IDENTIFYING AND EMBEDDING MITIGATION OPPORTUNITIES FOR SLCPs IN INDIA

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<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Sources of Emission</th>
<th>Lifetime</th>
<th>Major Impact</th>
<th>Type of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black carbon (BC)</td>
<td>Biomass cookstove</td>
<td>Days</td>
<td>Global:</td>
<td>Ice and Snow melting, Rainfall patterns and human health</td>
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<td></td>
<td>Diesel Exhaust</td>
<td></td>
<td>Regional:</td>
<td></td>
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<td></td>
<td>Black Coal</td>
<td></td>
<td>Local:</td>
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<tr>
<td>Tropospheric Ozone (O₃)</td>
<td>CH₄</td>
<td>weeks</td>
<td>Global:</td>
<td>Atmospheric warming, agricultural production and human health</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td></td>
<td>Regional:</td>
<td></td>
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<tr>
<td></td>
<td>CO</td>
<td></td>
<td>Local:</td>
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<td></td>
<td>VOCs</td>
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<td></td>
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<tr>
<td>Methane (CH₄)</td>
<td>Natural Gas</td>
<td></td>
<td>Global:</td>
<td>Climate and human health</td>
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<tr>
<td></td>
<td>Livestock</td>
<td></td>
<td>Regional:</td>
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<td></td>
<td>Waste</td>
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<td>Local:</td>
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<td>Hydrofluorocarbons (HFCs)</td>
<td>Air Conditioning</td>
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<td>Global:</td>
<td>Atmospheric warming</td>
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<tr>
<td></td>
<td>Refrigeration</td>
<td></td>
<td>Regional: NA</td>
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<td></td>
<td></td>
<td>Local: NA</td>
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Objectives

1. Promote a more integrated mitigation approaches for air pollution and Short Lived Climate Pollutants (SLCP), emphasizing the benefits of including such approaches in India

2. Generate background report to engage with stakeholders, organise stakeholder consultations

3. Propose a list of recommendations for how mitigation action can be strengthened
Key Sectors Identified

Agriculture Sector
Residential Sector
Waste Management Sector
Power Sector
Industry Sector
Transport Sector
Micro, Small & Medium Enterprises
Climate change and Human Health
Why these sectors?

- In India, 68.7% percent of GHG emissions come from the **energy sector**, followed by agriculture, industrial processes, land-use change and forestry, and waste sector (FAOSTAT, 2018)

- **Residential sector** contributes 59% of SLCPs emissions followed by industry, transport, agriculture and others (Venkataraman et al., 2016)

- **Municipal Landfills** are the major source of GHG/SLCPs emissions where, CH$_4$ contributes 29% of the total GHG emissions from the country, higher than the global average of 15% (Singh et al., 2018)

Source: WRI, 2017 and FAOSTAT, 2018
Emissions of **SLCPs** and **GHGs** by different Sectors and Technologies in India

- **SLCPs** in India arise from three main sectors:
  - residential cooking and lighting,
  - informal industry (including brick production), and
  - open burning of agricultural residues

- In contrast **GHG emissions** arise from
  - thermal power generation and
  - heavy industry sectors

(Venkataraman, et al., 2016)

Source: MT CO2-eq of (a) SLCPs and (b) GHGs from India in 2015, calculated using GWP-20 (Venkataraman, et al., 2016)
Agriculture Sector: Emission and Impacts

- Agriculture is second highest source (19.6% of total GHG emissions) (FAOSTAT, 2018)
- In India, more than 60% of methane emissions are from livestock followed by rice cultivation and soils (Sharma, 2020)
- In India, agriculture accounts for approximately **58% of total emissions of N₂O**, which are mostly caused by application of fertilizers (Sharma, 2020)
- Agriculture emissions increased up to 25% from 1990 to 2014 (Khan, 2021)
- Across India an **estimated 30% of food is wasted** (IISD Report, 2020)

![Percentage contribution of methane emission from different sources of agriculture sector](chart.png)

Source: Sharma (2020)
We have **SOLUTIONS** to Agriculture Emissions

- Improve Paddy Cultivation and Management
- On Farm Composting to reduce waste burning
- In-situ and Ex-situ Management of Crop Residue
- Bio gas Production
- Bio-CNG from Dung, Palanpur - Banas Dairy
- Restoration of Degraded Land
- Agriculture Waste to Energy
- Livestock management and reduce enteric fermentation
- Happy Seeder to Reduce Crop Burning
- Cold Chain
Access to **Clean Cooking and Electricity in India**

