR5). Hydrofluorocarbons have an atmospheric lifetime of up to 15 years and belong to the group of fluorinated GHGs with the three main groups of Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride (SF_6). Currently, HFCs contribute to just 1 percent of global GHG emissions. Yet, they are the fastest growing GHGs globally. They are regulated under the Kyoto Protocol, but if left unabated, HFC emissions could rise to as much as 19% of GHG emissions by 2050 (US EPA, 2014). The rapid growth in the use and emissions of HFCs comes principally as a result of the phasing out of ozone-depleting substances (ODS) under the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol).

33. HFCs are industrially produced; they do not have any natural sources. They are used in residential, commercial and industrial air conditioning (A/C), mobile air conditioning, refrigeration units, the manufacturing of insulation, fire extinguishing foams and solvents.

34. Possibilities to mitigate the further increase and spread of HFCs would include avoiding or minimizing HFCs in construction material as well as avoiding or identifying alternatives to HFCs in mobile air-conditioning systems in vehicles and other transport units such as trains and buses.

Table 1: Overview of properties of SLCPs in comparison to CO2

Substance	Lifetime	Global Warming Potential over 100 yrs	Health impacts	Ecosystem & Other impacts
Carbon dioxide (CO_2)	Decades, to centuries, about 20% remains for millennia	1 (reference unit)	no	indirect
Methane (CH_4)	12+/-3 years	21	Indirect (precursor to O_3)	indirect
Tropospheric Ozone (O_3)	4-18 days	Is indirectly included in the GWP of methane	yes	yes
Black Carbon (BC)	3-8 days	1055-2020	yes	yes
Hydrofluorocarbons (HFCs)	Between days and up to 15 years	140-11700	no	indirect

5. Policy Framework

35. There is no piece of legislation addressing the group of SLCPs as a whole and with the objective of tackling the effects of short-term climate change and air pollution. However, this does not mean that the substances grouped as SLCPs are not regulated. SLCPs are rather addressed together with other climate forcers and/or other air pollutants. Some are targeted in their capacity as air pollutants, some in their capacity as climate forcers. They are regulated at international, EU- and/or national level. The sections below provide a brief overview of where and how the different SLCPs are regulated or addressed otherwise. The following analysis focuses on the policy framework for SLCPs at international and EU level. A country level analysis would exceed the scope of this report.

5.1 International level

36. Both, substances causing anthropogenic climate change and those responsible for air pollution have a transboundary character. Regardless, of where a climate forcing substance is emitted, it will contribute to the overall amount of GHGs and warming agents. Likewise, air pollutants emitted in one country can be carried many hundreds of kilometres by winds and pollutants may have an impact in other countries than their country of origin. Thus, there is a good rationale for addressing such substances through international treaties or conventions.

37. At the international level the most important agreements in relation to SLCPs are the Paris Agreement, the Kyoto Protocol and the International Gothenburg Protocol. While the primary objective of the Paris Agreement and the Kyoto Protocol are to reduce global warming, the International Gothenburg Protocol's primary goal is to address air pollution harming human health and ecosystems.

38. The **Paris Agreement's** central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

39. The **Kyoto Protocol** is an international agreement linked to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) committing the Parties by setting internationally binding emission reduction targets. The Kyoto Protocol covers seven greenhouse gases — carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and Nitrogen Triflouride (NF_3). This means the Protocol covers two out of the four SLCPs.

40. **The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone** is part of the **Convention on Long-Range Transboundary Air Pollution (CLRTAP).** The Convention is an

international agreement to protect human health and the natural environment from air pollution. The Protocol is a multi-pollutant protocol designed to reduce acidification, eutrophication and ground-level ozone. Geographically, the Protocol covers Europe, North America and Countries of Eastern Europe, Caucasus and Central Asia and it entered into force in May 2005. The original Protocol sets emissions ceilings for sulphur-dioxide, nitrogen oxides, volatile organic compounds and ammonia. This means that the only SLCP directly addressed in the 1999 Protocol is ground-level ozone (O_3).

41. In 2012, however, the Parties to the Gothenburg Protocol agreed to amend and revise the Protocol. From an SLCP perspective the most important revision was that the revised Protocol will for the first time include emission reduction commitments for fine particulate matter ($PM_{2.5}$), i.e. black carbon as well as methane (CH_4). From a more general perspective, the most important decision was that the Parties agreed to include national emission reduction commitments to be achieved by 2020 and beyond. The Protocol still waiting to be ratified by all parties.

42. This means that these two international agreements, the Kyoto and the Gothenburg Protocol, in theory address all SLCPs – methane, ground level ozone, particulate matter and HFCs in the countries that signed these agreements once the revision of the Gothenburg Protocol has been implemented into EU and national legislations.

43. The **International Convention for the Prevention of Pollution from Ships** (MARPOL) and its Annex VI which entered into force 2005 specifically addresses air pollution from international shipping activities. Among other things MARPOL sets standards for the emission of particulate matter.

44. The **Montreal Protocol on Substances that Deplete the Ozone Layer** (Montreal Protocol) addresses ozone depleting substances (ODS), such as hydrochlorofluorocarbons (HCFCs). As a result of this international agreement the ozone layer over the Antarctica has been slowly recovering in recent years. In October 2016 the Parties to the Montreal adopted the Kigali Amendment to phase out hydrofluorocarbons (HFCs). HFCs had become a major replacement in many ODS applications and while they do not deplete the stratospheric ozone layer, they are potent greenhouse gases. Under the Kigali Amendment developed countries have committed to phase out HFCs by 2019 and reaching an 85% reduction by 2036 compared to 2011-2013 consumption levels. Most developing countries, including China, agreed to follow the developed countries commitments by freezing consumption in 2024 and gradually reducing use by 85% by 2045. The Amendment also included a commitment by developed countries to provide financing towards the cost of reducing HFCs.

5.2 EU level

45. Air pollution and climate change are issues that overlap and are closely intertwined. At an EU policy level, however, both topic areas are addressed mainly separately – though with effects on each other.

Main components of EU policy framework on GHGs

46. Substances causing climate change, in particular GHGs have been addressed by the successive policy frameworks on climate and energy (2008-2012 implementation by Member States of Kyoto Protocol commitments; Europe 2020 growth strategy; climate and energy policy framework 2030; Roadmap 2050 for building the low-carbon European economy). A number of other pieces of legislation, with a more sectorial focus equally aim at mitigating greenhouse gas emissions.

47. Commitments made in the Kyoto Protocol have been taken into consideration in the successive EU policy frameworks also referred to as "packages" on climate and energy which aim to progressively reduce greenhouse gas emissions. The current 2030 policy framework on climate and energy has set the objective of reducing the EU's overall emissions by at least 40% below 1990 levels by 2030. The main two tools developed to achieve these reductions are: the EU's Emissions Trading System and the "Effort Sharing Decision" which together cover GHGs including the two SLCPs, methane (CH_4) and some hydrofluorocarbons (HFCs).

Main components of current EU policy framework on air pollutants

48. Air pollution has been addressed through successive policy initiatives and various directives since the 1970s. The EU's long-term objective is "to achieve levels of air quality that do not result in unacceptable impacts on, and risks to, human health and the environment" (6th Environmental Action Programme). The following policies and directives guide the current EU policy on air quality:
    - The 2005 EU Thematic Strategy on Air Pollution, setting out strategic policy objectives,
    - The 2001 National Emission Ceilings Directive, NECD (2001/81/EC), establishing national emissions ceilings for all Member States covering four main pollutants
    - The Ambient Air Quality Directives, AAQD (2008/50/EC), setting local air quality limits which may not be exceeded anywhere in the EU, and
    - Source-specific legislation designed to limit emissions from specific economic sectors, such as the Euro standards for vehicles, energy efficiency standards or fuel standards for ships.

49. This current framework of EU air quality policy is currently being reviewed. As a result of the review, the European Commission has proposed a number of changes which have been formulated in the Clean Air Policy Package. The package is now being considered by the other EU institutions and awaiting approval. With respect to SLCPs the most important potential changes are in the proposed revised National Emissions Ceilings Directive (NECD):
    - emissions ceilings for methane and,
    - methodologies for monitoring and reporting on black carbon emissions with the possibility of also including emissions ceilings for black carbon in the future.

