FOR BUSINESSES

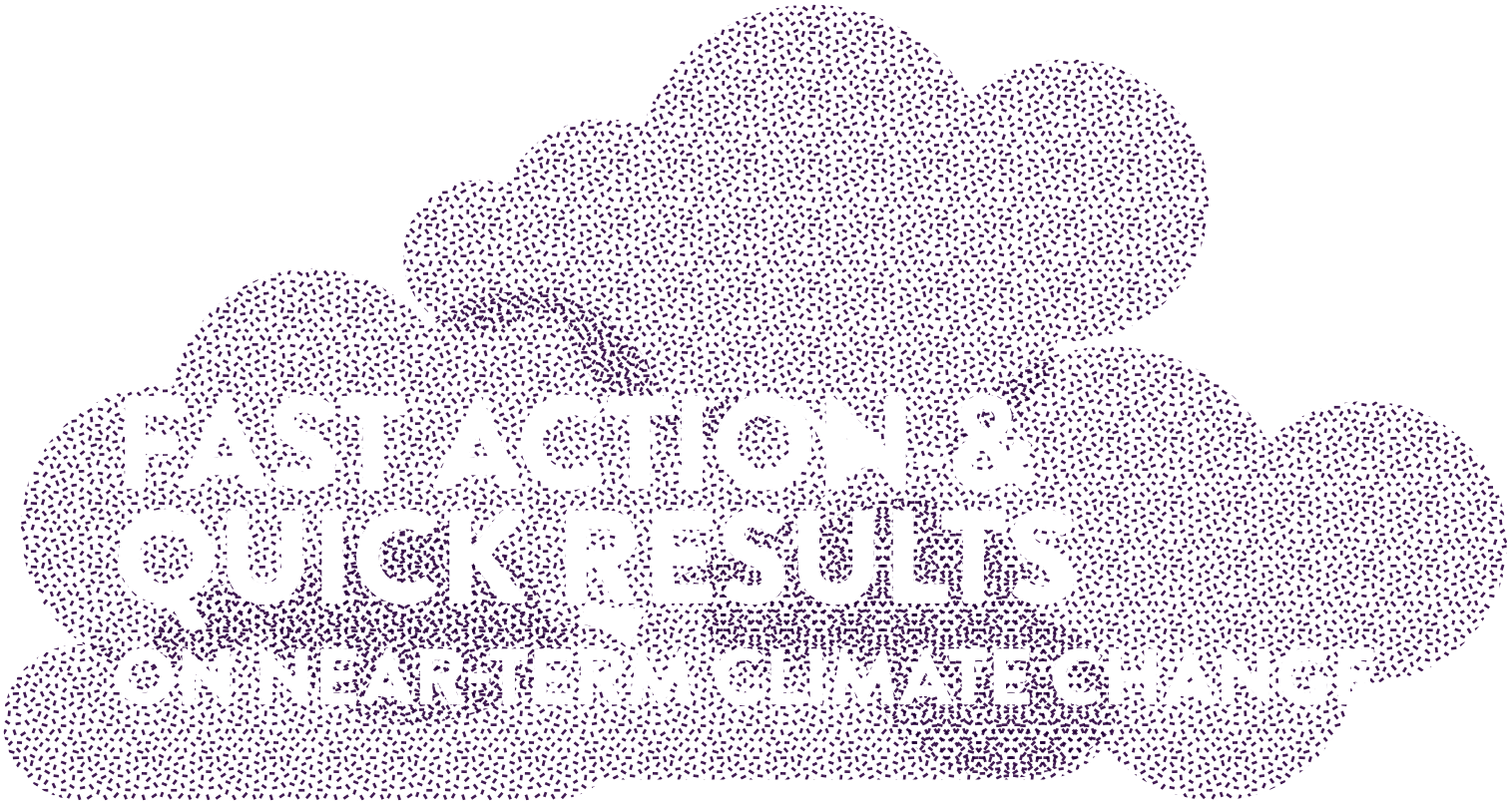
FAST ACTION & QUICK RESULTS

ON NEAR-TERM CLIMATE CHANGE

THE BENEFITS OF SHORT-LIVED CLIMATE POLLUTANT MITIGATION FOR BUSINESSES

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

BSR®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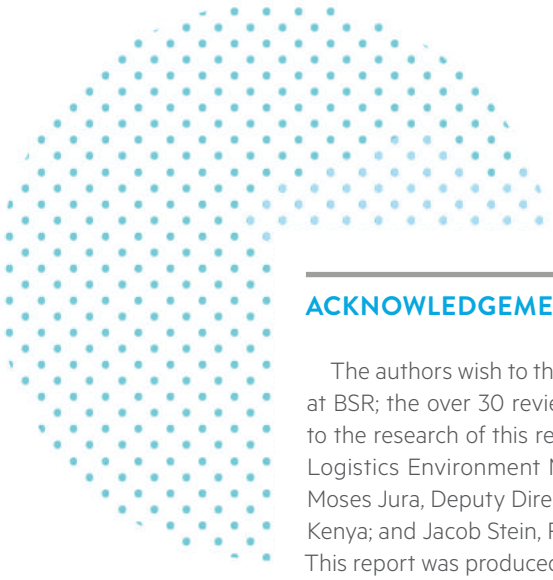

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ABOUT THIS REPORT

This report demonstrates that to take fast action on climate change, businesses should include measures to reduce short-lived climate pollutants (SLCPs) such as **Black Carbon, Methane & Tropospheric Ozone**, and **Hydrofluorocarbons** (HFCs). By reducing SLCP emissions, businesses can achieve ambitious yet pragmatic results on slowing or reducing the effects of climate change. Many businesses already are addressing SLCP emissions through engagement with the Climate and Clean Air Coalition (CCAC). There remain many opportunities for strengthening these types of actions.

This report outlines climate change-related risks for businesses as well as the significant opportunities possible from taking action to reduce SLCP emissions. It provides businesses with an overview of how reducing SLCPs can contribute to significant impact in fighting climate change in key sectors.

WHAT ARE SHORT-LIVED CLIMATE POLLUTANTS (SLCPs)?

BLACK CARBON

Black carbon is a major component of soot, and its particles are formed from the incomplete combustion of biomass and fossil fuels from various sources, such as diesel cars and trucks (19 percent of global black carbon emissions), residential stoves (20 percent of global emissions), and forest fires and agricultural open burning (42 percent of global emissions). It is both a powerful climate force and a dangerous air pollutant.

The climate effects of black carbon include increased snow and ice melt, changes in cloud reflectivity and rain patterns, and negative ecosystem impacts.

METHANE AND TROPOSPHERIC OZONE

Methane is a greenhouse gas (GHG) and air pollutant that directly influences the climate system. About 60 percent of global methane emissions are due to human activities. It is produced through natural processes such as the decomposition of plant and animal waste (about 40 percent of global methane emissions), but it is also emitted from human activities such as fossil fuel production (29 percent of global anthropogenic methane emissions), agricultural sources such as livestock enteric fermentation, manure and rice cultivation (50 percent), and waste treatment (20 percent).

Methane also is an important precursor gas of the powerful air pollutant, tropospheric ozone.

HFCS

HFCs are man-made GHGs used as replacements for ozone-depleting substances in air conditioning, refrigeration, foam-blowing, fire retardants, solvents, and aerosols. Their lifespans vary, but when weighted by usage, they remain in the atmosphere for a minimum of 15 years. Currently, HFCs are responsible for less than 1 percent of total global warming, but their prevalence is growing at a rate of 10-15 percent per year.

