

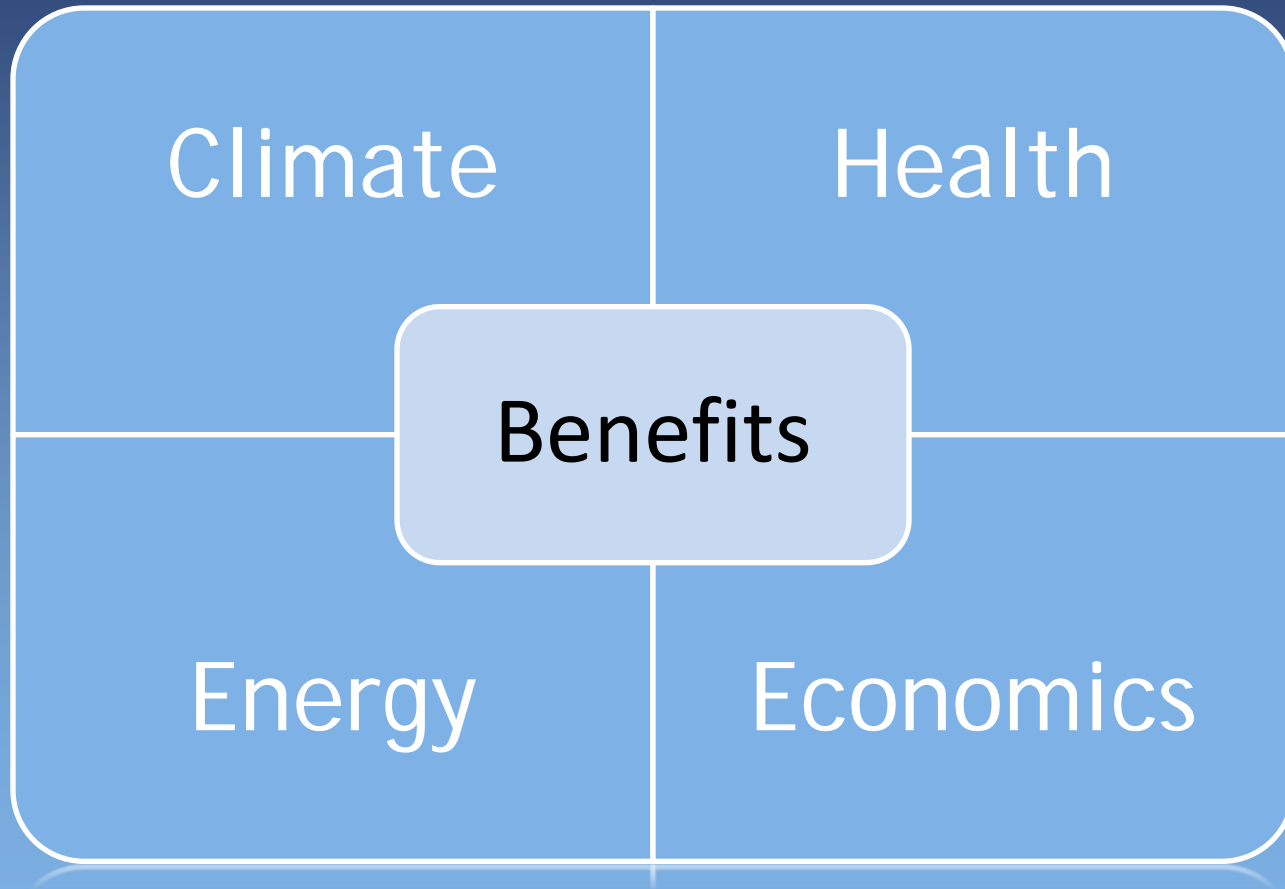
Reducing Black Carbon Emissions from Open Burning: A Co-benefit of Landfill Methane Recovery

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Multiple Cobenefits of Landfill Methane Recovery





Short-lived Climate Pollutants (SLCPs)

- ✓ A subset of greenhouse gases and aerosols that contribute to global warming and remain in the atmosphere for shorter time periods compared to other, long-lived greenhouse gases like carbon dioxide
- ✓ SLCPs from the solid waste sector
 - Methane
 - Black carbon

Role of Methane and Black Carbon as Climate Pollutants

- ✓ Black carbon and methane are the second- and third-largest contributors to global warming after carbon dioxide^{*}
- ✓ Black carbon's contribution to global warming is approximately 70% of carbon dioxide's contribution^{*}
- ✓ Methane's contribution to global warming is approximately 55% of carbon dioxide's contribution^{*}
- ✓ Because of their short lifetimes (e.g., days to weeks for black carbon), reducing emissions now can result in near-term climate benefits

^{*}Bond et al., 2013

Air Quality and Human Health Impacts

- ✓ Black carbon is a component of particulate matter. It contributes to all the same adverse impacts on human health that are associated with fine particulate matter (PM_{2.5})
- ✓ Methane contributes to the formation of tropospheric ozone, which is also an air pollutant
- ✓ Reducing emissions of black carbon and methane can result in an estimated 2.4 million premature deaths avoided annually*