- Residential sector is a major contributor to PM$_{2.5}$ and black carbon emissions (Venkataraman et al., 2018)
- Some 660 million Indians remain without access to modern, clean cooking fuels or technologies (IEA, 2021)
- The government has broadened availability to LPG through different schemes; still nearly half of all households in 2019 continued to rely on biomass for cooking
- India connected almost half a billion people to the electricity grid during the last decade; attaining universal access to clean cooking is the next big challenge (IEA, 2021)
- Household air pollution has been identified as the biggest cause of premature mortality in India, exposing about 60% of population to it (Gurjar, 2021)

Source: IEA, 2021
Alternatives to **Reduce** Residential Emissions

- **Clean Cooking**
- **Improved Biomass Cookstoves**
- **Switching to Energy Efficient Devices**
- **Pradhan Mantri Ujjwala Scheme**
- **Ujala Scheme**
- **India’s Cooling Action Plan**
- **Sobhagaya Scheme**
- **HFCs Phase-Out Plan**
In India, per capita waste generation is **450 grams per day**, and has increased at a rate of **1.3 percent per annum** (Report of the Task Force on Waste to Energy).

MoEFCC revised and notified the Solid Waste Management Rules in April 2016 which
- Prohibits waste generators from throwing, burning or burying solid waste in open public spaces
- Waste **generators to segregate** waste at source and allocate dry waste such as paper, plastic, glass and metal for recycling and reuse,
- **Promotes door-to-door collection** of segregated waste
- Utilize wet waste from the kitchen for composting or bio-methanation

The rules for waste segregation and recycling are poorly implemented, and many cities have failed to integrate door to-door collection (Singh, 2020)
Interventions to **Manage** Waste Emissions

- **Swachh Bharat Mission**
- **Waste-to-Energy**
- **Door-to-Door Collection, Trichy (India)**
- **Integration of Informal Sector in Solid Waste Management, Bangalore, India**
- **Plastic Waste Management**
- **Dumpsite Remediation**
- **Zero Waste Campaign**
- **Decentralize Waste Management, Indore**
Current Scenario and emissions from energy sectors

Key sources of emissions such as burning of fossil fuels from industrial activity or transport release both air pollutants and GHGs (Ramanathan, 2020).

01: Transport
Within inhouse sources this sector has highest sensitivity towards tropospheric ozone conc. (Sharma et al. 2016)

02: Industry
2nd highest sensitivity towards tropospheric ozone conc. (Sharma et al. 2016) including contributions from (MSME’s)

03: MSMEs
Don’t have any mandatory environmental law or regulation which aggravates the issue of air pollution from this sector.

04: Power
3rd highest sensitivity towards tropospheric ozone conc. (Sharma et al. 2016)

% National contributions

- NOX: 46%
  - Biggest contributor of NOX emissions in India (Singh et al. 2020)
- BC: 22%
  - 2nd biggest contributor on BC emissions (including all industries)
- SLCP: 15%
- NOX: 23%
  - 2nd major contributor of NOX emissions in India (Singh et al. 2020)
  - Of which 40% is contributed from Brick production
Interventions in the energy sectors

- Installation of control technologies
- Coal beneficiation
- Renewable energy
- Smart grid mission
- Incentivizing EV’s
- Transformative mobility solutions
- Diversifying freight transport
- Hydrogen fuel cell
- National Mission for Enhanced Energy Efficiency
- Emission trading scheme
- Environmental audit
- Zoning atlas for setting of industries
Due to the intricate scientific linkage between air quality and climate change, clear policy guidance embedding the interaction between the two is required and the following opportunity exists in India for such policy development -

- Establishing national scenarios for policy learning and innovation
- Emphasizing integrated action in key regions and sectors
- Setting and delivering national targets
- Legal frameworks and standards

Opportunities for embedding SLCP mitigation in India
Thank you

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The Energy and Resources Institute (TERI)
Reference


CCAC, 2014. Time to Act, Climate and Clean Air Coalition to Reduce Short-lived Climate Pollution (CCAC), Paris, France.