For more information, please visit our website at:
www.ccacoalition.org

KEY FINDINGS

1. By reducing emissions of Short-Lived Climate Pollutants (SLCPs), businesses can achieve ambitious yet pragmatic results on near-term climate with immediate benefits for air quality, public health & energy security.
2. SLCP mitigation is simple, pragmatic, and cost effective.
3. SLCP mitigation has climate and development benefits.
4. SLCP mitigation within companies shows results in operational and organizational efficiency.

EXECUTIVE SUMMARY

Fast action to reduce SLCPs — black carbon, methane, HFCs, and tropospheric ozone — is a crucial part of keeping temperatures below the 1.5°C-2°C threshold agreed upon by the 196 countries who adopted the Paris Agreement during COP21.

For businesses, climate action is achieved incrementally, by working at different points of a value chain. Within a portfolio of business actions, reducing SLCPs is an opportunity to improve a company's performance on minimizing contributions to climate change in ways that are pragmatic and achievable.

Governments around the world are increasingly promoting low emissions policies, and have begun the shift to a new economy with low emissions and reduced climate risk. Businesses from across sectors and all segments of the value chain are seeking their own large-scale emissions reductions, as well: 540 companies and investors made such commitments through the *We Mean Business Coalition* in the run-up to COP21.

According to UNEP, "adoption of near-term measures on methane and black carbon (CH4 + BC) along with the CO_2 reductions would provide a substantial chance of keeping the Earth's temperature increase below 1.5˚C for the next 30 years."[1]

Businesses can seize opportunities while hedging against risks associated with the new political and economic landscape opened up by the Paris Agreement. For the most efficient and effective action on mitigating deleterious effects on our climate, businesses should complete their climate portfolios by including measures to reduce SLCP emissions. The reasons are as follows:

1. **SLCP mitigation within companies shows results in operational and organizational efficiency.** These gains include more efficient use of logistical resources, increased energy efficiency, or product and business model innovation. For example, improving manure and animal feed management can be achieved with net savings to moderate costs resulting in increased energy efficiency, increased crop production, improved meat quality, and significant benefits to fighting climate change.[2]

2. **SLCP mitigation is simple, pragmatic, and cost effective.** Reducing SLCPs provides companies with a tangible way to take action on their approaches to mitigating climate change; a tactical strategy that is beneficial across a range of sustainability metrics, takes account of economic opportunities, and opens up revenue streams. For example, according to a World Bank-commissioned report, "if gas is valued at an average price of US$4 per British Thermal Unit (Btu), the 140 billion cubic meters of gas flared annually would be worth about US$20 billion." What is flared annually is equivalent to more than 30 percent of the entire European Union's gas consumption.[3]

3. **SLCP mitigation has climate and development benefits.** By reducing SLCPs, businesses can signal a strong commitment to actions that have a positive effect on climate, as well as commitments to enhanced public health, energy security, and air quality. Businesses that reduce SLCPs also can bring the business community closer to policymakers in both developed and developing economies. With regard to HFCs, the opportunity includes enabling other sectors to reduce emissions, too. According to the International Council of Chemical Associations (ICCA), the chemical industry emits GHGs during manufacturing, but also enables emissions reductions, including SLCP emissions, through the application of its products. ICCA estimates that for every gigaton of GHGs emitted, the enabled savings for other industries and end users is approximately 2.1 to 2.6 gigatons CO_2e.[4]

The CCAC is the only global effort to reduce SLCP emissions. It unites governments, civil society, and the private sector, all of which are committed to improving air quality and protecting the climate and environment in the next few decades by reducing SLCPs across the board.

CCAC has identified specific measures in specific sectors to reduce SLCP emissions. BSR has selected four sectors that, because of their mitigation potential and because mitigation measures can be integrated into the heart of their operations and supply chains: agriculture, oil and gas, transport, and waste management, and all sectors emitting hydrofluorocarbons from air conditioning, foams, or other manufacturing processes.

Many businesses already are engaged in SLCP mitigation efforts, recognizing the CCAC as a unique platform to provide cross-sector and multi-stakeholder collaboration. As a core value of collaboration in the CCAC, ministers from partner countries have placed great importance on meaningful and practical private-sector engagement.

1 http://www.unep.org/dewa/Portals/67/pdf/BlackCarbon_SDM.pdf.
2 CCAC 2014, page 23.
3 The World Bank, 2015.
4 ICCA, 2009.

THE BUSINESS CLIMATE IS CHANGING

A shift is underway in terms of action to combat climate change. Public policy commitments are rising. Businesses are hedging risks and seizing opportunities. Investors and shareholders are taking bold actions.

GOVERNMENTS ARE CREATING A PATH TO A LOW-EMISSIONS FUTURE AND CLEANER AIR

On December 11, 2015, 196 countries adopted the Paris Agreement during COP21. In doing so, these countries signed up to create a thriving clean economy fueled by innovation and low-emissions technologies, products, and services. The Paris Agreement covers action in the short- and medium-term, and sets a long-term goal for bold collective action for the decades ahead.

Even before the Paris Agreement, many governments already had started to act on the issue of mitigating climate change. The number of climate laws nearly doubled to 804 in 2014 from 426 in 2009.[5] Since 1997, the number of climate laws and policies has doubled every five years.[6] Some of these laws address absolute emissions reductions, others attempt to deviate from business as usual pathways, and a third group tackles emissions intensity. [7] In addition, many countries, states, and cities are tackling air pollution by regulating transport, oil refineries, smokestacks, and waste incinerators and boilers.

COMPANIES ARE RESPONDING THROUGH INVESTMENTS AND OPERATIONS ACROSS THE VALUE CHAIN

Companies are taking action to protect our climate, motivated by a revised assessment of climate risk, disrupted supply chains, reduced availability of scarce natural resources, damage to vital infrastructure and utilities, disrupted transport and logistics routes, heightened price and market volatility, and unpredictable impacts on the workforce and consumers. Other businesses are motivated not only by reducing these impacts but also by the financial opportunity afforded by action to mitigate emissions and processes that contribute to climate change. Leading companies that have set science-based emissions reductions targets are seeing an Internal Rate of Return (IRR) of 27 percent on low-emissions investments, with some reporting an IRR as high as 81 percent.[8] Overall, some estimates put the cumulative global cost of climate change impacts as high as US$4 trillion by 2030 if we continue on our current path.[9]

The number of Global 500 companies undertaking initiatives to mitigate climate risk shows a steadily increasing trend. The number of companies incorporating climate action into their overall business strategies (332), the number meeting or exceeding their emissions reduction targets (232), and the number that have achieved overall emission reductions as a result of successfully implementing reduction activities (269) are all up from previous years.[10]

INVESTOR PRESSURE IS INCREASING

Responsible investors also are changing the climate landscape. Many investors recognize the importance of broader context on business success—particularly the environmental, social, and governance (ESG) aspects of their investment decisions. These investors are adjusting their asset allocation and investment management strategies accordingly. For example, in the United States, the total professional managed assets considering ESG factors expanded to nearly US$7 trillion at the start of 2014, up from just under US$4 trillion at the start of 2012.[11]

5 Nachmany, et al. 2015.
6 Ibid.
7 World Resources Institute (WRI), 2013. (This analysis is from unpublished assessments from WRI.)
8 We Mean Business, 2014. *The Climate Has Changed.*
9 Mercer. 2011. "Climate Change Scenarios—Implications for Strategic Asset Allocation." Mercer LLC, Carbon Trust, and International Finance Corporation, New York.
10 CDP Global 500 Climate Change Report. 2013. https://www.cdp.net/CDPResults/CDP-Global-500-Climate-Change-Report-2013.pdf.
11 US SIF. US Forum for Sustainable and Responsible Investment. http://www.ussif.org/sribasics. 2014.