*UNEP/WMO, 2011

What is Black Carbon



Artist rendition of black carbon cloud droplets. Source: NASA

- ✓ Black carbon is the most strongly light-absorbing component of particulate matter
- ✓ Formed by the incomplete combustion of fossil fuels, biofuels, and biomass
- ✓ Emissions patterns and trends vary significantly across regions, countries, and sources
- ✓ Black carbon is an aerosol (not a greenhouse gas)
- ✓ Remains in the atmosphere for as little as a few days to a week before falling to the surface

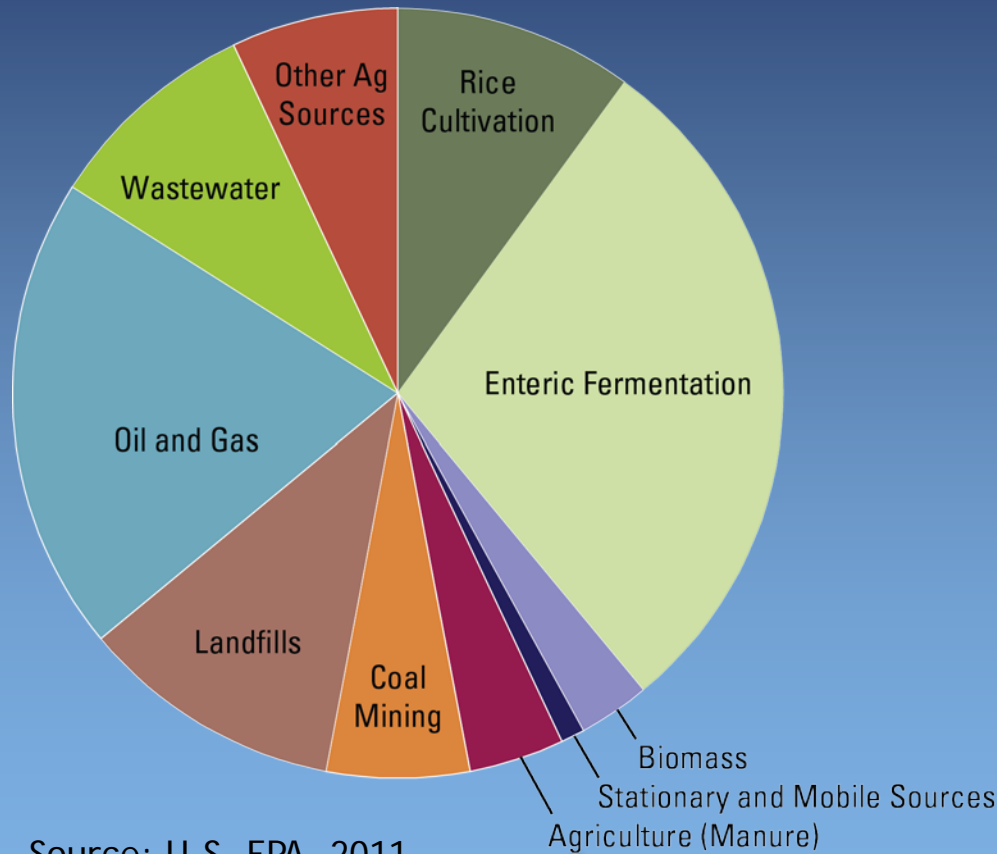
Terminology*

- ✓ Black carbon is a solid form of mostly pure carbon that absorbs solar radiation (light) at all wavelengths
- ✓ Organic carbon generally refers to the mix of compounds containing carbon bound with other elements like hydrogen or oxygen
- ✓ Brown carbon refers to a class of organic carbon compounds that absorb ultraviolet and visible solar radiation
- ✓ Carbonaceous particulate matter includes black carbon and organic carbon - primary combustion particles are largely composed of these materials
- ✓ Soot, a complex mixture of mostly black carbon and organic carbon, is the primary light-absorbing pollutant emitted by the incomplete combustion of fossil fuels, biofuels, and biomass