Brief overview of the EU policies and legislation targeting the different SLCPs

50. Methane

- Effort Sharing Decision – methane forms part of the basket of seven of the Kyoto Protocol and is regulated under the Effort Sharing Decision. Yet, the Effort Sharing Decision only provides limits for all greenhouse gases per Member State without specifying a reduction target for methane (CH_4).
- National Emission Ceilings Directive, NECD (2001/81/EC) – methane is currently not included in the NECD. However, if the Clean Air Policy Package was accepted, ceilings for methane would be included in the revised Directive.
- Ambient Air Quality Directive (2008/50/EC) – does not set direct reduction targets for methane emissions. Yet, the Directive sets reduction targets for ozone. As methane is an important precursor to ozone, the Member States could in theory be expected to reduce methane emissions to achieve the reduction targets set for ozone.
- Source-specific directives/regulations – e.g. Landfill Directive (1999/31/EC); Waste Directive (2006/2012/EC); Waste Management Framework Directive (2008/98/EC) and agriculture directives (Nitrate Directive 1991/676/EEC); the Common Agriculture Policy (CAP). These source-specific directives/regulations can have an important impact on the emissions of methane: for example, by reducing the amount of biodegradable waste that is landfilled, methane emissions from landfills have dropped by 35% since 1990.

51. Tropospheric Ozone

- Ambient Air Quality Directive (2008/50/EC) – sets targets for ozone concentration in a specific zone or agglomeration. Among other issues, the protection of human health and the protection of vegetation are addressed. The target for the protection of human health is set at a maximum daily 8 hour mean of 120µg/m3 within a calendar year. Where targets are systematically not achieved, fixed measurement for ozone will be required.

52. $PM_{2.5}$ - Black Carbon

- Ambient Air Quality Directive (2008/50/EC) – in the AAQD $PM_{2.5}$ is regulated through EU air policy standards. These standards are currently local concentration limit values for the air pollutants most harmful to health. For $PM_{2.5}$ the AAQD set a limit value of 25µg/m3, a value which entered into force in January 2015. Before 2015 the same value was a target value. A target value needs to be attained as far as possible whereas a limit value is legally binding.
- Revised National Emission Ceilings Directive, NECD (2001/81/EC) – if the Air Policy Package is ratified, the Directive would introduce EU emissions ceilings for $PM_{2.5}$ which Member States would have to respect by a certain date. The suggested overall emission ceilings for $PM_{2.5}$ would be a reduction of 22% compared to 2005 levels by 2020 and a reduction of 51% by 2030 in the EU.

This revision would implement the 2012 revision of the Gothenburg Protocol which introduced emission ceilings for $PM_{2.5}$.

- Industrial Emissions Directive (2010/75) – which sets limit values for fine particulate emissions from industrial plants. The Directive makes no distinction between PM_{10} and $PM_{2.5}$.

53. Hydrofluorocarbons

- Mobile Air-Conditioning System Directive, MACs (2006/40/EC) – Directive on air conditioning systems used in small motor vehicles. It prohibits the use of F-gases with a GWP which is more than 150 times greater than that of carbon dioxide (CO_2) in new types of cars and vans introduced from 2011, and in all new cars and vans produced from 2017 onwards.
- F-gas Regulation (517/2014) – covers all other key applications in which F-gases are used (entered into force in 2015). The regulation limits the total amount of the most important F-gases that can be sold in the EU, bans the use of F-gases in many new types of equipment where less harmful alternatives are widely available, requires checks for existing equipment, proper servicing and recovery of the gases at the end of the equipment's life and prohibits the sale of a number of products which contain HFCs with a GWP greater than 150.

Policy Framework Summary

All signatories to the main international agreements on climate forcing agents and air pollutants, through the Paris Agreement, the Kyoto Protocol, the Gothenburg Protocol and the Montreal Protocol have in theory committed to address all SLCPs. The Paris Agreement and the Kyoto Protocol address methane (CH_4) and hydrofluorocarbons (HFCs), the Kigali Amendment to the Montreal Protocol addresses HFCs and the revised Gothenburg Protocol addresses ground-level ozone (O_3), methane (CH_4) and fine particulate matter ($PM_{2.5}$). However, the transposition of the agreements at the regional and national levels can sometimes be inconsistent, which may lead to SLCPs being emitted without the appropriate controls. Even where the agreements have been transposed into national legislation there often is a lack of enforcement and air quality requirements not being met (e.g. $PM_{2.5}$ limits are regularly exceeded in urban areas in the EU (Cars 2020 Communication[9])).

For countries and regions which have not signed one or both of the agreements, emissions of SLCPs may be less regulated.

5.3 International Actors

54. In addition to state actors, there are other initiatives that address SLCPs outside regulatory frameworks of which two are particularly important.

- The leading initiative in this area is **the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC)** which was launched by six governments and the United Nations Environment Programme (UNEP) as the first global effort to address short-lived climate pollutants. As of 2015, the CCAC counted 100 partners, including state partners, multilateral organizations

and private organizations. Partners in the Coalition have agreed to take meaningful and fast action to reduce SLCPs. The EIB became a partner in the CCAC in 2013.

- The **Global Methane Initiative (GMI)** addresses, as the name suggests, the abatement and recovery of methane emissions internationally. This voluntary initiative, which was launched in 2004 brings together national governments, private sector entities, development banks, NGOs and other interested stakeholders. The European Commission became a member of the GMI, which is led by the United States Environment Protection Agency, in 2007.

6. EIB and SLCPs

55. Following this general overview of SLCPs, the benefits of mitigation and an overview on how they are currently regulated, the following sections will focus on how considerations for SLCPs are integrated into the EIB's activities and the impact of those activities on SLCP emissions. The report identifies potential opportunities for the EIB to address and mitigate SLCPs, as well as highlight to the Bank's counterparts what the Bank can offer and how it can support projects addressing SLCPs. This should contribute to more efficiently matching the interests of the Bank and potential project developers who aim at addressing SLCPs.

6.1 Mitigation of climate and air pollutants at EIB to date

56. The EIB addresses climate change and air pollution through two principal mechanisms. The first mechanism or tool is a commitment by the Bank to invest at least 25 percent of its total lending in climate action projects. This target helps to channel finance into projects which contribute to mitigating GHG emissions, sequestering GHG emissions or adapting to the impacts of climate change. Projects that mitigate the emission of greenhouse gases can, for example, be projects which have an effect on reducing the emissions of methane. Projects that have an impact on reducing the emission of black carbon often include the reduction of carbon dioxide emissions (e.g. the replacement of an old bus fleet) and would hence also be considered as climate action projects.

57. The second mechanism to address climate and air pollutants is the mainstreaming of standards, criteria and the application of thresholds. In addition to the Bank's in-house standards, the Bank applies EU directives and regulations within the EU-28, but often also outside the EU. The application of EU directives and regulations namely those described above ensures a certain quality of the projects.

58. In the section below, both mechanisms and approaches to financing projects which mitigate climate forcers and air pollutants are described. It is explained how the Bank's criteria, standards and thresholds take SLCPs into consideration, what effect the EIB's lending activities have on the emissions of SLCPs and how both mechanisms could be fine-tuned in order to address SLCPs in a more targeted way. Finally, whether or how finance for projects which have a mitigating impact on SLCPs could be scaled up is discussed.

6.2 Standards & Criteria on GHG and air pollution - SLCPs at EIB

59. In an organization that traditionally does not proactively develop its project portfolio, but rather responds to project financing proposals by project developers, standards are one of the main tools to steer the Bank's lending portfolio in a desired direction. The Bank has introduced standards and criteria with respect to the emission of GHGs and the emission of air pollutants in many of its processes. Many of these standards or criteria directly or implicitly apply to one or more SLCPs. Standards and processes applied may have an informative function, serve to price in an externality, or have the capacity to single out projects (where the expected emissions of a project exceed a certain threshold). The following standards and criteria relevant to SLCPs are applied in the Bank.

