

Household Energy Consumption, Emissions, Pollution, and Health Impacts in India

STATE **Madhya Pradesh**

(state and district as of census-India, 2011)

DISTRICT **Bhopal**

Household energy consumption (HEC) emissions were calculated in four classes - cooking (CK), lighting (LG), space heating (SH), and water heating (WH). Bottom-up emissions for the four classes are available @ 0.25 degree spatial resolution, and further aggregated to district and state level. A sub-classification is available by fuel - biomass, coal, kerosene, liquified petroleum gas (LPG), and others.



%Households Primary Cooking Fuel

gas+elec

others

58.2%

41.8%

Estimated district annual HEC emissions

Paticulates (2.5µm)	3,120 tons
Sulfur dioxide	330 tons
Nitrogen oxides	75 tons
Carbon monoxide	47,000 tons
Hydrocarbons	6,780 tons
Black carbon (BC)	670 tons
Organic carbon	1,280 tons
Carbon dioxide (CO ₂)	0.33 mil tons

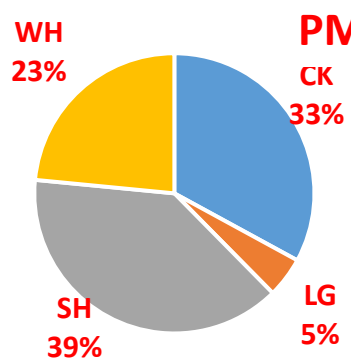
Estimated PM_{2.5} emissions @ 0.25 degree resolution



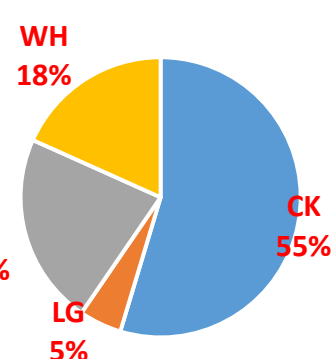
Modeled share of HEC emissions to ambient PM_{2.5}



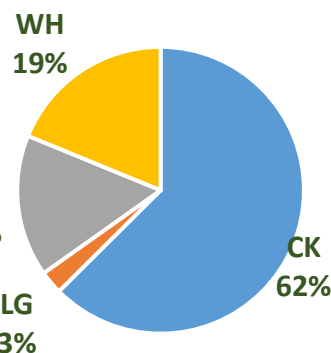
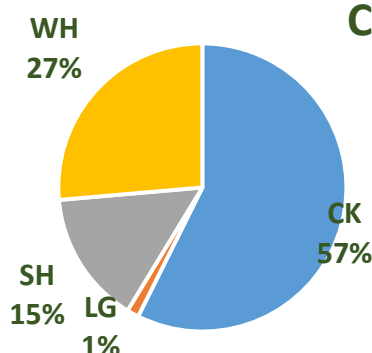
DISTRICT EMISSIONS



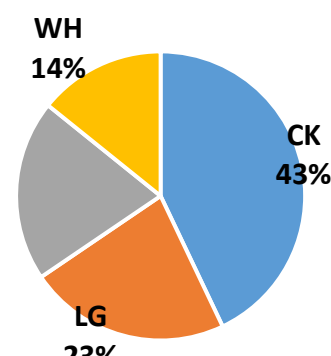
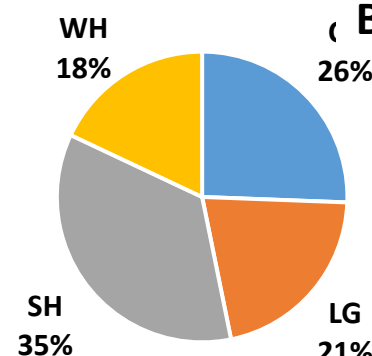
NATIONAL EMISSIONS



CO₂



BC



% contribution of HEC emissions to modeled ambient PM_{2.5} concentrations

(concentrations were conducted using the WRF-CAMx models)

National	29.6%
District	26.1%

The health impacts of outdoor air pollution as ischemic heart diseases (which can lead to heart attacks), cerebrovascular disease (which can lead to strokes), chronic obstructive pulmonary diseases, lower respiratory infections, and cancers (in trachea, lungs, and bronchitis) were estimated using the age-dependent relative risk functions detailed in the Global Burden of Disease study and dispersion modeling results from this study. The final calculations were conducted at the district level using the population distribution by age presented in Census-India.

Estimated premature mortality of outdoor air pollution per year - apportioned to HEC emissions

National	84,000 - 115,000
District	85 - 100

Emission and dispersion modeling results, pollution animations, and summary sheets by district and state are hosted @ <http://www.urbanemissions.info>
Send your comments and questions to sim-air@urbanemissions.info