*U.S. EPA, 2012

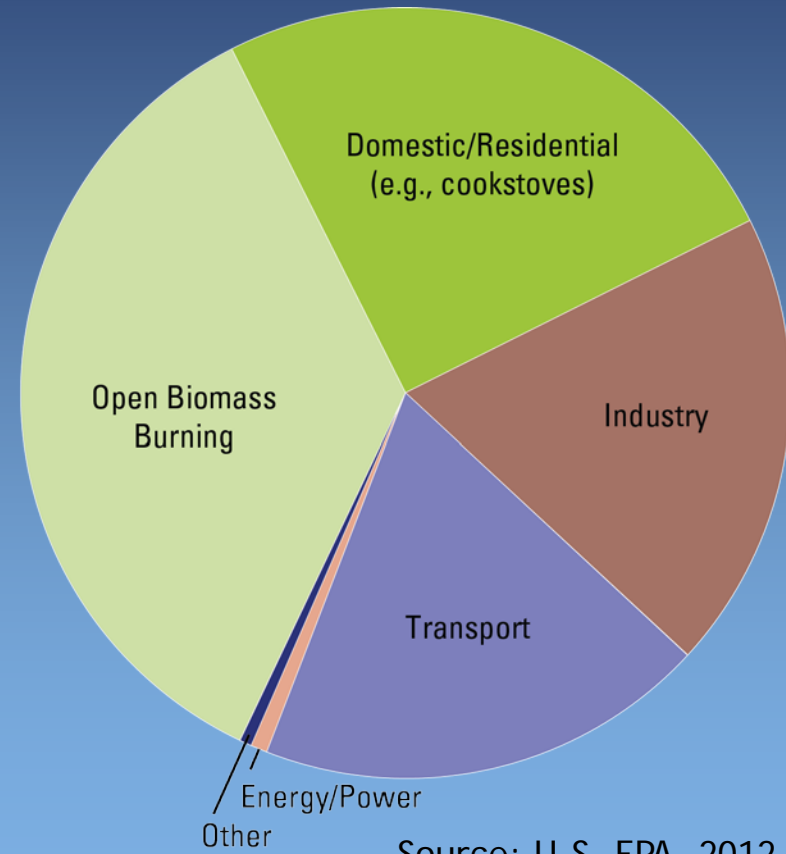
Sources of Methane and Black Carbon

Global methane emissions by source (2010)



Source: U.S. EPA, 2011

Global black carbon emissions by source (2000)



Source: U.S. EPA, 2012

Open Burning of Waste



- ✓ Open waste burning is common in many countries
- ✓ Deliberate waste burning by
 - Municipal employees and landfill workers to reduce waste
 - Homeless people to keep warm
 - The informal recycling sector to recover scrap metals
 - Residents who lack waste collection services
- ✓ Incidental waste burning

Impacts of Open Burning

✓ Health impacts

- Particulate matter emissions
- Emissions of dangerous carcinogens, including dioxins and furans
- Pollution of local water resources

✓ Economic impacts

- Fire fighting costs
- Property damage

✓ Climate impacts

Does Waste Burning Contribute to Warming?

- ✓ Composition of emissions
 - Ratio of black carbon to organic carbon
 - Other co-emitted pollutants (sulfate and nitrate particles)
- ✓ Some factors that affect composition
 - Fuel source (fossil fuels, biofuels, biomass)
 - Efficiency of combustion (oxygen and temperature)
 - Atmospheric processes (lifetime, location)

Municipal Solid Waste (MSW) Framework

1. Address open burning
2. Improve solid waste collection system
3. Use of landfills and waste to energy as final disposal options
4. Organic diversion programs: composting and anaerobic digestion
5. Recycling program
6. Waste prevention
7. Sustainable MSW financing system

Addressing Open Burning



- ✓ Black carbon and methane emissions reductions
- ✓ Development cobenefits:
 - Improved sanitation
 - Improved air quality
 - Reduced property damages
 - Improved land use

Improving Solid Waste Collection Systems



- ✓ Black carbon and methane emissions reductions
- ✓ Development cobenefits:
 - Improved sanitation
 - Improved air quality
 - Improved water quality
 - Economic development
 - Reduced property damages

Using Landfills and Waste to Energy as Final Disposal Options



- ✓ Black carbon and methane emissions reductions
- ✓ Development cobenefits:
 - Improved sanitation
 - Improved air quality
 - Improved water quality
 - Economic development
 - Energy security
 - Improved land use

Instituting Recycling Programs



- ✓ Black carbon and methane emissions reductions
- ✓ Development cobenefits:
 - Resource conservation
 - Economic development

Substantial Data Gaps

- ✓ Waste composition
- ✓ Waste collection
- ✓ Open burning practices and locations
- ✓ Composting
- ✓ Recycling
- ✓ Waste to energy
- ✓ Landfills

Analytical Activities

- ✓ Identify mitigation options
- ✓ Estimate emissions through modeling
- ✓ Identify leveraging factors and barriers
- ✓ Conduct feasibility assessments
- ✓ Evaluate mitigation options
- ✓ Prioritize mitigation options

Climate and Clean Air Coalition (CCAC)

- ✓ Currently collecting city-specific information using detailed questionnaires
- ✓ Questionnaires can help inform understanding of barriers and enabling factors in each city
- ✓ Ultimately can be used to determine the best strategies for mitigating emissions and achieving the most development cobenefits



CCAC MSW Initiative

- ✓ Provide technical support and capacity building in pilot cities
- ✓ Help develop strategies for reducing SLCPs from waste management activities
- ✓ Build a knowledge network for sharing best practices in cities around the world
- ✓ Use the MSW framework to understand opportunities for SLCP emissions mitigation

Solid Waste Sector: GMI and CCAC

- ✓ GMI focuses on capacity building and promotes the development of sanitary landfills and methane recovery
- ✓ Feedback from GMI stakeholders: Need capacity building for all aspects of solid waste management
- ✓ CCAC focuses on reducing methane and black carbon at all stages of waste management

References

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