60. Best Available Techniques (BATs) and the guidelines of the accompanying BREFs are applied to all industrial installations including for example wastewater or solid waste management systems.

61. Carbon Footprints are undertaken for all projects that have significant emissions[4]. The Carbon Footprint exercise takes not only CO_2 emissions into account, but again the seven gases listed in the Kyoto Protocol including the SLCPs methane (CH_4) as well as some hydrofluorocarbons (HFCs). The Carbon Footprint currently has mainly an informative function. An area where the information gained from the Carbon Footprint exercise is used, is the Emission Performance Standard described below.

62. An Emission Performance Standard (EPS) for electricity generation excludes projects where the expected emissions exceed the set threshold (currently 550g CO_2-eq./kWh and to be reviewed over time) and are not in line with EU emission reduction targets. The estimated emissions from a project consider not only carbon dioxide (CO_2), but also other gases commonly emitted during the generation of electricity (all 7 gases of the Kyoto basket). One of the gases considered is methane (CH_4) which for the estimate is converted into CO_2-eq. emissions. This means the EPS excludes electricity production projects where the cumulative CO_2-eq. emissions including the SLCP, methane (CH_4) exceed the threshold.

63. When reporting on the footprint of projects financed by the Bank, non CO_2 emissions are often converted into CO_2-eq. emissions, which means that the reported emission figures do not show the specific share of an SLCP emitted by a project.

64. As part of its economic analysis of a project, the Bank carries out a Cost Benefit Analysis (CBA) which not only measures the monetary benefits and costs of a project to the direct owner of an asset, but also takes into account the external costs/benefits or environmental externalities. The environmental externalities taken into account may include the damage and costs caused by local air pollutants, such as ammonia, nitrogen oxides, nitrous oxide, non-methane volatile organic compounds certain heavy metals as well as fine particulate matter (PM), as appropriate on a project

[4] Emissions are considered significant where the absolute emissions are >100,000 kt CO_2.eq./yr and/or the relative (positive or negative) emissions >20,000 kt CO_2.eq./yr.

basis. The categories considered include damage to human health, materials, crops and biodiversity losses. The unit values applied by the Bank for local air pollution are taken from different sources such as a recent report, commissioned by the Bank and carried out by the Institute for Energy Economics and the Rational Use of Energy (IER). This study inter alia explores and reports on the costs caused by the emission of $PM_{2.5}$ and its component black carbon. Other sources are the TREMOVE[10] and EMEP/EEA[11] databases.

65. Today, the external costs caused by emissions of particulate matter (PM_{10}) are already integrated in the Cost Benefit Analysis (CBA) in the energy and the transport sector. The smaller fine particulate matter ($PM_{2.5}$) and its component black carbon are, however, only included in the Cost Benefit Analysis (CBA) for projects in the energy sector, but not yet in the transport sector. As one of the sectors with the highest impact on $PM_{2.5}$ emissions it is, however, important that the costs caused by $PM_{2.5}$ emissions are internalised in the costs of transport projects. Therefore a key output of this report is to consider further the inclusion of $PM_{2.5}$ in Cost Benefit Analysis (CBA) for transport projects.

66. The Bank may also consider extending the practice of carrying out Cost Benefit Analysis taking account of air pollutants emissions from other sectors and project types where emissions of $PM_{2.5}$ and its component black carbon are significant. Yet, in other areas and sectors (residential heating, replacing traditional cooking ovens, banning open burning of agricultural waste) in which the UNEP/WMO report suggests measures (Table 2) to reduce emissions of black carbon, the Bank has traditionally very limited activities.

67. It can be concluded that the consideration of SLCP emissions is widely integrated into the Bank's activities and that there is awareness of all four SLCPs at the Bank. While some of the standards and criteria applied contribute to preventing or reducing the emission of SLCPs, other standards have an informative function only. The Bank will therefore seek to explore whether standards and criteria may be applied even more widely across sectors and areas in which the Bank finances projects.

Conclusions & Opportunities

- The consideration of SLCP emissions is widely integrated into the bank's activities and there is awareness of all four SLCPs at the Bank. While some of the standards and criteria applied contribute to singling out and/or internalising the costs of emissions of SLCPs, other standards have an informative function only.
- The Bank has already integrated the costs and damage caused by the coarser fine particulate matter (PM_{10}) in the energy and transport sector, but those of fine particulate matter ($PM_{2.5}$) are included for the energy sector only. **Therefore the Bank will explore whether the inclusion of the external costs caused by $PM_{2.5}$ into the Cost Benefit Analysis (CBA) for transport projects is of value.**

6.3 Understanding the impact of EIB's lending activities on SLCP emissions & Financing of SLCP mitigating projects

68. The preceding section looked at the Bank's standards and criteria which are relevant to SLCPs and which guide projects that the Bank finances. The following section will focus on the Bank's lending activities which are relevant to the emission of SLCPs. The section will explore what impact projects have on SLCP emissions, provide an overview to potential project developers of what type and where the Bank can offer support, and finally identify options for increasing support and scaling up finance for projects with a positive impact on the mitigation of SLCP emissions.

69. For the identification of areas where the Bank could step up and fine-tune its efforts, it is important to have in mind what the Bank can and cannot offer. While the EIB is a not-for-profit bank, it only finances projects which are economically viable and which provide added value to EU policy objectives. In contrast to purely commercial banks, the EIB offers a number of additional benefits. On the financial side these include concessional lending, lowering of the project risk and a variety of innovative financial instruments. On the technical side, the Bank offers technical support through in-house technical experts as well as technical assistance (TA) for technical and/or financial project preparation, implementation and monitoring which is often funded through grants.

6.3.1 Methodology

70. To understand the impact of EIB activities, and in particular the sectors or areas of EIB projects related to the emissions of SLCPs, and which areas the Bank should focus its attention on, this report assesses the 16 measures addressing SLCPs identified by the report "Integrated Assessment of Black Carbon and Tropospheric Ozone" (UNEP/WMO, 2011). The UNEP/WMO report identified 16 measures addressing emissions of black carbon (BC) and methane (CH_4) which are considered to have the greatest potential to both deliver health benefits and reduce near-term global warming. This and later reports estimate that full implementation of the 16 identified measures globally would reduce near-term global warming by between 0.4°C and 0.5°C (UNEP/WMO, 2011).

71. Table 2 below shows the measures identified by the UNEP/WMO report and the sectors in which these measures are suggested, and compares this to where these overlap with the sectors and areas in which the EIB is traditionally active. As the identified measures only address the abatement of methane and black carbon, but not HFCs, we have complemented the UNEP/WMO measures by areas where HFCs are known to be regularly emitted. In those sectors and specific areas where the Bank is active, the report i) briefly describes the Bank's activities to date, and ii) describes the estimated impacts with respect to SLCPs. In the final step the report iii) identifies potential opportunities for future action by the Bank. This will be done by taking into account in which sectors and specific areas the Bank is active and has expertise.