WE MEAN BUSINESS

TOGETHER WITH THE WE MEAN BUSINESS COALITION, THE CLIMATE AND CLEAN AIR COALITION (CCAC) IS ENCOURAGING BUSINESSES TO MAKE COMMITMENTS TO:

- Include measurement and reporting of black carbon and co-pollutants, methane and/or HFCs into their GHG accounting
- Reduce emissions of SLCPs
- For most initiatives, engage stakeholders in their supply chain to reduce emissions of SLCPs
- Promote best practices and showcase successful efforts, including through CCAC initiatives

WHY SHORT-LIVED CLIMATE POLLUTANTS (SLCPs)?

Integrating measures to reduce SLCP emissions into a climate strategy provides a way for businesses to increase the rate of their emissions reductions and at the same time take part in other positive trends, such as contributing to cleaner air and reduced air pollution.

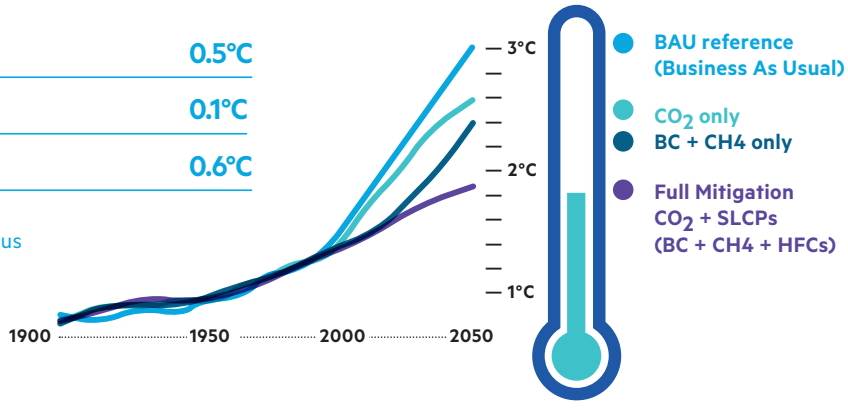
THE SCIENCE OF SLCPs

According to UNEP and the World Meteorological Organization, adopting SLCP mitigation together with measures to reduce CO_2 emissions improves the chances of limiting the global temperature rise to less than 2˚C relative to pre-industrial levels.[12] With the CO_2 measures alone, warming is very likely to exceed 2˚C before 2050. However, according to this study, the combination of mitigating CO_2, methane, and black carbon together holds the temperature increase below 2˚C until around 2070.[13] SLCPs remain in the atmosphere for a short time, ranging from a few days (black carbon) to a few decades (methane). Widespread SLCP reductions, which complement the need for aggressive global action on carbon dioxide, therefore can contribute significantly to the goal of limiting warming to less than 2˚C before the end of the century.

SLCP CLIMATE BENEFITS
AVOIDED GLOBAL WARMING BY 2050

BC + CH_4	0.5°C
HFCs	0.1°C
SLCPs	0.6°C

Simulated temperature change under various mitigation scenarios CO_2, BC, CH4, HFCs

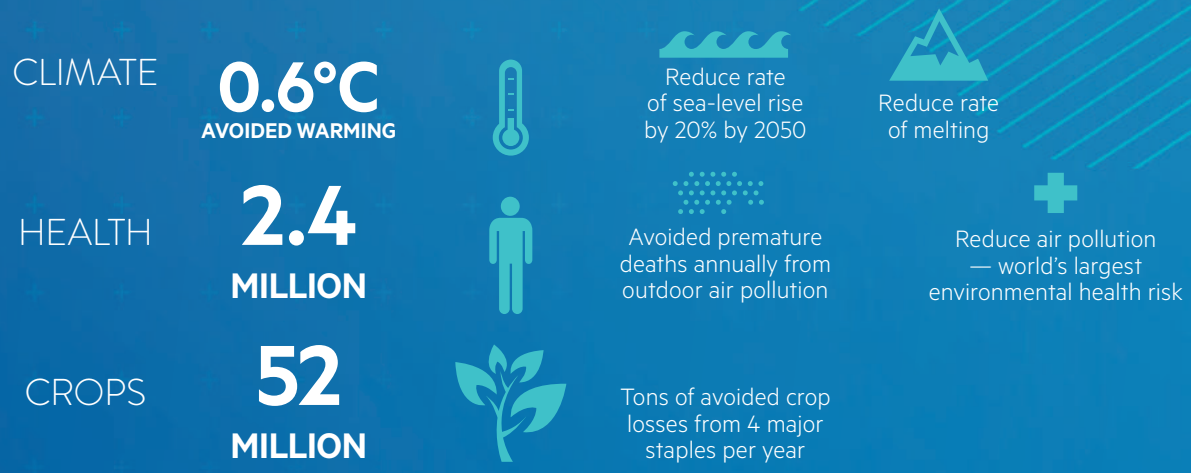


SCLPs & GLOBAL WARMING POTENTIAL

Global Warming Potential (GWP) is the factor that quantifies the heat-trapping potential of each pollutant in comparison to that of CO_2 in the same period of time, usually 100 years (which is symbolized as GWP100). With this in mind, SLCPs can be more potent than CO_2 (per unit weight) at trapping heat in the atmosphere. For example, methane has a GWP value of 21, which means that each unit of methane released into the atmosphere is 21 more times effective at trapping heat compared to an equivalent unit of CO_2. The timeframe used to calculate the GWP of different pollutants is crucial, as the average lifetime of the HFCs in use today is 21.7 years. By using GWP100 as the main measure of potency, the impact of SLCPs is averaged over a much longer timeline.

[12] http://www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf.
[13] Ibid..

ANNUAL BENEFITS
FROM LARGE-SCALE SLCPs MITIGATION BY 2030



SOCIO-ECOLOGICAL IMPACTS OF SLCPs

Reducing SLCPs can also contribute to protecting air quality and public health, promoting food security, enhancing energy efficiency, and alleviating poverty. Concerted global action to reduce SLCPs could prevent an estimated 2.4 million premature deaths annually from outdoor air pollution, significantly reduce the estimated 4.3 million deaths and other health impacts from indoor air pollution, and avoid 52 million tons of crop losses annually.[14]

Black carbon, for instance, has a considerable impact on mortality[15] and human health. It is a component of PM2.51 , fine particles that, by entering and remaining inside the lungs through pollution, can cause premature mortality, cardiovascular[16] and respiratory diseases,[17] and birth defects.[18] According to the World Health Organization (WHO), 3.7 million premature deaths[19] resulted from outdoor air pollution in 2014. About 88 percent of these deaths occurred in low- and middle-income countries that use older engines and dirtier fuels, and where vehicle use is surging.

