

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

STATE **Uttar Pradesh**

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

DISTRICT **Agra**

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

37.7%

62.3%

Estimated district annual HEC emissions

|                      |               |
|----------------------|---------------|
| Paticulates (2.5µm)  | 8,520 tons    |
| Sulfur dioxide       | 1,000 tons    |
| Nitrogen oxides      | 265 tons      |
| Carbon monoxide      | 103,800 tons  |
| Hydrocarbons         | 18,940 tons   |
| Black carbon (BC)    | 1,640 tons    |
| Organic carbon       | 3,260 tons    |
| Carbon dioxide (CO2) | 0.61 mil tons |

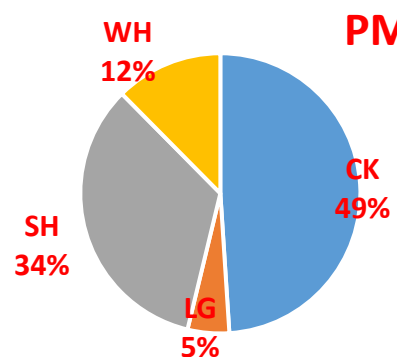
Estimated PM<sub>2.5</sub> emissions @ 0.25 degree resolution



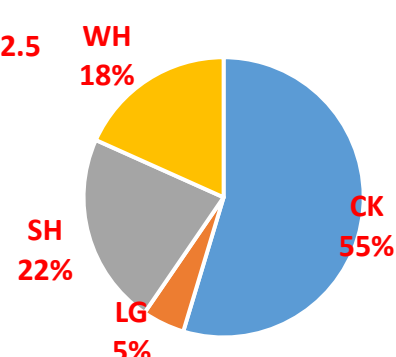
Modeled share of HEC emissions to ambient PM<sub>2.5</sub>



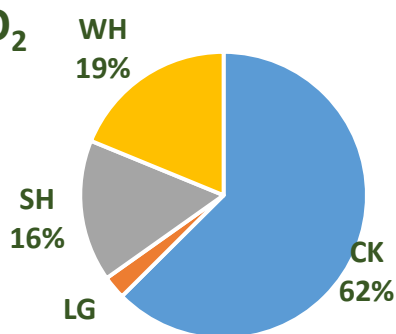
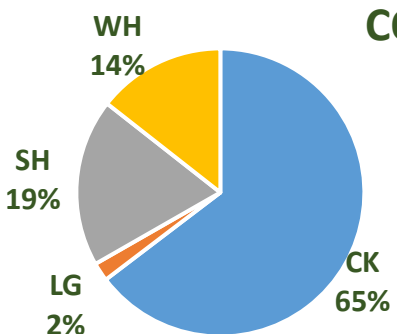
DISTRICT EMISSIONS



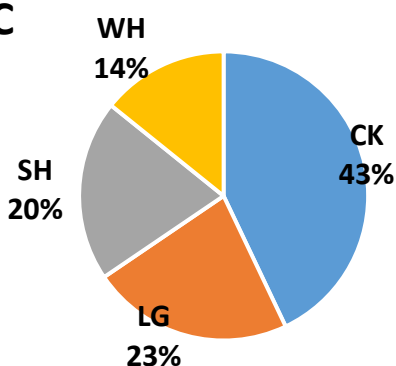
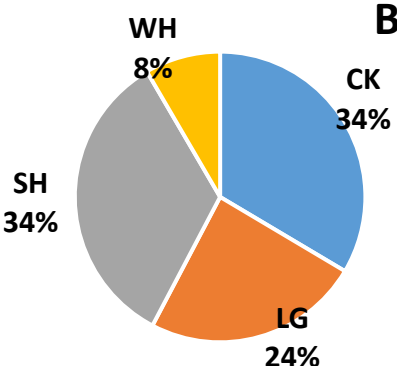
NATIONAL EMISSIONS



CO<sub>2</sub>



BC



% contribution of HEC emissions to modeled ambient PM<sub>2.5</sub> concentrations

(concentrations were conducted using the WRF-CAMx models)

|          |       |
|----------|-------|
| National | 29.6% |
| District | 34.6% |

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 | 221 - 272        |

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](mailto:sim-air@urbanemissions.info)