Table 2: Overlap between 16 selected UNEP/WMO measures and EIB activities

Sector		Suggested measure	EIB activity
Mitigation of main substance: methane (CH_4)			
Energy	1	Extended pre-mine degasification and recovery and oxidation of CH_4 from ventilation air from coal mines	No activity
	2	Extended recovery and utilization, rather than venting, of associated gas and improved control of unintended fugitive emissions from the production of oil and natural gas.	Yes
	3	Reduced gas leakage from long-distance transmission lines	Yes
Solid Waste management	4	Separation and treatment of biodegradable municipal waste through recycling, composting and anaerobic digestion as well as landfill gas collection with combustion/utilization	Yes - Collection, separation and treatment (MBT) through recycling
	5		Yes - Composting and anaerobic digestion (AD)
	6		Yes - Landfill with gas collection, incineration, waste-to-energy (WTE)
	7		Yes - Rehabilitation of dumpsites
Wastewater management	8	Upgrading primary wastewater treatment to secondary/tertiary treatment with gas recovery and overflow control	Yes
Agriculture	9	Control of CH_4 emissions from livestock, mainly through farm-scale anaerobic digestion of manure from cattle and pigs	No activity
Agriculture	10	Intermittent aeration of continuously flooded rice paddies	No activity

Sector		Suggested measure	EIB activity
Mitigation of main substance: fine particulate ($PM_{2.5}$) matter and its component black carbon			
Transport	11	Diesel particle filters as part of a Euro 6/VI package for road and off-road diesel vehicles	Yes, partly*
	12	Elimination of high-emitting vehicles in road and off-road diesel vehicles	Yes, partly*
Residential	13	Replacing coal by coal briquettes in cooking and heating stoves	No activity
	14	Pellet stoves and boilers, using fuel made from recycled wood waste or sawdust, to replace current wood-burning biomass stoves for cooking and heating in developing countries	No activity
	15	Substitution of clean-burning cook stoves using modern fuels for traditional biomass cook stoves in developing countries.	No activity
Industry		Replacing traditional coke-ovens with modern recovery ovens, including the improvement of end-of-pipe abatement measures in developing countries	No activity
Agriculture	16	Ban of open field burning of agricultural waste	No activity*
Mitigation of main substance: hydrofluorocarbon (HFCs) *(Additionally added to complement UNEP/WMO suggested measures)*			
Industry		Production of refrigeration	Yes, partly
		Air conditioning	Yes, partly
		Fire protection	Yes, partly
		Foams	Yes, partly
		Aerosols	Yes, partly

** Policy related action, outside the EIB's scope of activities.*

6.3.2 Overview of SLCP-relevant financing at EIB

72. Table 2 shows that the EIB traditionally finances projects in a number of those areas and sectors in which the UNEP/WMO (2011) report has identified the 16 measures which are considered most effective to mitigate the emissions of SLCPs. Those areas include the energy, solid waste, wastewater and transport sector.

73. The report refers to 'SLCP-relevant projects' where a project is in one of the areas in which the UNEP/WMO report suggests measures and where the project has an impact on the emission of SLCPs.

74. A more granular picture of the impact of EIB financed projects on SLCPs can be derived from looking at those SLCP-relevant projects which are included in the Bank's carbon footprint exercise. Table 3 provides an overview of the relative emissions of SLCP-relevant projects in the six year period between 2009 and 2014 that were included in the carbon footprint. Projects have been included either, because their absolute emissions or their relative emissions surpassed the threshold set by the Bank's carbon footprint methodology. Where relative emissions are negative this indicates a saving compared to a baseline economically viable alternative project. The relative emission savings have to be seen in relation to the number of projects as well as to the financing volume of the project. No immediate conclusion can be drawn from the overview. Savings are, for example, not consistently higher in one sector than in another. The emission saving potential of SLCPs will be discussed in more detail in the following sector sections. The informative value of this overview of emissions from the included projects seems at first limited. Firstly, it only includes those SLCP-relevant projects where emissions are according to the EIB's carbon footprint methodology significant[5] and other smaller projects which may also reduce SLCP emissions do not appear in this overview. Secondly, the data in the carbon footprint does not always show the specific greenhouse gas, i.e. which share of the relative emission is CO_2, methane (CH_4) or other, because all emissions have been converted into CO_2-eq. emissions. Finally, lending through intermediaries is not captured in the footprint exercise either. The total CO_2-eq. emission savings from SLCP-relevant projects in the six years between 2009 and 2014 amounts to 663 kt CO_2-eq. emissions saved.

[5] Emissions are considered significant where the absolute emissions are >100,000 kt CO_2.eq./yr and/or the relative (positive or negative) emissions >20,000 kt CO_2.eq./yr.

Table 3: Relative emissions (avoided emissions) from SLCP-relevant projects

Activity & Relative Emissions / Year of Financing contract	Retrofitting gas pipelines[6]		Solid waste		Wastewater		Transport (Elimination of high-emitting vehicles*	
	Nr. of projects	Relative emissions	Nr. of projects	Relative emissions	Nr. of projects	Relative emissions	Nr. of projects	Relative emissions
2009	1	-29	no data	no data	2	18	1	-259
2010	2	-14	0	0	0	0	1	-3
2011	0	0	2	13	8	-62	2	-5
2012	4	-83	0	0	0	0	0	0
2013	2	-56	2	-24	0	0	0	0
2014	2	-101	2	-32	0	0	2	-26
TOTAL		**-283**		**-43**		**-44**		**-293**

(relative emissions in kt)

** Includes GHGs but not $PM_{2.5}$*

6.3.3 The Energy Sector

75. In 2014 the EIB provided EUR 12.8 billion of lending in support of projects in the energy sector, representing 16.6% of the total financing provided by the Bank. The type and mix of energy projects financed is determined by the Bank's Energy Lending Criteria. In the context of climate action one of the most important standards for projects in the energy sector is the Emission Performance Standard (EPS) which sets a maximum threshold for emissions per kWh of electricity produced (currently 550g CO_2-eq./kWh). The Bank's portfolio of projects in the energy sector includes finance for renewable energy, energy efficiency investments, heat production and heat transmission, electricity and gas systems such as, electricity generation and gas production as well as transmission and distribution networks, smart grids, and storage facilities. In 2014 the Bank provided almost EUR 6 billion for renewable energy projects, EUR 2.2[7] billion for energy efficiency and EUR 6 billion for energy networks (heat transmission, electricity, gas and oil infrastructure).

[6] The Bank finances gas transmission and distribution for both new and refurbishment of gas pipelines

[7] The EE figure comprises EE financing not only in the energy sector, but also from various other sectors (e.g. EE in industry or buildings) contribute. Hence, the figures indicated above add up to an amount higher than the total amount of financing indicated for the energy sector.

76. The EIB is active in the areas targeted by ***Measure 2 and 3*** proposed in the UNEP/WMO report. The activity in these areas and potential to mitigating SLCPs are described below.

UNEP/WMO Measure 2: 'Extended recovery and utilization, rather than venting, of associated gas and improved control of unintended fugitive emissions from the production of oil and natural gas'

77. Measure 2 of the UNEP/WMO report relates to the area of oil and gas production where methane emissions could be more efficiently recovered and utilized rather than vented or flared. While the EIB does not finance exploration of gas or oil, the Bank could support the development of new gas and oil production. Projects which aim at an extended recovery and a more efficient utilization of gas produced during oil production are in theory eligible for financing by the Bank. In practice, however, a project that recovers and utilizes gas associated with the production of oil has not been financed by the Bank during the last 5 years. Projects recovering and utilizing gas associated with oil production are of interest not only with respect to their potential to mitigate emissions of methane, but also with respect to their economic potential. The economic impacts of flaring and venting are significant in terms of loss of revenues. In Nigeria alone, a joint UNDP – World Bank report estimated in 2004 that the annual economic loss to Nigeria from flaring and venting (based on LNG values) was approximately USD 2.5 billion[12].

78. It can be concluded that while the Bank has not financed a project specifically focused on the recovery and utilization of gas associated with the production of oil, it is possible to finance projects which focus on the recovery of gas in the future, provided a project complies with all applicable EIB standards.

UNEP/WMO Measure 3: 'Reduced gas leakage from long-distance transmission lines' and retrofitting gas distribution lines

79. Measure 3 of the UNEP/WMO report relates to reducing fugitive emissions from leakages in long-distance gas transmission lines. At the EU level trans-European energy network projects (TEN-E), including long-distance gas transmission lines' are considered projects of 'high priority' because they contribute to the security of supply and the integration of the internal energy market. As an EU priority, TEN-E projects are automatically also a priority for the EIB. Gas transmission and distribution, especially interconnections are considered critical investments.

80. As a result, the building of new transmission lines, extensions and/or refurbishing of old transmission and distribution lines is carried out on a regular basis and the Bank is one of the major investors in energy network projects in the EU. The Bank provided EUR 895 million for gas transmission and distribution lines in 2014 and more than EUR 7.8 billion

Refurbishing and replacing old gas pipelines contributes to reducing methane emissions.

over the last 5 years. Financing from one year to the other and from one country to the other can, however, vary significantly depending on market demand and the national legislative framework.