The economic costs of public health challenges stemming from black carbon are significant, too. In Europe, the economic cost of deaths from air pollution is more than US$1.4 trillion, which amounts to almost 2 percent of the global economy. For the entire Organization for Economic Cooperation and Development region, this figure is estimated to be US$3.5 trillion.[20]

Black carbon and tropospheric ozone also can affect the health, growth, and productivity of crops, trees, and other plants. Implementing a suite of measures to reduce methane and ground-level ozone could assist in avoiding annual yield losses of up to 25 million tons of staple crops.[21] Significantly curbing black carbon emissions would account for another 25 million tons of avoided crop losses annually.

SLCPs AND BUSINESS

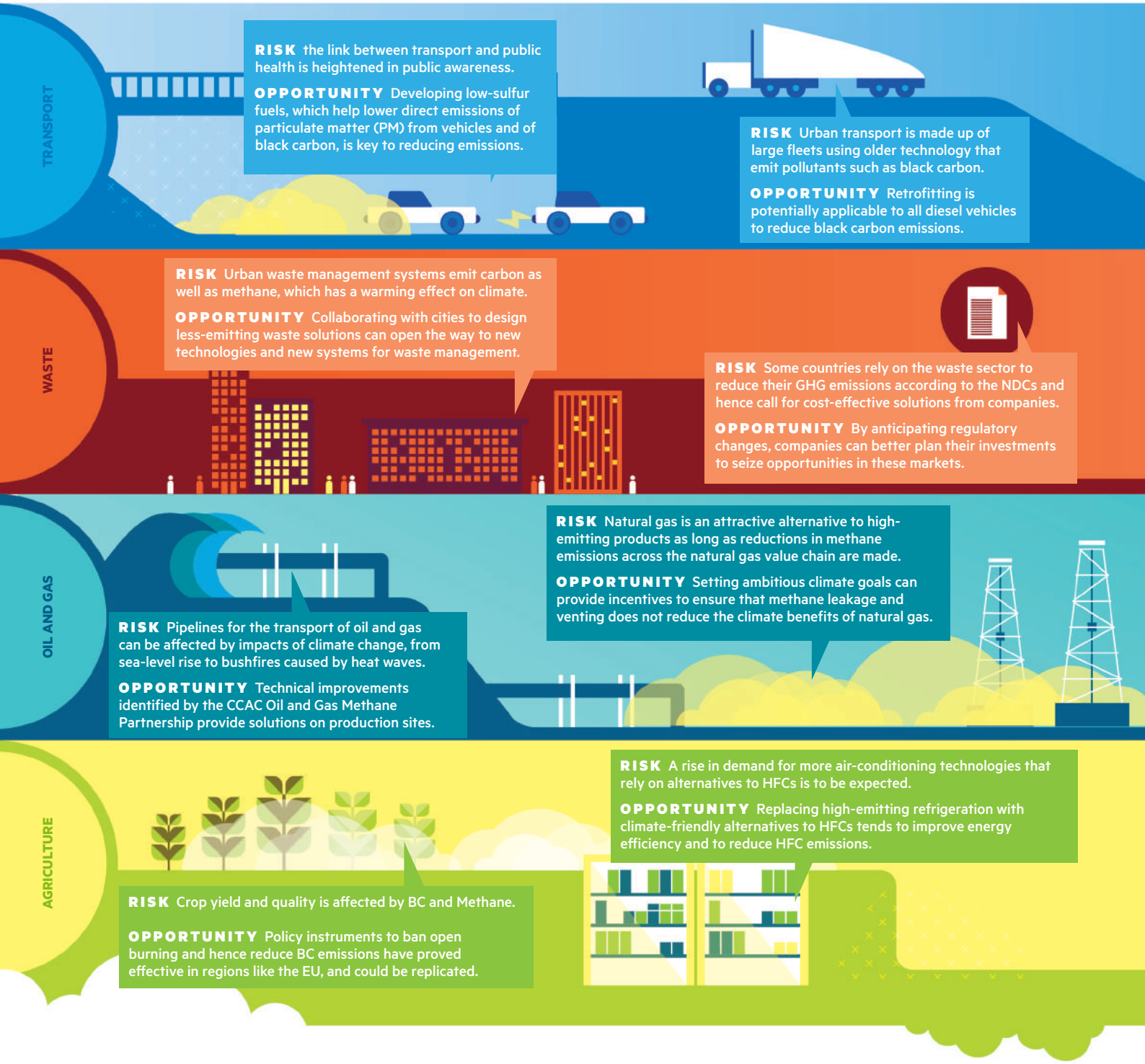
In order to reduce the risks associated with SLCP emissions and to take advantage of the opportunities business will need to, in some cases, deploy supplementary resources (financial, operational, or organizational). Judged against the potential for emissions reductions and benefits beyond mitigating climate change, however, most of these investments are attractive ways to complete and strengthen a business' strategy toward protecting local ecosystems and the broader climate as a whole.

Many of the most effective solutions are collaborative. Collaboration underpins all efforts to mitigate SLCPs for three distinct reasons. First, SLCP emissions are best managed through a systemic approach to their sources. Second, companies are interdependent within and across sectors, in particular through supply chains. Third, policy and regulation frameworks need to be applied across sectors to be efficient. Though these measures can be implemented at the company level, they thrive on collaboration between stakeholders.

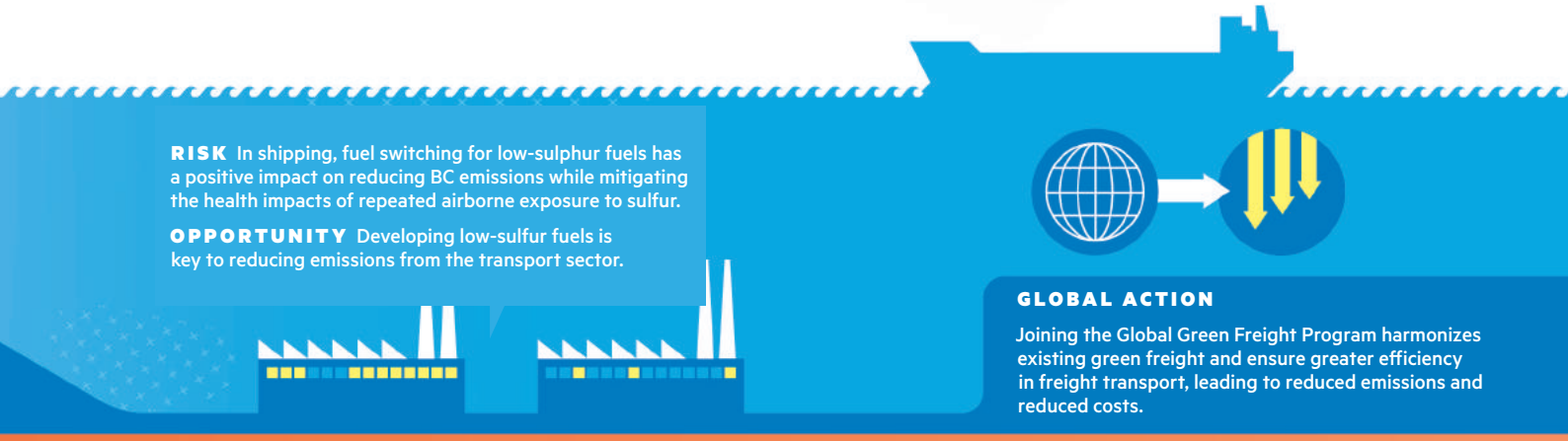
14 http://documents.worldbank.org/curated/en/972571468326204977/pdf/804810WP0G80Re00Box0379805B00OUO090.pdf.
15 http://www.atmos-chem-phys.net/11/7253/2011/acp-11-7253-2011.pdf.
16 https://www.mcgill.ca/newsroom/channels/news/black-carbon-linked-risk-cardiovascular-disease-238419.
17 http://erj.ersjournals.com/content/44/Suppl_58/2923.
18 http://aje.oxfordjournals.org/content/155/1/17.full.
19 http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/
20 Tagaris, E., et al.. 2009. "Potential impact of climate change on air pollution-related human health effects." *Environmental Science & Technology* 43:4979-4988, doi:10.1021/es803650w.
21 http://www.wmo.int/pages/prog/arep/gaw/documents/BlackCarbon_SDM.pdf.

