ASSESSING THE IMPACT OF LONG-TERM CLIMATE ACTIONS ON REGIONAL EMISSIONS: A SLCP-FOCUSED STUDY OF PUNJAB AND HARYANA, INDIA

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INTRODUCTION

This study assesses short-lived climate pollutant emissions in Punjab and Haryana, focusing on sources, trends, and their implications for environmental and public health. Key findings highlight that the cooking sector, especially solid fuel use, contributes significantly to carbon monoxide (CO) and black carbon (BC) emissions. Industrial, transport, and non-energy sectors, such as landfill methane and agriculture, also impact air quality. While cleaner technologies have been introduced, challenges remain in estimating non-energy sector emissions and assessing policy effectiveness. The study calls for improved data, targeted interventions, and interdisciplinary efforts to enhance air quality management and public health in the region.

OBJECTIVES & RESEARCH QUESTIONS

- To conduct a holistic assessment of Short-lived climate pollutants (SLCPs) in Punjab and Haryana.
- To perform sectoral emission assessment for Punjab and Haryana.
- To quantify the reduction potentials of state action plans and climate change policies.
- What is the specific impact of SLCP-focused strategies on emissions?
- What are the potential reductions in emissions achievable through targeted mitigation strategies?
- What are the key policy implications and recommendations for improving air quality and reducing emissions in Punjab and Haryana?

MATERIALS AND METHODOLOGY

- **Utilizing Low-Emissions Analysis Platform (LEAP) Software:** Modelled SLCP emissions, projected energy supply and demand, identified potential issues, and evaluated impacts of energy policies.
- **Emission Inventory Development:**

STEP 1: Identifying the source sectors- Energy and non-energy sectors are taken into account. Exclusions are commercial sector, legacy waste and railway transport.

STEP 2: Data collection- From various datasets by ministries of the Government of India and converting them into the units compatible with the LEAP energy model.

STEP 3: Evaluating historical trends and establishing current accounts- Emissions are estimated based on technology type, efficiency, fuel used, and emission factors. For non-energy sectors, IPCC 2006 guidelines has been followed.

STEP 4: Identifying key stressors and improvement potential- Mitigation opportunities such as business-as-usual (BAU) scenario and alternate scenarios are created.

STEP 5: Scenario analysis- This approach assessed the potential reduction in emissions and pollutant concentrations resulting from specific interventions.

CONCLUSION AND WAY FORWARD

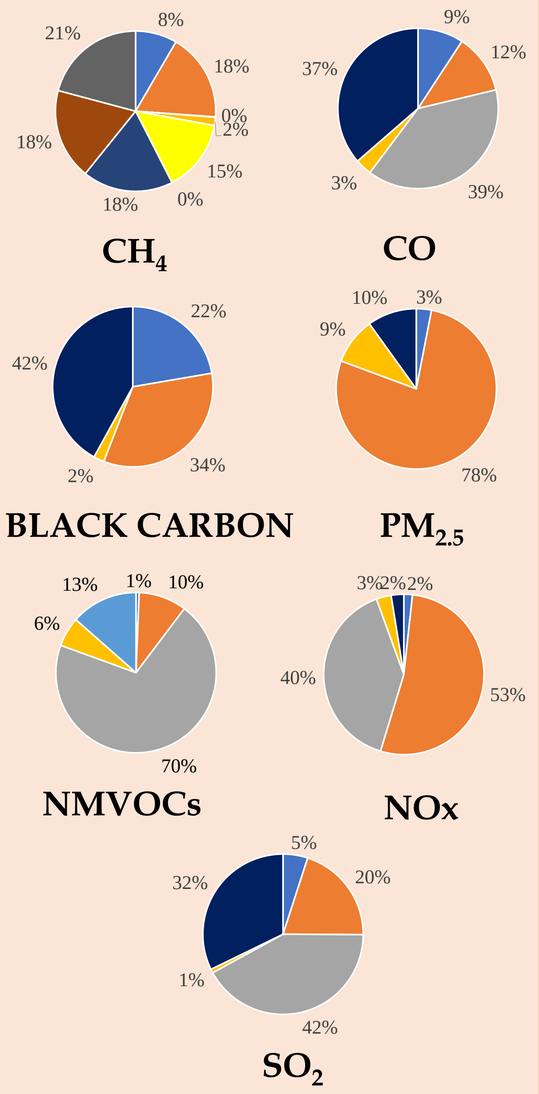
The study highlights the dominant role of the cooking sector, particularly the use of solid fuels like wood and charcoal, in emitting carbon monoxide (CO) and black carbon (BC). Additionally, insights into industrial emissions, transportation-related emissions, and non-energy sector emissions such as landfill methane emissions and agricultural activities have been elucidated. Critically, the analysis underscores the need for targeted interventions and policy measures to mitigate short-lived pollutants climate effectively. Addressing emissions from agriculture and waste management demands innovative solutions and collaborative approaches.

Future research should focus on improving emission inventories, especially in non-energy sectors like agriculture and waste management, to address data gaps. Enhanced data collection and real-time monitoring systems can improve accuracy. Further research should also focus on the evaluation of existing policies to determine their effectiveness in reducing short-lived climate pollutants (SLCPs). Policymakers can use this knowledge to tailor interventions that better target the most critical emission sources. Additionally, research into innovative technologies for emission reductions in key sectors—especially clean cooking solutions and industrial emissions—should be expanded.

SECTOR	INPUT DATA
Residential	Number of households Fuel consumption Fuel share Lighting Electrical appliances
Industry	Number of brick kilns Industrial output Coal consumption
Transport	Number of vehicles in each category Fuel consumption Vehicle kilometres
Power plants	Number of power plants Capacity Generation of electricity Efficiency Peak load factor
Municipal solid waste landfill	Waste generated Generation rate Fraction of waste disposed
Crop residue burning	Annual crop production Residue to crop ratio Fraction burned
Livestock enteric fermentation and manure management	Livestock population
Rice cultivation	Annual harvested area Cultivation period

SECTORAL EMISSIONS CONTIBUTION OF BOTH THE STATES IN 2019

RESULTS



BAU vs AVOIDED SCENARIO RESULTS OVER THE YEARS