81. The Bank not only refurbishes long-distance transmission lines, but also distribution lines. Refurbishing gas networks considerably reduces leakages and hence contributes to reducing fugitive methane emissions. This means that by replacing old pipelines the Bank contributes to reducing fugitive methane emissions and the proposed 'measure 3'.

82. Table 3 shows the avoided emissions from SLCP-relevant operations in those areas and sectors in which the UNEP/WMO report suggested that measures to address SLCP would have the greatest impact. The replacement of old gas networks financed by the Bank avoided 283 kt CO2-eq. over the six year period analysed between 2009 and 2014. An advantage of the emission data available for gas pipelines is that it has a relatively high informative value, because the emission savings indicated as CO_2-eq. are methane (CH_4) emissions only. For other areas in which measures have been suggested, e.g. waste and transport the Bank only has the CO_2-eq. emission data, but not the exact share of the different gases (e.g. methane, carbon dioxide, etc.) or avoided particulate matter emissions. In the transport sector, for example, the avoided emissions were higher, 293 kt CO2-eq. over the six year period analysed, but this figure is not as directly linked to SLCP emission savings as in the energy sector. All refurbished gas networks projects show consistently negative relative emissions, i.e. avoided emissions. The available data indicates that from all the areas in which the UNEP/WMO report suggests measures, the EIB makes the biggest direct contribution to mitigating the SLCP methane in the area of leakage reduction by replacing and refurbishing gas networks.

Conclusion & Opportunities

- The EIB does not currently finance any projects which focus on the recovery and utilization of gas associated with the production of oil. The Bank would, however, take into consideration project proposals in this area. Projects in this area are generally eligible and will be financed if viable and in line with all EIB standards.
- Data from the carbon footprint shows that replacing and/or refurbishing of old gas pipelines reliably reduces SLCP (CH_4) emissions. The data available at present indicates that gas pipelines are among those projects in the EIB's portfolio which contribute most to avoiding the SLCP methane (CH_4). The EIB already treats energy network projects in the EU as priority. Unless more energy network projects are, however, proposed to the EIB and there is market demand, potential for scaling up is limited.
- The EIB can support projects that replace and refurbish gas pipelines outside of the EU. Demand for such projects strongly depends on market demand which in turn is closely linked to national regulatory frameworks.
- The Bank has recently endorsed the World Bank's 'Zero Routine Flaring by 2030' initiative. The Bank de facto has implemented a no routine flaring policy in its petroleum sector investments for at least the last 20 years.

6.3.4 Waste management – Solid Municipal Waste

83. The Bank provided almost EUR 432 million for 18 solid waste management projects in 2014 and more than EUR 2 billion for solid waste projects inside and outside the EU over six years between 2009 and 2014. The waste treatment technologies supported by the Bank range from waste collection, mechanical and biological treatment (MBT) facilities, recycling, composting, anaerobic digestion (AD), waste to energy (WTE) and the rehabilitation of dumpsites. Beyond funding waste treatment facilities, the Bank also supports upstream activities such as raising public awareness of the need for avoidance and minimisation of waste which are key to any comprehensive waste programme. Compared to projects in other sectors where the Bank is active, some waste processes with a high economic and environmental return such as recycling and composting have relatively small financing needs of between EUR 4 and EUR 40 million. By contrast a large offshore windfarm can have a financing volume of up to EUR 500 million. Therefore, innovative financing instruments are strongly required to address those specific processes. Furthermore, the provision of waste services (as public goods) involves multiple stakeholders and different layers of governance and hence requires a large amount of preparation and time from EIB staff. The frequent absence of a stringent regulatory framework and the lack of basic awareness of the benefits of waste management, e.g. recycling, in the population also add to the complexity of solid waste projects. These characteristics often make solid waste projects a challenge for a mainly volume-driven bank. Yet, for the very reason of being complex projects and operations with multiple benefits to society, the environment and climate, the Bank recognizes that solid waste management is an area in which the Bank can truly provide an added value.

EIB loan helped financing the rehabilitation of an open dumpsite and introducing a sustainable solid waste management system in Tunisia

Sector and Opportunities

84. According to 'The European environment – state and outlook' (SOER, 2015) report overall per capita waste generation in the EU-28 declined by 7% in the period 2004–2012. Recycling rates have increased and waste is more frequently used for energy recovery and production. Material that was deposited to landfill in the EU 28, Iceland and Norway dropped from 31 percent of total waste generated to 22 percent between 2004 and 2010 (ibid).

85. Despite this progress, EU waste generation remains substantial, and performance relative to policy targets is mixed. In order to achieve the EU target of phasing out landfilling by 2025, waste management in the EU will have to change fundamentally. Substantial efforts are needed from

many Member States in order to achieve the target of 50% recycling by 2020. Currently, the recycling rates of municipal waste streams vary considerably between different European countries. While some of the frontrunners recycle more than 50% of their municipal waste (e.g. Germany, Austria) other countries (e.g. Romania, Malta) show extremely low recycling rates (see figure below). In neighbouring countries of the EU (e.g. Turkey or Ukraine) and in countries in the Mediterranean region (Tunisia) the share of municipal waste that is still being landfilled amounts to approximately 80-95 percent. At a global level it is estimated that the world currently produces 1.3 billion tonnes of landfill waste annually. The World Bank report (*What a Waste, 2012*) estimated that global solid-waste generation will rise from more than 3.5 million tonnes per day in 2010 to more than 6 million tonnes per day in 2025.

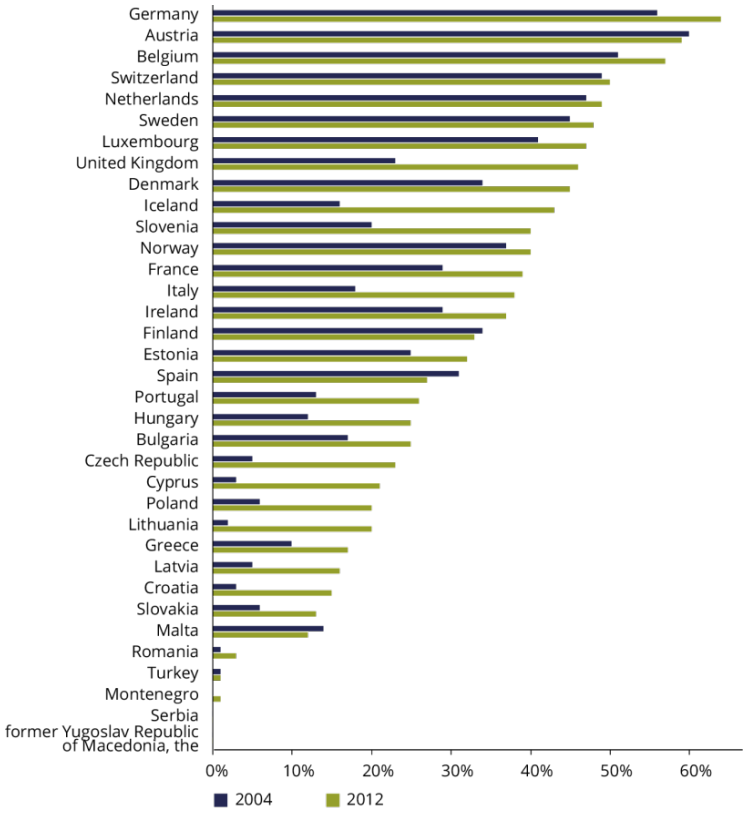


Figure: *Municipal waste recycling rates in European countries 2004 and 2012 (in SOER, 2015)*

86. In many regions of the world, however, waste is not even sent to sanitary landfills, i.e. sites where waste is isolated from the environment until relatively safe, but is deposited in dumpsites where measures to control the operation and to protect the surrounding environment do not or only to a very limited degree exist. Such dumpsites are particularly frequent in Latin American and parts of Asia and Africa and the majority of the world's largest dumpsites can be found in these regions (Waste Atlas, 2014)[13]. Yet, even though dumping waste is illegal, dumpsites still also exist in some of the EU-28 (e.g. Italy, Bulgaria, Greece) and other European countries (e.g. two of the largest dumpsites globally can be found in Ukraine, Alushta and Serbia, Vinča).