SHORT-LIVED CLIMATE POLLUTANTS:

RISKS AND OPPORTUNITIES FOR BUSINESSES IN HIGH-EMITTING SECTORS



Agriculture, oil and gas, transport, waste management, and all sectors emitting hydrofluorocarbons (HFCs) from air conditioning, foams, or other manufacturing processes can integrate mitigation measures into the heart of their operations and supply chains. Each of these sectors can reduce SLCP emissions — with immediate or near-term results — and expect operational gains, as well as multiple benefits beyond climate, such as improved air quality and human health. Many companies are already engaged, recognizing the CCAC as a unique platform to provide cross-sector and multi-stakeholder collaboration.



RISK In shipping, fuel switching for low-sulphur fuels has a positive impact on reducing BC emissions while mitigating the health impacts of repeated airborne exposure to sulfur.

OPPORTUNITY Developing low-sulfur fuels is key to reducing emissions from the transport sector.

GLOBAL ACTION

Joining the Global Green Freight Program harmonizes existing green freight and ensure greater efficiency in freight transport, leading to reduced emissions and reduced costs.

RISK Other sectors rely on the waste management sector for less-emitting solutions and will expect solutions from it.

OPPORTUNITY As other sectors increase their reliance on the waste sector for their own emissions reductions, waste management companies can open up markets by offering solutions for these sectors.

GLOBAL ACTION

Landfill gas can be recovered and used to fuel power plants, manufacturing facilities, vehicles, or homes.

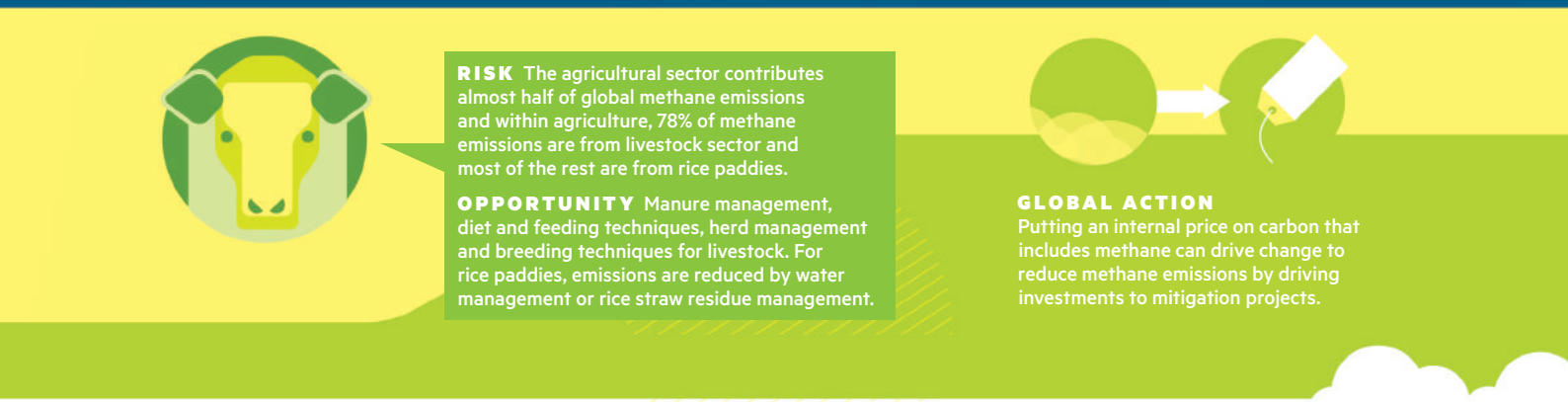
RISK There is an increasing demand from the investor community for "fossil-free" assets and portfolios.

OPPORTUNITY

Paying attention to investor activities is key to driving change to reduce methane emissions.

GLOBAL ACTION

Putting an internal price on carbon, or encouraging the adoption of a global price on carbon, including methane, can drive change to reduce methane emissions by driving investments to mitigation projects.



RISK The agricultural sector contributes almost half of global methane emissions and within agriculture, 78% of methane emissions are from livestock sector and most of the rest are from rice paddies.

OPPORTUNITY Manure management, diet and feeding techniques, herd management and breeding techniques for livestock. For rice paddies, emissions are reduced by water management or rice straw residue management.

GLOBAL ACTION

Putting an internal price on carbon that includes methane can drive change to reduce methane emissions by driving investments to mitigation projects.

MEASURES FOR BUSINESSES TO REDUCE SLCPs

There are a variety of ways businesses can reduce SLCPs. Strategies for reducing SLCPs might fall under three different areas: technology, operational practices, and systemic change. In most cases, these measures can be integrated into current business practices in ways that are **simple, pragmatic, and cost-effective.**

ADAPT/CHANGE END-USER TECHNOLOGY

Emissions from end-use of products are a significant source of SLCPs. Acting on this aspect of the value chain, either by introducing new products or new ways of using them, is one way to reduce emissions stemming from this source. Here are some specific ideas.

(a) Retrofit vehicles to reduce black carbon emissions. TRANSPORT
Retrofits most suitable to black carbon control include installing diesel particulate filters—at least in situations where low-sulfur diesel fuel is available. Many diesel emissions reduction programs in the United States, such as the EPA's National Clean Diesel Campaign,[22] also provide funding for different kinds of retrofits—"repowering" campaigns during which a vehicle's engine is replaced with a newer one built to stricter emissions standards or one burning cleaner fuel.[23]

(b) Develop innovative refining methods for low-sulfur fuels that emit less black carbon. TRANSPORT
Low-sulfur fuels are critical to lowering direct emissions of particulate matter and black carbon. By developing innovative refining methods, it has been possible to cut sulfur levels in fuels and to mitigate black carbon emissions.[24, 25]

(c) Use climate-friendly alternatives to HFCs. TRANSPORT AGRICULTURE
There is no "one size fits all" alternative for HFCs. This is due to a number of reasons: safety properties, chemical properties, end-use, and market availability of climate-friendly alternatives. For each category of product—whether the product is domestic, commercial, industrial refrigeration, air conditioning, or industrial process, usage—different alternatives will be required. In addition, especially for refrigeration and air conditioning sectors, ambient temperatures also will need to be taken into account. For instance, Unilever has observed a 10 percent energy usage reduction by freezers that use HFC alternatives.[26]

CHANGE OPERATIONAL PRACTICES

Making changes in operational practices and logistics such as improving supply chain management, stakeholder engagement, or measurement practices can reduce SLCP emissions significantly. In many cases these changes also can improve efficiency and management practices.

(a) Change organizational structures and incentives to facilitate reduced methane emissions from oil and gas production. OIL & GAS
Decision-making on reducing methane emissions is most likely to happen •••

[22] http://www2.epa.gov/cleandiesel.
[23] EPA 2015.
[24] Blumberg et al, 2003; Peckham, 2011.
[25] PCFV 2014.
[26] http://www.unileverusa.com/brands-in-action/detail/UNILEVER-AND-BEN-AND-JERRY-S-BRING-CLIMATE-FRIENDLY-FREEZER-CABINETS-TO-U-S-/302180/

BEST PRACTICE OF INCREASING ENERGY EFFICIENCY

In 2011 Unilever's average "Lean & Green" ice cream cabinets delivered up to 30 percent energy reductions compared to 2008 models with associated cost savings. From 2010 to 2013, the company purchased approximately 520,000 of these more energy-efficient freezers, resulting in approximately 40,000 tons of CO_2 emissions avoided.. In 2014 Unilever started piloting technologies that are capable of providing a 50-percent energy reduction. The company currently is exporing options that would increase this rate to 70 percent, which has the potential to deliver emissions reduction equivalent to removing half a million cars from the road.

> *To address the largest industrial source of methane globally, we encourage oil and gas firms operating within our borders to join the Climate and Clean Air Coalition's Oil and Gas Methane Partnership.*
>
> **GLACIER CONFERENCE COMMUNIQUÉ SIGNED BY 18 GOVERNMENTS,** Alaska, 31 August 2015

at headquarters level, whereas leaks occur at the asset level. Changes to organizational structures and incentives can be instrumental to facilitate implementation of methane-reducing measures. Research has indicated that five organizational features are key to the successful implementation of measures to reduce methane emissions. These are corporate strategy, climate goals, top-down attention and leadership, internal rewards and incentives, and stakeholder attention.

(b) Train employees to better manage loads in road freight to reduce black carbon emissions. TRANSPORT

Employee training is a relatively low-cost and simple method for reducing fuel consumption and (consequently) emissions from trucks. The strategy also has potential to reduce labor costs, because more efficient deployment of employees could result in fewer hours worked. Improving load factors and maximizing the capacity of vehicles is an attractive mitigation action, too. It is estimated that in Europe the load factor for freight vehicles is below 50 percent, leaving much room for improvement.[27] Through joint delivery and joint transport, shared delivery centers or hubs, companies that operate freight trucks can improve on this practice.

(c) Prioritize goods over ballast in maritime transport to reduce black carbon emissions. TRANSPORT

When they're not loaded down with goods, sea vessels must be loaded with ballast in order to ensure stability at sea. With this in mind, companies should load vessels as efficiently as possible to reduce the use of ballast water in favor of goods. Taking this step increases efficiency and reduces total emissions per ton of goods moved. Fuel switching while vessels are berthed also is an effective measure to reduce emissions, including black carbon.

(d) Change manure management, feeding techniques, herd management, and breeding to reduce methane emissions from animal farming. AGRILCULTURE

By changing manure management, increasing usage of manure digesters and separators, composting manure, and improving manure storage and handling practices, companies can reduce methane emissions at an average of approximately 20 percent per year. A baseline of manure management improvement also opens up new revenue streams by creating sellable energy from manure. Changing diet and feeding techiques is a low-tech, low-cost, and low-risk measure for reducing methane emissions. Modern herd management techiques also have the potential to reduce methane emissions, and often result in increased productivity.

(e) Change water and rice straw residue management in rice paddies to reduce methane emissions. AGRILCULTURE

Up to 120 million tons CO_2-equivalent of methane can be reduced[28] through two key operational changes in paddy rice production. Changing water management of rice paddies is one key measure, and can be implemented by ensuring mid-season drainages, multiple drainages, and shallow flooding where water levels are managed to keep soil humid. Ensuring rice straw residue is not burned or left on continuously flooded fields can reduce methane emissions even more. Since rice largely is grown in Asia, a regional approach is necessary to achieve maximum reductions.

SYSTEMIC CHANGE

(f) Shift toward a circular economy by developing new technologies and practices. WASTE

The main opportunities in the waste management sector relate to a shift to a circular economy, where products and materials are valued after what typically is thought of as end-use. Unlike in the traditional linear economic model, this move promotes recycling, reuse, and remanufacturing in ways that allow for materials that would have been discarded to be resold or recaptured. As a result, the strategy can generate additional revenue or cost savings in raw material procurement. According to the World Economic Forum (WEF), a shift toward a circular economy can generate up to US$1 trillion material cost savings for the global economy, and 100,000 new jobs. The move also can prevent 100 million tons of waste globally within five years.[29]

[27] Sathaye et al. 2006.
[28] California Environmental Associates, 2014.
[29] http://www3.weforum.org/docs/WEF_ENV_TowardsCircularEconomy_Report_2014.pdf.

BENEFITS FOR BUSINESS FROM SLCP REDUCTIONS

Reducing SLCPs provides a tangible and transformative way for businesses to innovate in a manner that is beneficial across a range of sustainability metrics, and consistent with other trends in the economy.

MORE EFFICIENT USE OF LOGISTICAL RESOURCES

TRANSPORT: By collaborating with shipper and freight carriers, HP provides tools to access the most current data, helping to reduce route times and identify less-emitting modes. According to interviews carried out for this report, nine out of ten times, HP associates estimated these efficiency gains are associated with cost savings.

REDUCED FEEDSTOCK WASTE

OIL & GAS: Venting and flaring in oil and gas production wastes valuable natural gas that instead could be used to generate power on production sites. Based on satellite data recorded by the World Bank, approximately 4.9 trillion cubic feet of natural gas is flared and vented every year.[30] In other words, annual gas flaring equates to 20 percent of annual gas consumption in the United States,[31] approximately 30 percent in the European Union,[32] and 20 percent in Russia.[33] If this amount of associated gas were used for power generation, it could provide more electricity (750 billion kilowatt hours) than the entire African continent is consuming today.[34]

INCREASED ENERGY EFFICIENCY

HFCs: Improving the efficiency of air conditioners and using lower global warming potential refrigerants would not only yield an estimated 98 billion tons of avoided CO_2.emissions by 2050, but also would provide an energy savings of between 540 and 1270 gigawatts in peak load electricity demand by 2050, equivalent to avoiding between 1,090 and 2,540 medium-sized 500 MW peak power plants globally.[35]

PRODUCT INNOVATION

In the chemicals sector, growing regulation and the increased demand for lower-emitting refrigeration and air-conditioning solutions has led many companies to innovate their products.

HFCs: Arkema, a French specialty chemicals and advanced materials company, has found that through a combination of collaborating with customers and heeding market signals, the company was able to develop a series of HFCs with a null ozone-depleting potential, meaning they cause no degradation to the ozone layer whatsoever.