87. Bad waste management is negative from various points of view – climate, environmental, health, economic. From a climate perspective waste considerably contributes to the emission of greenhouse

gases, in particular methane (CH_4). Firstly, material that is sent to landfill or dumpsites not only constitutes lost resources, but also a loss of the energy that was used for extracting and producing the material sent to landfill. Secondly, the deposition of waste also directly leads to the emission of GHGs, fine particulate and black carbon emissions. Waste that is deposited in landfills or dumpsites often has different components, in particular the biodegradable waste which under anaerobic conditions is broken down by bacteria and produces approximately 40-60 percent methane (GWP 21) and 40-60 percent carbon dioxide as well as some nitrous oxide (N_2O). Gas production in a landfill continues for 10 to 20 years and it takes approximately 100 years until all the degradable materials are broken down and all emissions are released. It is estimated that emissions from waste account for 11% of global greenhouse gases (UNEP, CCAC). The study "Climate Protection Potential in the Waste Management Sector" by the German Environment Agency finds that "landfills give rise to substantial methane emissions: 50 million and 80 million CO_2-eq. per annum. Therefore, based on the replacement of landfilling with the high-quality material and energetic use of waste, there are still substantial climate protection potentials – within the range of 140 million to approx. 200 million t CO_2-eq. per annum – to be realised in the EU" (German Federal Environment Agency, 2010[14]). Worldwide CH_4 emissions from landfill/dumpsite waste were estimated to amount to 640 to 760 million t CO_2-eq. in 2010 (IPCC, AR4, 2007 chapter 10, p.595), a moderate figure in comparison to the figures estimated for the EU where waste management is comparatively advanced.

88. From an environmental and health perspective, landfills and especially dumpsites have a number of undesirable impacts. Poorly engineered landfills or dumpsites often contaminate surface and ground water, release potentially toxic elements into the soil and consequently contaminate the surrounding fauna and flora. The development of methane emission contributes to the development of ground-level ozone which negatively impacts on the growth of vegetation and human health. Sometimes the build-up of gases also leads to underground fires and open burning of dumpsites which in turn leads to the emission of $PM_{2.5}$ contributing to local air pollution. As a result, people living in the vicinity of a dumpsite often suffer from a number of negative health impacts (infectious diseases, dermatological problems, gastrointestinal, respiratory diseases, chest pain or headaches).

89. Finally, from an economic point of view the disposal of material as waste constitutes lost economic opportunities. Already today recycled materials meet a considerable demand for material in the EU and help to reduce the EU's dependency on imported resources. For example, recycled steel has accounted for about 56% of EU-27 steel production in recent years (BIR, 2013[15]). However, the low recycling rate for municipal waste across a number of EU countries also points to significant opportunities for increased recycling in many areas. It is estimated that resource efficiency improvements all along the value chains could reduce the resource need by 17–24 percent by 2030[16] and better use of resources represents an overall savings potential of EUR 630 billion per year[17] for European industry. In the impact assessment for the 2014 Circular Economy Package, the European Commission estimated that better implementation and simplification of existing EU waste

legislation could create more than 180.000 direct jobs in the EU. The investment needs in the solid waste sector are estimated to be between EUR 5.4 billion and EUR 20.6 billion in the EU alone (P. Dorvil, 2014[18]). Despite the variety of benefits offered by waste management, they are often not fully taken into account by decision makers when making a decision with respect to the management of resources. The EIB is active in the areas targeted by *Measures 4, 5 and 6* proposed in the UNEP/WMO report. The Bank's activity in these areas and potential to mitigating SLCPs are described below.

UNEP/WMO Measures 4, 5 & 6: 'Separation and treatment of biodegradable municipal waste through recycling, composting and anaerobic digestion as well as landfill gas collection with combustion/utilization'

90. The EIB supports a wide range of different types of waste projects and technologies and is traditionally active in the areas in which measures 4, 5 and 6 are suggested. Projects that the Bank supports range from municipal waste collection and recycling schemes, including Mechanical and Biological Treatment (MBT) facilities, composting, municipal solid waste-to-energy (WTE) plants, municipal solid waste incineration to solid waste landfilling projects and the rehabilitation of landfills or dumpsites. Following the concept of the 'circular economy', the Bank also supports projects which adopt a more holistic approach to managing resources and integrating considerations of resource efficiency into its activities. This is for example explored by supporting a project which searches for ways to design products following the "cradle-to cradle" approach.

91. Waste projects financed by the Bank often bundle several components of a waste management scheme (e.g. financing of a waste collection fleet, a recycling scheme and a waste-to-energy component) or waste projects of different municipalities. Sometimes the waste management component is part of a larger urban development project.

92. The Bank consistently finances MBT facilities, recycling, composting as well as anaerobic digestion (AD) facilities which help divert not only recyclable, but also wet components and thus reduce the development of methane and carbon dioxide emissions from the remaining material. The Bank also regularly finances the rehabilitation of badly engineered landfills or dumpsites. Sometimes the collected gas can be used to produce energy that can be fed into the electricity grid or used locally. The Bank also rehabilitates dumpsites with good economic and environmental returns (collection and use of gas, land value, protection of groundwater, and also the overall benefits for local and regional development).

93. The results from the carbon footprint exercise for waste projects, i.e. the total avoided emissions from solid waste projects indicate modest benefits, especially if compared to the avoided SLCP emissions in the energy sector. The total avoided emissions from solid waste projects that were included in the Bank's carbon footprint exercise amounted to -44 kt CO_2-eq. This figure consists of avoided methane (CH_4) and carbon dioxide (CO_2) emissions in an almost equal share, i.e. approximately half of the avoided emissions; -22 kt correspond to an avoided SLCP. The total relative emissions for waste projects as indicated above have, however, to be considered taking the

following points into consideration. First, estimating the carbon footprint of the Bank's projects is a relatively new exercise (since 2010) and the volume of data collected does not yet allow firm conclusions. Secondly, the Bank's carbon footprint exercise only includes projects which are above the set threshold to be included. As some solid waste projects are often comparatively small, as explained before, potential avoided emissions from many small projects are not included. Thirdly, if the avoided emissions from, for example energy and waste are compared in relation to the volume lent, the difference between the avoided emissions from waste (-22kt per 1 bn) and from energy (-36kt per 1 bn) is not as stark as it seems at first sight. Finally, the reduction in the emission of $PM_{2.5}$ and black carbon through stopping the open burning of dumpsites is currently not taken into consideration at all.

94. Solid waste projects combine a high number of benefits and other factors which make them an area worth focusing on for the EIB. As outlined above the results from the carbon footprint need to be read with care and in isolation they do not make solid waste a priority area. The following combination of different factors should, however, put solid waste projects further up the agenda of the Bank: i) an emission saving potential that is probably higher than the current carbon footprint exercise indicates, mainly because the avoided emissions from recycling and also avoided $PM_{2.5}$ emissions are not taken into consideration today ii) the combination of the high number of environmental benefits as described above iii) the immediate positive impacts on local communities and development iv) the benefits to the economy at large v) the number of opportunities and the demand for addressing waste management issues in Europe and globally vi) the fact that the UNEP/WMO report suggests that a high potential for improved management of municipal waste to avoid methane emissions lies in Europe and North America[8] vii) the fact that solid waste operations are complex projects in which the EIB can have a catalytic effect and provide significant added value.

Conclusions & Opportunities

- Today the volume of waste projects financed is comparatively low due to the operations complexity. Municipal solid waste projects show a good potential for SLCP emission savings. However, the savings potential might currently not be fully reflected in the Bank's carbon footprint data and could potentially be higher when considering the emissions of BC and the emissions avoided through recycling and keeping material in the value chain. Solid waste projects offer a high number of environmental, social and economic co-benefits.

[8] "The improved management of municipal waste could contribute one fifth of the potential reduction (total potential of methane emission reductions), half of which could be achieved in North America and Europe" (UNEP/WMO report, 2011, p.9)

► The need to address solid waste management in municipalities is great and the market potential is high. Due to the complexity of the projects the EIB can have a catalytic effect in these operations and offer significant added value. In view of the Bank's 2015 Climate Strategy, which commits to giving more weight to high impact projects, solid waste projects are an area in which the Bank can increase its impact, even if in volume terms these projects may seem less attractive.

6.3.5 Wastewater

95. Water resource management is another important area in which the EIB provides finance inside and outside the EU. Over the six year period analysed (2009-2014) the Bank financed more than 200 projects providing more than EUR 21 billion to the water sector. In 2014 the Bank provided EUR 2.6 billion for projects in the water sector. Projects in the water sector include water resources, water treatment, water supply, wastewater collection, wastewater treatment, sludge treatment and disposal, water efficiency, but also flood control, coastal protection projects and more specific adaptation projects. The projects having the highest potential to reduce methane emissions are sewage water treatment projects. The latter range from providing primary treatment sewage installations in developing and emerging countries to more advanced solutions with aerobic biological wastewater treatment, and with sludge treatment which employs anaerobic digestion to produce stabilised sludge and biogas which is utilised for co-generation of electricity and heat through cogeneration/combined heat and power units (CHP). Over the six year analysis period (2009-2014), the EIB provided EUR 6 billion for sewage projects alone. In times of rising electricity costs, adding a combined heat and power plant becomes increasingly interesting to sewage plant operators. Wastewater treatment processes include energy-intensive operations such as aeration and pumping. As a result, wastewater treatment plants require significant energy consumption. In municipalities wastewater plants are often among the highest energy consumers. Sewage plants which employ a CHP can on average cover 30% to 40% of their electricity needs and 100% of heat needs which helps to reduce their operational costs and consequently also the wastewater fees or the municipal taxes levied from the citizens.

96. In addition, like solid waste management projects, wastewater management projects offer a number of health and environmental co-benefits, such as reducing the amount of pollutants entering the environment through groundwater, soil and surface water. The EIB is active in the areas targeted by Measure 8 proposed in the UNEP/WMO report. The activity in these areas and potential to mitigating SLCPs are described below.

UNEP/WMO Measure 8: Upgrading primary wastewater treatment to secondary/tertiary treatment with gas recovery and overflow control

Measure 8 relates to reducing the emission of methane from wastewater by upgrading primary wastewater treatment plants to secondary treatment through gas recovery and overflow control.

Primary treatment is usually the first stage of wastewater treatment in which gross, suspended and floating solids are removed from raw sewage, but gas is freely released into the atmosphere. More advanced secondary and tertiary treatment plants remove the dissolved organic matter that escapes primary treatment and tertiary treatment can eventually remove more than 99 percent of all the impurities from sewage. The Bank regularly finances such upgrades of wastewater plants, often in combination with anaerobic digestion and/or combined heat and power plant which captures the methane emitted from the sewage. The financing of the upgrading of waste treatment plants, the combination with anaerobic digestion and/or CHP and overflow control is applied to all economically viable projects which are in line with the Bank's standards and criteria. In the EU the solution and level of treatment are driven by the compliance with the EU relevant environmental directives, notably the Urban Wastewater Treatment Directive and Water Framework Directive, while outside the EU, they depend - amongst others - on the users' capacity to pay

97. The carbon footprinting data for wastewater projects is limited. Over the six year analysis period (2009-2014), wastewater projects contributed to a saving of -44 kt CO_2-eq. compared to baseline scenarios. This figure accounts for ten major projects in 2009 and 2011. In later years, the Bank's activities in the area of wastewater concentrated on projects with financial intermediaries. While these intermediated operations are expected to contribute significantly to SLCP to emission savings, such projects are not tracked in the Carbon Footprint exercise.

Conclusions & Opportunities

- The Bank regularly finances the construction and upgrading of wastewater treatment plants, often in combination with anaerobic digestion and combined heat and power generation which prevents emissions of methane from the sewage and sewage sludge.

  The EIB offers financing for the upgrading of waste treatment plants, including combination with anaerobic digestion and CHP and overflow control, to all economically and financially viable projects which are in line with the Bank's standards and safeguards.
- The Carbon Footprint data for wastewater projects in the six years between 2009 and 2014 shows a good contribution to reducing SLCP emissions. However, the overall contribution of this sector to mitigating SLCPs is estimated to be considerably higher, but is currently not tracked, because significant savings may be achieved by lending through financial intermediaries. Wastewater is a key sector for the EIB with projects inside and outside of the EU.

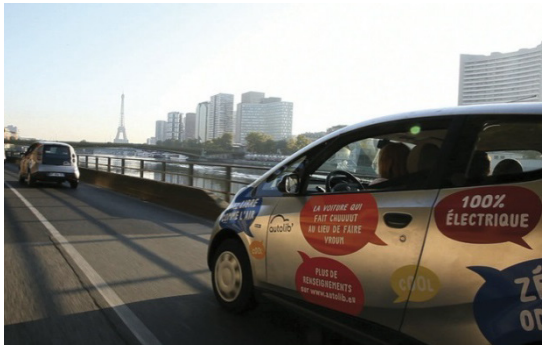
6.3.6 Transport

98. Transport is a key sector for the EIB. On average 20-25% of EIB total lending supports projects in the transport sector inside as well as outside the EU. The Bank provided more than EUR 86 billion for transport projects in Europe and internationally between 2009 and 2014, and more than EUR 13 billion supported transport projects in 2014 alone. Bank lending in the transport sector contributes to multiple EU policy objectives including environmental improvement, regional development, the knowledge economy, and the trans-European networks. In this respect the European Commission's White Paper on Transport (2011) which outlines the challenges and a future vision for transport in Europe, is particularly important in guiding the Bank's actions. It outlines a vision in which mobility in Europe is high and increasing whilst reaching a 60% emission reduction target (below 1990 levels by 2050), an efficient intercity travel and transport network and clean urban transport and commuting. At the global level the challenge to meet the demand for transport in growing economies and for an increasing number of people in a sustainable and climate friendly way will be an even bigger challenge.
99. Transport projects supported by the EIB typically include railways (conventional as well as high-speed lines), urban transport (urban railways, underground, metro or bus fleets), but also roads and motorways, sea transport, air transport as well as research and development (RDI) projects that aim at identifying more efficient and sustainable transport options.
100. The large majority of transport projects that the Bank finances reduce the overall emissions of GHGs (even highways often have a decongestion effect and hence contribute to reducing emissions)
101. The WMO/UNEP report estimates that some of the largest particulate matter ($PM_{2.5}$), i.e. black carbon, emission reductions in the transport sector can be obtained by using diesel particle filters on high-emitting vehicles. The UNEP (2011) report specifies that addressing emissions from the transport sector would bring about the largest reduction in black carbon emissions in Latin America and the Caribbean. Yet, in Europe, Africa and Asia replacing and eliminating high-emitting vehicles would also have a significant beneficial impact on black carbon emissions. The EIB is active in the areas targeted by *Measure 12* proposed in the UNEP/WMO report. The activity in this area and potential to mitigating SLCPs are described below.

UNEP/WMO Measure 12: Supporting the progressive elimination of high-emitting vehicles in road and off-road transport

102. One of the most effective ways to eliminate high-emitting vehicles in road and off-road transport is probably policies setting standards which in practice exclude high-emitting vehicles. While the Bank has no influence on the setting of policies, it finances a number of solutions which, both indirectly and directly, contribute to eliminating high-emitting vehicles in road and off-road transport. The Bank helps to take vehicles, including high-emitting vehicles off the road by providing alternative means of transport, such as different types of railways, or by expanding public transportation in

cities by financing metros, tram lines or bus fleets. By providing this type of infrastructure the Bank contributes to reducing the overall traffic load and the use of high-emitting vehicles in particular. The Bank also invests in financing research projects which explore how engines can be made more fuel efficient which may eventually lead to high emitting vehicles being increasingly replaced by less emitting ones.