BUSINESS MODEL INNOVATION

WASTE: The main opportunities in the waste management sector all pertain to a shift toward a circular economy where products and materials are valued after what is typically thought of as their end-use. This requires rethinking and redesigning most elements of value chains as they exist currently.[36]

REVENUE GENERATION

AGRICULTURE: For example, dairy and livestock farms can convert the methane gas from cow manure into electricity. In these cases, the excess energy is either used for providing energy to production facilities or sold back to the local power utility's grid. In 2011, approximately 180 biogas recovery systems were operating on American commercial livestock farms, and they produced enough electricity to power the equivalent of 47,000 homes.[37]

OIL & GAS: It is estimated that the worldwide potential for

reducing yearly emissions of SLCPs at negative or zero cost is greater than 600 million tons of CO_2. Many of these measures increase operational efficiency and minimize losses.[38] Of the SLCPs, methane abatement options provide the largest and most cost-effective reduction potential. The most effective abatement options come from the natural gas and waste sectors.[39] According to a report commissioned by the World Bank, "if gas is valued at an average price of US$4 million British thermal unit (Btu), the 140 billion cubic meters of gas that is flared annually would be worth about US$20 billion." What is flared annually is equivalent to roughly 20 percent of the United States' gas consumption and more than 30 percent of the European Union's gas consumption.[40]

WASTE: Morocco is creating a new market and growing an existing one for waste management businesses. In its Intended National Determined Contribution (INDC) document, Moroccco has committed to reducing 18 percent of its GHG emissions by focusing on the waste sector, which has been growing at the same rate as production and consumption in the country.[41] This includes measures to establish landfill and recycling centers for household waste for the benefit of all urban areas by 2020 or to develop chains of "sorting-recycling-recovering" with sorting pilot projects to achieve a 20 percent recycling rate by 2020.[42]

CONTRIBUTION TO CLIMATE GOALS

Given the role of SLCPs in climate change and projections about how they will continue to grow in impact, businesses can reach emissions reduction goals faster and more effectively by integrating SLCP mitigation into their strategies. According to UNEP, fast action on pollutants such as black carbon and methane may help limit near-term global temperature rise and significantly increase the chances of keeping the temperature rise below 2°C, and perhaps even below 1.5°C.[43]

In addition to contributing to curbing global temperature rises, SLCP action has multiple benefits that can be observed in the near term: improved air quality, health benefits for surrounding communities, waste reduction, strengthened stakeholder engagement, and reduced congestion in cities. While co-benefits seldom are a driving force by themselves, they can bolster the case for SLCP mitigation: The process can set a company on the path to fulfilling other sustainability commitments.

CONTRIBUTION TO DEVELOPMENT GOALS

Reducing SLCPs will bring multiple benefits for public health, air quality, food, and energy security. The effort also will help to alleviate poverty. On the issue of health in particular, both black carbon and tropospheric ozone are major air pollutants contributing to approximately 7 million deaths in 2012.[44] Ambient ozone pollution also is a major contributing factor in asthma-induced deaths.[45] Implementing measures to reduce black carbon and methane emissions have the potential to avoid 2.4 million annual premature deaths by 2030 from outdoor pollution alone. In relation to food security, reducing black carbon and methane emissions could avoid around 50 million tons in annual crop losses globally by 2050.[46] Agriculture is affected by black carbon emissions because the emissions affect temperatures, cloudiness, rainfall amounts and patterns, and river flow (by impacting glacier melting and evaporation).

30 http://siteresources.worldbank.org/INTGGFR/Resources/Guidance_Document_Flaring_Estimates_Produced_by_Satellite_Observations.pdf (Latest figures are from 2011.)
31 https://www.eia.gov/dnav/ng/hist/n9140us2A.htm.
32 https://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=3&pid=26&aid=2.
33 https://www.eia.gov/beta/international/analysis.cfm?iso=RUS.
34 http://www.worldbank.org/en/news/press-release/2015/04/17/countries-and-oil-companies-agree-to-end-routine-gas-flaring.
35 Shah et al. 2015. *Benefits of Leapfrogging to Superefficiency and Low Global Warming Potential Refrigerants in Air Conditioning.* http://eetd.lbl.gov/sites/all/files/lbnl-1003671_0.pdf.
36 http://www3.weforum.org/docs/WEF_ENV_TowardsCircularEconomy_Report_2014.pdf.
37 EPA, 2010 Biodigester Update. Retreived from http://www.epa.gov/agstar/documents/2010_digester_update.pdf.
38 Bankuti et al. 2011.
39 IEA 2013.
40 The World Bank 2015.
41 According to its National Communication to the UNFCCC in 2010, Morocco has estimated that the share of GHG emissions attributable to the waste sector in its global emissions would more than double in 2030 compared to a 2000 baseline. http://unfccc.int/resource/docs/natc/mornc2f.pdf.
42 http://www4.unfccc.int/submissions/INDC/Published%20Documents/Morocco/1/Morocco%20INDC%20submitted%20to%20UNFCCC%20-%205%20june%202015.pdf.
43 http://www.unep.org/annualreport/2011/docs/UNEP_Annual_Report_2011.pdf.
44 WHO 2014. Burden of Disease from Household Air Pollution for 2012.
45 Lim S., et al. (2012) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990—2010: a systematic analysis for the Global Burden of Disease Study 2010. ("Using simulated concentrations for 2000 and 1850 and concentration–response functions (CRFs), we estimate that, at present, 470,000 (95% confidence interval, 140,000 to 900,000) premature respiratory deaths are associated globally and annually with anthropogenic ozone, and 2.1 (1.3 to 3.0) million deaths with anthropogenic PM2.5-related cardiopulmonary diseases (93%) and lung cancer (7%).")
46 UNEP & WMO 2011; Carvalho et al. 2013.

One company cannot do it alone; there must be a consolidated effort to tackle short-lived climate pollutants.

GARY CRAWFORD,
vice president, public affairs, Veolia

EXAMPLE OF INCREASING ENERGY EFFICIENCY

Seventy percent of the coolers bought annually by Annheuser Busch, an American brewing company with US$15 billion in annual revenue, are eco-friendly, leading both to energy efficiency increases and reduced HFC emissions. This plan will contribute to reducing the company's GHG emissions per hectoliter of production by 10 percent, including a specific 15 percent reduction per hectoliter in China, as well as to decreasing global energy usage per hectoliter of production by 10 percent.

FIRST STEP
GET INVOLVED WITH CCAC AND OTHER INITIATIVES

Reducing SLCPs is part of a global effort. Global action requires strong collaboration within and across sectors, as well as with policymakers. As a first step, businesses can take action through participation in one or more of the CCAC's 11 initiatives and can benefit from technical guidance and peer-to-peer learning.

OIL & GAS: CCAC OIL AND GAS METHANE PARTNERSHIP

After agriculture and forestry, the oil and gas industry is the largest manmade emitter of methane, which is more than 80 times more potent than CO_2.[47] The CCAC's Oil and Gas Methane Partnership helps oil and gas companies manage emissions. Founding company partners include BG-Group, Pemex, Eni, PTT, Southwestern Energy, Statoil, and Total; technical partners comprise Natural Gas Star, EDF, and the Global Methane Initiative to name a few.

As members of the **Oil and Gas Methane Partnership**, companies and partners are working together to research and analyze the major sources of methane emissions in upstream operations; evaluate technologies that can support aggressive emissions reductions; and communicate the impact they are driving as a result of these efforts. Most important, the ultimate goal of the group is to create a global standard that will guide companies on the subject of methane reductions across the oil and gas industry by helping the companies measure and report emissions more accurately.

AGRICULTURE: CCAC INIITIATIVE ON ADDRESSING SLCPS FROM AGRICULTURE

CCAC's **Agriculture Initiative** reduces emissions by focusing on four key areas: the cultivation of paddy rice, livestock and manure management, open agricultural burning, and enteric fermentation. Near-term, low-cost reduction opportunities in the livestock sector include direct capture of methane emissions, which can reduce up to 40-50 percent of current emissions.