EIB helped introducing an electric vehicle scheme in Paris contributing to model shift to low carbon transport.

103. More directly the Bank contributes to eliminating high-emitting vehicles in road traffic by, for example, financing electric and hybrid bus fleets, electric cars and the associated infrastructure for cities. Beyond roads the Bank has in recent years also financed the replacement of large and outdated cargo vessels through more efficient ones. The cargo vessels the Bank has invested in can now run on fuel with lower sulphur (SO_2) content and producing less $PM_{2.5}$ and black carbon emissions. Replacing aging vessels with new ones led in one project to approximately halving the total emission volumes. (For example, for one of the vessel projects financed, it was assumed that the vessels being replaced by the project (between 25 and 30 years old) would emit an average of 1,400 kg CO_2 per truck on the Mediterranean Lines and 5,000 kg of CO_2 per truck in the Deep Sea Lines. In contrast, the emission from the new vessels would represent approximately half of those volumes.

104. The suggested measure 12 aims at reducing black carbon emissions. As outlined in previous chapters black carbon is a warming agent, but not a greenhouse gas. For this reason emissions of black carbon are not considered and accounted for in the Bank's carbon footprint exercise which only captures the seven GHGs. The avoided emissions from the Bank's transport projects indicated in table 3 above are avoided carbon CO_2-eq.and hence not reduction in the SLCP, black carbon. Yet, it can be assumed that there is a certain correlation between the avoided carbon dioxide (CO_2) and the avoided black carbon emissions.

Conclusion & Opportunities

- EIB generally finances all economically viable transport projects as of a certain financing volume which is in line with the Bank's policy objectives, environmental and social standards and procurement guidelines. Projects can be within or outside the EU. As mitigating climate change is a key policy priority for the EIB, the Bank welcomes project proposals from project developers for retrofitting high emitting vehicle fleets, financing new technologies or supporting a model shift from high-emitting vehicles to cleaner transport modes. A team of transport engineers and economists can provide final advice and for more in-depth project preparation the Bank can provide technical assistance.

- The Bank's carbon footprint exercise only shows avoided CO_2-eq.emissions and only allows coarse estimates of how CO_2 savings correspond to the reduction of black carbon emissions. As stated in the chapter on standards and criteria, the Bank will **work towards the inclusion of the external costs caused by $PM_{2.5}$ into the Cost Benefit Analysis (CBA) for transport projects, if of value.**

6.3.7 Agriculture

106. Between 2011 and 2015 the EIB supported rural economies inside and outside the EU by investing more than EUR 24 billion throughout the bio-based value chains and in natural capital protection.

107. The EIB activities in the agricultural sector (here only crop and livestock production is considered) includes on-farm investments in fixed assets with the objective to contribute to access to finance for small- and medium-sized enterprises, improving resource efficiency, the environmental impact and to reduce the emission of greenhouse gases. The lending to the agricultural sector is mainly implemented through intermediated lending targeting SMEs. However, there are also some microfinance projects outside the EU which aim to support (smallholder) farmers and are thereby making a contribution to EU development policies. This type of projects is often combined with technical assistance to ensure the achievement of these objectives. In addition to the support via partner financial institutions, the Bank aims at supporting the EU rural development policy through its co-financing of EU Member States' Rural Development Programmes under the second pillar of the EU Common Agricultural Policy.

108. At the time of writing this report, the Bank did not have any direct projects in the two areas suggested by Measure 9 and 10. This means projects which either specifically focus on the control of CH_4 emissions from livestock production, or projects which focus on intermittent aeration of continuously flooded rice paddies. Such projects would, however, generally be eligible for financing by the Bank and the Bank would consider supporting them if they are in line with our standards and criteria.

6.3.8 Industry

109. Within the industry sector, the EIB's lending volume for the six year period analysed (2009-2014) totals EUR 46 billion. The EIB typically supports research, development and innovation-related projects (RDI, accounting for the majority of lending in the industry sector) and manufacturing. EIB-financed RDI projects typically concern improving energy efficiency, reducing fuel consumption, improving equipment performance, reducing the weight of automotive components and safety improvements. In manufacturing, the EIB typically supports the modernisation and expansion of manufacturing facilities as well as in some cases the implementation of state-of-the-art greenfield manufacturing facilities.

110. The original 16 types of SLCP reduction measures listed by UNEP/WMO do not include measures in relation to HFCs. However, as they belong to the main SLCP group, the Bank has deemed it

important to include them in the overview in Table 2. Specific areas in relation to industry where HFCs can be found are listed for the sake of completeness and to be sure that the Bank is not overlooking an area of its activities where SLCPs are emitted in a significant way.

111. As mentioned above, the main focus of industry sector financing is on RDI as well as EE and depollution projects. Up to now, none specifically deals with SLCPs. If there was a research project looking, for example into developing economically viable alternative substances, the Bank would, of course, be interested in and examine whether such a project could be financed. For projects in the manufacturing sector, the Bank is not aware of any projects which involved significant HFCs emissions. The Bank's services are very attentive to the GHG emissions associated with each project financed. This includes, of course, emissions of SLCPs. As a rule, for all projects causing or saving significant GHG emissions, the Bank's services prepare a detailed carbon footprint. However, by publishing this report, we have raised further the awareness among colleagues of the importance of SLCPs.

109. Conclusions & Outlook

112. This report constitutes an important building block in the EIB's efforts to further develop and refine its approach to addressing climate change. Addressing the emissions of short-lived climate pollutants (SLCPs) – methane (CH_4), ground-level ozone (O_3), black carbon (BC) and hydrofluorocarbons (HFCs) – can substantially contribute to tackling near-term climate change. This report explored how SLCPs are taken into account in the Bank's standards and criteria, it looked at the impact the EIB's projects have on the emissions of SLCPs and finally, at opportunities for the Bank to address SLCPs in its projects.

113. **A key finding of the report was that not only are most SLCPs taken into account in the Bank's monitoring exercises, but SLCPs were also considered in the Bank's standards and criteriaand therefore in the decision-making process.** An overview of the Bank's standards, criteria and safeguards and the projects financed by the Bank, and potential future projects with impacts on SLCP emissions was presented.

114. In the process of preparing this report, awareness was raised amongst EIB staff of the benefits and potential of mitigating SLCPs. Discussions with sectoral experts were held on the EIB's project portfolio and their impact on the emission of SLCPs, and on how projects can potentially address and mitigate SLCPs. **This heightened awareness sets the stage for a better understanding of SLCPs and the impact of the Bank's activities on their emissions.**

115. The report found that the external costs caused by emissions of fine particulate matter ($PM_{2.5}$) are already included in the Cost Benefit Analysis (CBA) for projects in the energy sector. An area where fine particulate matter ($PM_{2.5}$) and its component black carbon are, however, not yet integrated and priced into the project costs is the transport sector. As one of the sectors with the highest impact on $PM_{2.5}$ emissions, it is important that the costs caused by $PM_{2.5}$ emissions are internalised into the costs of transport projects. **Therefore the Bank will work towards the inclusion of the external costs caused by $PM_{2.5}$ into the Cost Benefit Analysis (CBA) for transport projects, if considered of value.** Finally, this report also aimed at illustrating for the Bank's counterparts and potential project developers willing to address SLCPs, what the Bank can offer. Identified opportunities in terms of possible projects were illustrated per sector. The Bank looks forward to further project proposals addressing the emissions of SLCPs, both inside and outside the EU.

116. Exploring the relationship between SLCPs and the EIB's activities has helped contribute to raising awareness about emissions of SLCPs within the different sectors financed by the Bank, as well as the benefits of mitigating these substances. The analysis has shed light on additional opportunities to contribute to mitigating climate change which the Bank has not explored to date. **Integrating the findings of this report will contribute to the objectives set out in the Bank's Climate Strategy, further refine the Bank's approach to climate action as well as to support the Bank's continued focus on reducing air pollution.**

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