The Paddy Rice Component supports the use of alternating wetting and drying practices in order to improve rice yields and reduce environmental impacts in Vietnam, Colombia, and Bangladesh. Technically this strategy is called Alternate Wetting and Drying, and applying it in paddy rice production in conjunction with reducing methane emissions lowers water use and costs.

[47] http://www.ccacoalition.org/en/content/ccac-oil-gas-methane-partnership.

HFCs — OPTIONS FOR ENGAGEMENT

1 One of the ways to get involved in adopting alternatives to HFCs: Joining collaborative groups. Refrigerants, Naturally! was launched in 2004 by the Coca-Cola Company, Unilever, and McDonald's, and was later joined by PepsiCo and Red Bull. This group encourages investment in low-carbon technologies and embraces a shared commitment to eliminate fluorinated gases such as chlorofluorocarbons, hydrochlorofluorcarbons, and HFCs in point-of-sale cooling appliances. By joining Refrigerants Naturally!, companies from manufacturers of refrigerants and actors in agri business to retailers and distributors commit to an HFC-free future for cooling and freezing units in an example of collaboration across the value chain.. Participants achieve these goals by replacing man-made refrigerants with natural refrigerants, using HFC-free insulation material, and reducing the energy consumption of new refrigeration equipment.

2 Joining the Global Cold Chain Alliance offers another way to share best practices and knowledge with peers along the entire value chain of food refrigeration. Launched in 2007 by Association of Refrigerated Warehouses and the World Food Logistics Organization, the group aims to educate and offer networking opportunities to all stakeholders involved in the management of temperatures of food across the value chain.

3 The Global Refrigerant Management Initiative also provides an opportunity for companies to get involved. Founded in 2014 by The Alliance for Responsible Atmospheric Policy, the Air-Conditioning, Heating and Refrigeration Institute, and the Brazilian Association for HVAC-R in 2014, the group seeks to share knowledge with management in the global supply chain on ways to improve practices and to reduce leaks and service emissions, particularly where current leak rates are the greatest.

HFCs: CCAC INITIATIVE ON PROMOTING HFC ALTERNATIVE TECHNOLOGY AND STANDARDS

Through the **HFC Alternatives Initiative**, CCAC endeavors to reduce the projected growth in use and emissions of high-GWP HFCs. More specifically, the initiative aims to mobilize efforts of the private sector, civil society, international organizations, and governments in overcoming barriers that limit the widespread introduction of climate-friendly technologies in order to promote three distinct efforts: adopting climate-friendly HFC alternatives; building international awareness and support for approaches to curb HFC growth; and encouraging responsible management and design of equipment in order to minimize leaks.

Under the CCAC HFC Alternatives Initiative, coalition partners support developing HFC inventories and studies, exchanging information on policy and technical issues, demonstrating projects to validate and promote climate-friendly alternatives and technologies, and various capacity-building activities to disseminate information on emerging technologies and practices. The overarching goal is to transition away from high-GWP HFCs and minimize HFC leakages.

TRANSPORT: CCAC INITIATIVE ON REDUCING BLACK CARBON EMISSIONS FROM HEAVY-DUTY DIESEL VEHICLES AND ENGINES

Heavy-duty diesel engines and equipment are significant sources of harmful emissions. Most of the emissions from older diesel vehicles come in the form of particulate matter, 75 percent of which is typically black carbon. Particulate matter is among the top human health risk factors, resulting in millions of premature deaths worldwide every year. With this in mind, CCAC's **Heavy-Duty Diesel Vehicles and Engines Initiative** aims to catalyze major reductions in black carbon through adoption of clean fuel and vehicle regulations. The initiative also supports policies in order to address harmful emissions from diesel vehicles.

This initiative endeavors to lay the technical and political groundwork that will enable global black carbon emission reductions by developing: 1) A global fuel sulfur strategy that addresses the major hurdles facing low-sulfur fuels today, from financing to obstructive subsidies and political inertia; 2) National programs to address emissions from the existing vehicle stock; and 3) A high-level coalition of industry, country, and NGO leaders to improve the energy efficiency and environmental performance of freight operations worldwide. The Initiative works with several countries in Latin America, Africa, and Asia to produce black carbon inventories, form national task forces and regional coalitions for harmonized black carbon reduction strategies and policies, and set target dates for the introduction of fuel sulfur-content standards.

WASTE: CCAC INITIATIVE ON MITIGATING SLCPS FROM THE MUNICIPAL SOLID WASTE SECTOR

Municipal solid waste landfills are the third largest source of global methane emissions, while the practice of open garbage burning emits black carbon and other toxic compounds and GHGs. CCAC's **Municipal Solid Waste Initiative** aims to reduce methane and air pollution across the sector by securing city and country commitments to undertake a variety of best practice policies and strategies for waste management. Through technical assistance, training, capacity-building, and awareness-raising, cities work to mitigate emissions of methane, black carbon, and other pollutants as they transition to more sustainable waste management options.

The Municipal Solid Waste Initiative has helped 10 cities to implement city action plans on SLCPs, and additional cities are waiting to join the effort. Some cities are mentoring others, and the group has established an online knowledge platform to help scale up the effort from individual cities to nations and regions.

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ABOUT

ABOUT THE CCAC

The Climate and Clean Air Coalition (CCAC) is the only global effort that unites governments, civil society, and the private sector in an ongoing effort with the goal of improving air quality and protecting the climate by reducing SLCPs across sectors. In addition to helping mitigate CO_2 emissions, CCAC acts as a catalyst to create, implement, and share immediate solutions addressing near-term climate change to improve people's lives, and to ensure sustainable development down the road. The CCAC's mission is to support and inspire collective and individual actions that reduce SLCPs in the hopes of improving people's health, increasing food security, enhancing energy efficiency, alleviating poverty, and addressing climate change.

> *Fast action on pollutants such as black carbon and methane may help limit near-term global temperature rise and significantly increase the chances of keeping temperature rise below 2°C, and perhaps even 1.5°C.*
>
> **UNEP,** 2011

ABOUT BSR, A CCAC PARTNER

BSR is a global nonprofit organization that works with its network of more than 250 member companies and other partners to build a just and sustainable world. From its offices in Asia, Europe, and North America, BSR develops sustainable business strategies and solutions through consulting, research, and cross-sector collaboration. Visit www.bsr.org for more information about BSR's 25 years of leadership in sustainability.

This report highlights a BSR climate-risk mapping strategy that is a pillar of a larger campaign to reduce emissions that contribute to climate change. That campaign, called "Business in a Climate-Constrained World", seeks to address the causes of climate change through significant greenhouse gas reductions consistent with holding the increase in global average temperature to well below 2˚C. and to increasing the adaptive capacity of business and society in order to anticipate, absorb, accommodate, or recover from the climate impacts that are already widespread and consequential. To achieve this we work with business to understand climate risk and build comprehensive strategies for climate resilience.

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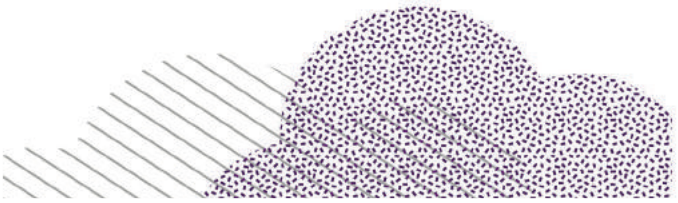

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